

H10798

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. RA-5-1-98
Registry No. H-10798

LOCALITY

State Washington
General Locality Seattle Harbor
Sublocality Elliott Bay

1998-99

CHIEF OF PARTY

CAPT Alan D. Anderson, NOAA

LIBRARY & ARCHIVES

DATE SEP 16 1999

HYDROGRAPHIC TITLE SHEET

H-10798

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

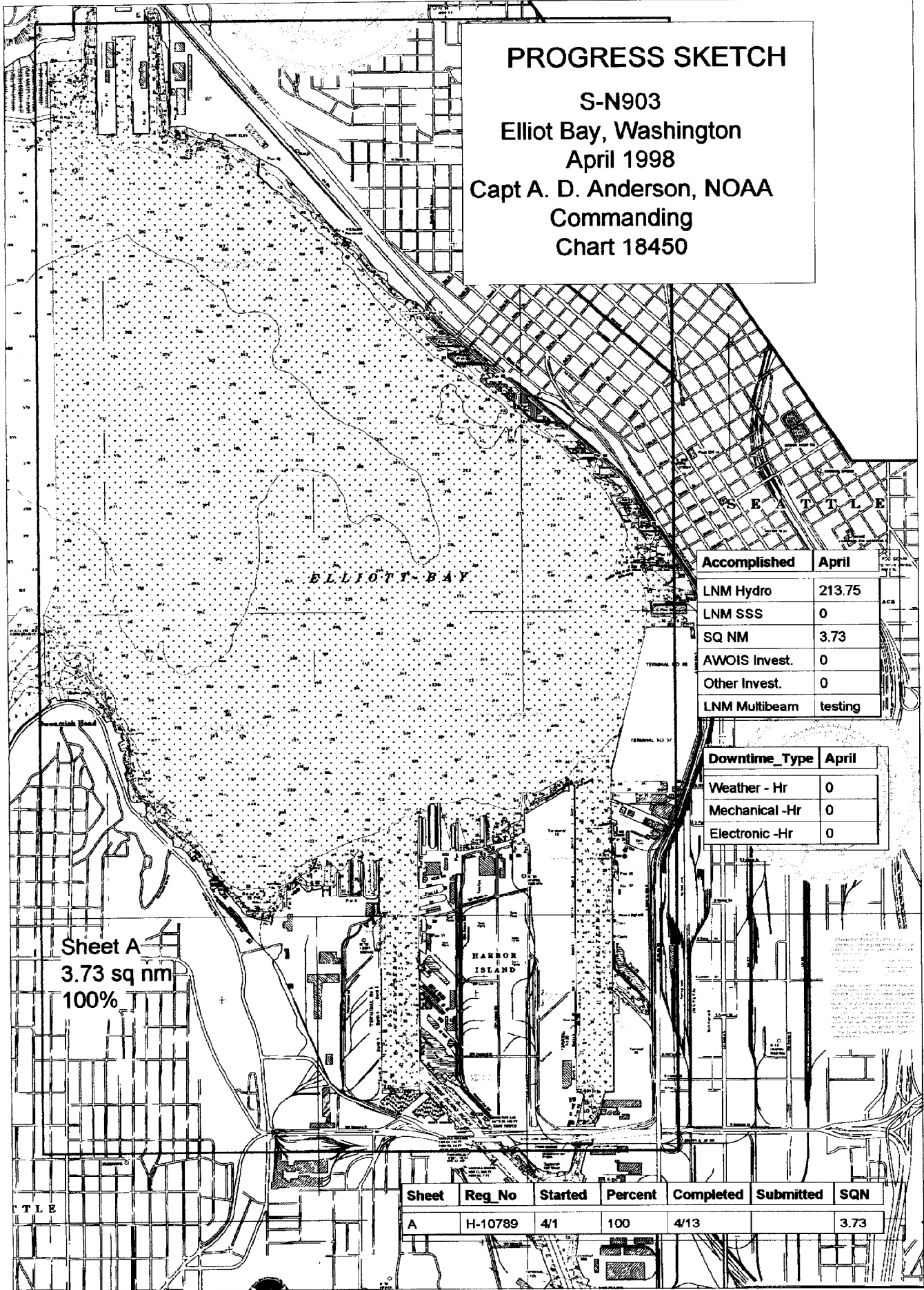
FIELD NO.

RA-5-1-98

State WashingtonGeneral locality Seattle HarborLocality Elliott BayScale 1:5,000 Date of survey 3/15/99 - 3/18/99
4/1/98-4/10/98Instructions dated April 17, 1998 * Project No. S-N903-RAVessel NOAA Ship RAINIER Launches (2125), (2126), (2124), (2123) & (2122)Chief of party CAPT Alan D. Anderson, NOAASurveyed by CAPT A. Anderson, LT R. Fletcher, LCDR D. Kruth, LT D. Baird, ST J. Lazar,
ST A. Lim, ST D. PattisonSoundings taken by echo sounder, ~~XXXXXX, XXX~~ DSF-6000N, Knudsen 320M, Reson Sea Bat 810
Multibeam, DivesGraphic record scaled by RAINIER PersonnelGraphic record checked by RAINIER PersonnelEvaluation by: R. Davies Automated plot by HP 650C Plotter
~~Processed by~~Verification by M. Bigelow, E. DomingoSoundings in ~~fathoms~~ feet at ~~MHW~~ MLLW (data collected in Meters)REMARKS: Time in 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.* Change No. 1 dated March 2, 1999.AWOIS & SURF 8/30/99
MCR

PROGRESS SKETCH

S-N903
 Elliot Bay, Washington
 April 1998
 Capt A. D. Anderson, NOAA
 Commanding
 Chart 18450



Accomplished	April
LNM Hydro	213.75
LNM SSS	0
SQ NM	3.73
AWOIS Invest.	0
Other Invest.	0
LNM Multibeam	testing

Downtime_Type	April
Weather - Hr	0
Mechanical -Hr	0
Electronic -Hr	0

Sheet A
 3.73 sq nm
 100%

Sheet	Reg No	Started	Percent	Completed	Submitted	SQN
A	H-10789	4/1	100	4/13		3.73

Descriptive Report to Accompany Hydrographic Survey H-10798

Field Number RA-05-01-98

Scale 1:5,000

April, 1998

NOAA Ship RAINIER

Chief of Party: Captain Alan D. Anderson, NOAA

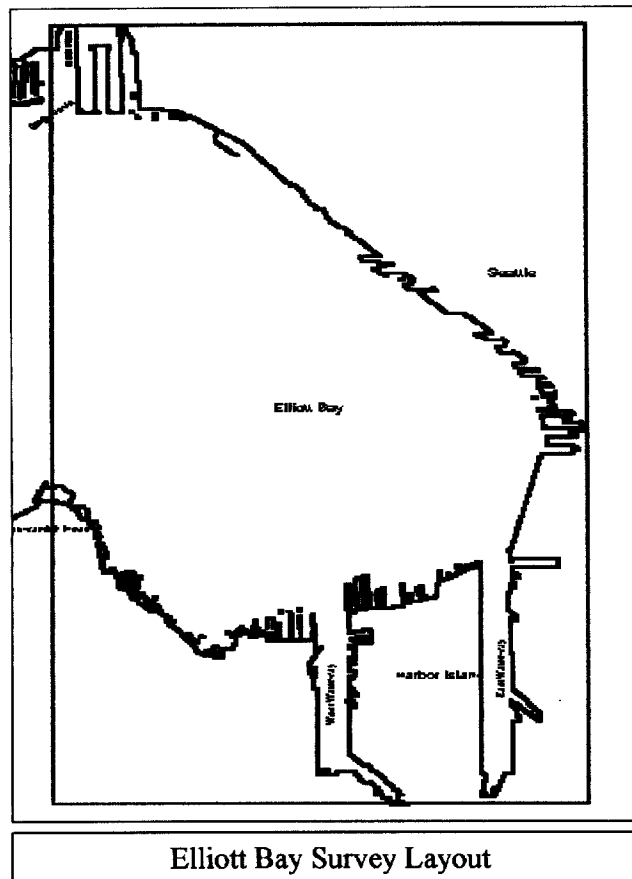
A. PROJECT ✓

This navigable area hydrographic survey was completed in Elliott Bay, Seattle, WA., as specified by Project Instructions S-N903-RA dated April 17, 1998. * Survey H-10798 corresponds to sheet A as defined in the sheet layout. This survey will provide data to supersede surveys performed in 1935, 1970, and 1995.

* Project Instructions dated completion of survey.

B. LOCATION ✓ See Eval Rpt., section B

This survey is located in Elliott Bay, Washington bounded on the west by longitude $122^{\circ}23'10''$ W. On the south, north and east it is bounded by the 18 foot curve and/or the pier line. Data acquisition was conducted from April 1 (DN 091) to April 10, 1998 (DN 100). and MARCH 15-18, 1999 - See attached Addendum.



C. SURVEY VESSELS ✓

Data were acquired by RAINIER survey launches (2124, 2125, 2126 for single beam; 2121 & 2123 for shallow water multi-beam) as noted in the Survey Information Summary printout appended to this report. There were no unusual vessel configurations or problems encountered. * was not used, poor quality.

D. AUTOMATED DATA ACQUISITION AND PROCESSING

All data were acquired and preliminary processing was accomplished using HYPACK version 7.9, and Hydro Processing System (HPS). Using the sounding and shoreline data in MapInfo, facilitated charted and prior survey comparisons. Final Detached Positions and Soundings based on predicted tides were saved in MapInfo 4.5 format. **

E. SONAR EQUIPMENT ✓

No side scan equipment was used during this survey. Shallow Water Multibeam system imagery^{*} was collected and will be submitted separately at a later date. was not used due to poor quality.

F. SOUNDING EQUIPMENT ✓

The Raytheon DSF-6000N is a dual frequency (100 kHz, 24 kHz), digital echo sounder with analog printout. The Knudsen 320M is a dual frequency, thermal depth sounder using the same transducer frequencies. A table of equipment and serial numbers used during the survey is included in Separate IV. **

One peculiarity of the Knudsen is when the fathometer is operated in the single scale mode, the low frequency trace overprints the high frequency trace. The fathometer trace in affect represents the low frequency and not the digitized high frequency. This occurred at the beginning of the survey before survey technicians were instructed to always operate the Knudsen in the dual scale mode. Both high and low frequency depths were recorded, with the high frequency used for the primary sounding depths for this survey. No new problems, which affect survey data, were encountered. Shallow water multi-beam (SWMB)^{*} was collected in conjunction with this survey, and will be submitted separately at a later date. * was not used due to poor quality.

G. CORRECTIONS TO ECHO SOUNDINGS ✓

One sound velocity cast was acquired within the survey limits for application to single beam data as shown in the appended Survey Information Summary report. The sound velocity cast was acquired on DN 091 with SBE SEACAT Profiler (SN 2543), calibrated on 1/10/98. Additional sound velocity casts were made for multibeam purposes but were not needed for the reduction of this data. Velocity correctors were computed using the PC programs SEACAT and VELOCITY, version 3.3 (1997), in accordance with Field Procedures Manual (FPM) section 2.4.3. Printouts of the sound velocity profile, data, and correctors used in field processing are included in the "Separates to be Included with Survey Data, IV. Sounding Equipment Calibrations and Corrections". **

A static transducer depth was determined using FPM Fig 2.2 for vessels 2124, 2125 and 2126 in the spring of 1998. Settlement and squat correctors were computed in accordance with Hydrographic Manual Section 4.9.4.2, using FPM Fig. 2.3 and are included with project data for S-N903-RA. The data for vessels 2124 and 2126, was collected in Shilshole Bay, Washington in March 1996. The data for vessel 2125 were collected at Scull Island in March 23, 1997. All offset tables^{**} contain offsets for the GPS antenna, as well as static draft measurements, and settlement and squat data. Offset table measurements for all launches were collected March 26, 1998. Offset tables 1-6 correspond to the last digit of the vessel number. The offset tables are included with project data for S-N903-RA. The launches are not equipped with heave, roll and

** Filed with the hydrographic data

pitch sensors.

The operating tide station at Seattle (944-7130) served as control for datum determination. HPS listings of the data used in generating tidal correctors are included in Appendix V of this report. Tidal correctors as provided in the project instructions for H-10786 are shown on the appended Survey Information Summary report.

A request dated April 28, 1998 for approved tides, was forwarded to N/OES23 in accordance with FPM 4.2.3. *Approved tide note, dated Sept. 16, 1998 is attached to this report.*

H. CONTROL STATIONS

The horizontal datum for this project is NAD 83. See the S-N903-RA-98 Horizontal Control Report for more information.

I. HYDROGRAPHIC POSITION CONTROL ✓

All soundings were positioned using USCG differential Beacons Whigbey Island or Robinson Point. Elliott Bay is a highly developed commercial port. The cultural development near shore creates a medium to high multipath environment for the GPS signal. Any suspected data affected by a multipath problem has been rejected.

Launch-to-launch DGPS performance checks were performed in accordance with Section 3.4.4 of the FPM. Two observations of position were made from two different DGPS base stations while the launches were rafted together with their GPS antennae within 2-3 meters of each other.

J. SHORELINE *See EVAL Report, section J*

No photogrammetric source data was available for this project. Detailed shoreline verification was not done. A few significant changes in charted shoreline are listed in Section O. The shoreline for the field sheet is from NOS chart 18450 14th edition (6/96). Charted shoreline is shown in brown in final field sheets, and should be used for orientation purposes only. Gross discrepancies in charted shoreline are shown on the final field Detached Position and Bottom Sample plot and DP and BS Workspace.**

K. CROSSLINES ✓

Crossline agreement was excellent (within 1-3 feet) with mainscheme hydrography. There were a total of 15.36 nautical miles of crosslines, comprising 14.2% of mainscheme hydrography.

L. JUNCTIONS ✓

This survey does not junction with any other contemporary survey. *Concur*

M. COMPARISON WITH PRIOR SURVEYS *See EVAL Report, section M*

Prior surveys H-5845 (1:5,000, 1935), H-9167 (1:5,000, 1970), H-9169 (1:5,000, 1970) and ~~Fe-419~~⁰⁰⁴¹⁹ (1:5,000, 1995) were compared with the final field sheet. The priors agreed well (generally within 1-3 ft) with the chart except in highly developed areas and in the East and West Waterways which are being frequently dredged by the Army Corps of engineers. *Concur* It is recommended that the current survey soundings be used in all cases. *Do not concur*

** Filed with the hydrographic data

Comparison with H-9167 ✓

The current survey was compared to H-9167 utilizing MapInfo. Prior contours matched well with the current survey throughout Elliot Bay. As expected, some changes were noted in the waterways and around the highly industrialized dry dock areas.

⁵⁸⁴⁵
Comparison to H-5485

⁵⁸⁴⁵
H-5485 is a 1935 survey of the East and West Waterways. As expected, current soundings in both the east and west waterway were found to be deeper due to dredging. *Do not concur. There were soundings originating with the prior survey which were both deeper and shallower than the present survey. See Ensl report, section III*
Comparison to H-9169 and FE-419

This survey was compared to prior surveys H-9169 and FE-419. These surveys cover the East Waterway. Again the priors show some shallower depths along the west pier face in the East Waterway. This is not unexpected since the waterway is constantly being dredged, maintained, and monitored by the Army Corps of Engineers. *Concur*

Final comparisons will be completed at PHB after application of smooth tides. *See Ensl Report, section III*

N. ITEM INVESTIGATIONS ✓

None.

O. COMPARISON WITH THE CHART *See Ensl Report, section O*

Chart 18450, 1:10,000, 14th edition, 6/96 is the largest scale chart covering the survey area and was used for visual comparison. Final sounding comparisons will be made at PHB after reduction to final vertical datum.

An uncharted wreck was found at ^{Lat.} 47-35-16.1 N, ^{Long} 122-22-17.6 W (DN 091, Fix # 50,357), with a raw depth of 52.1 meters). Shallow water Multi-Beam imagery shown below also confirmed the wreck and position. The wreck rises approximately 9 meters off the bottom. Due to its deep depth, it does not pose a danger to surface navigation. *Concur* However it could pose problems for vessels anchoring or dragging a net. Recommend charting a sounding over a wreck. *Concur* A wreck symbol is not warranted. *Chart 167 wk at the above position.*

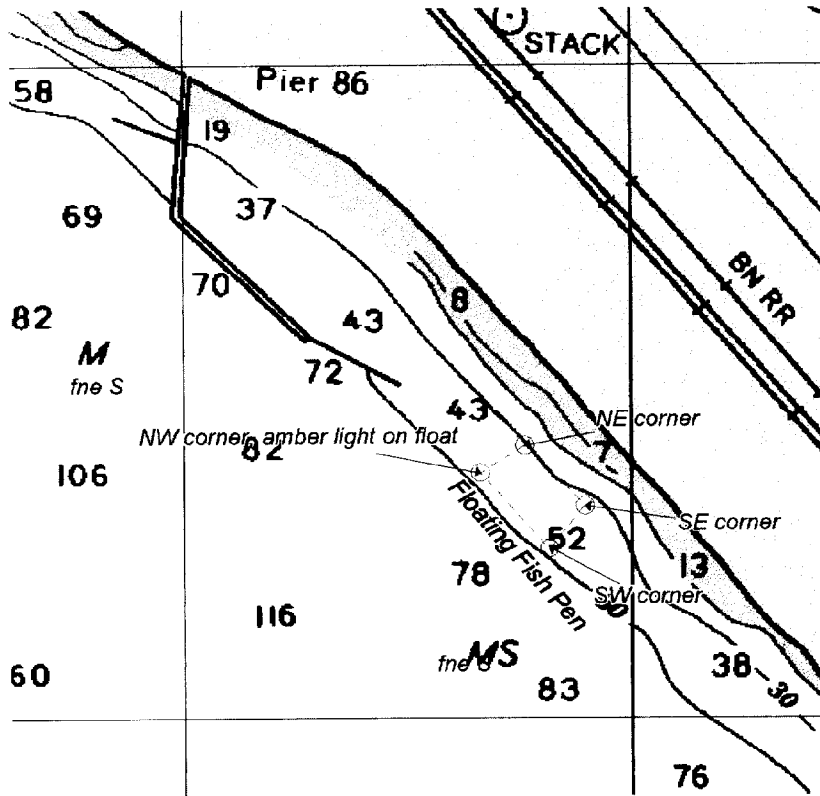


SWMB side-scan imagery of wreck

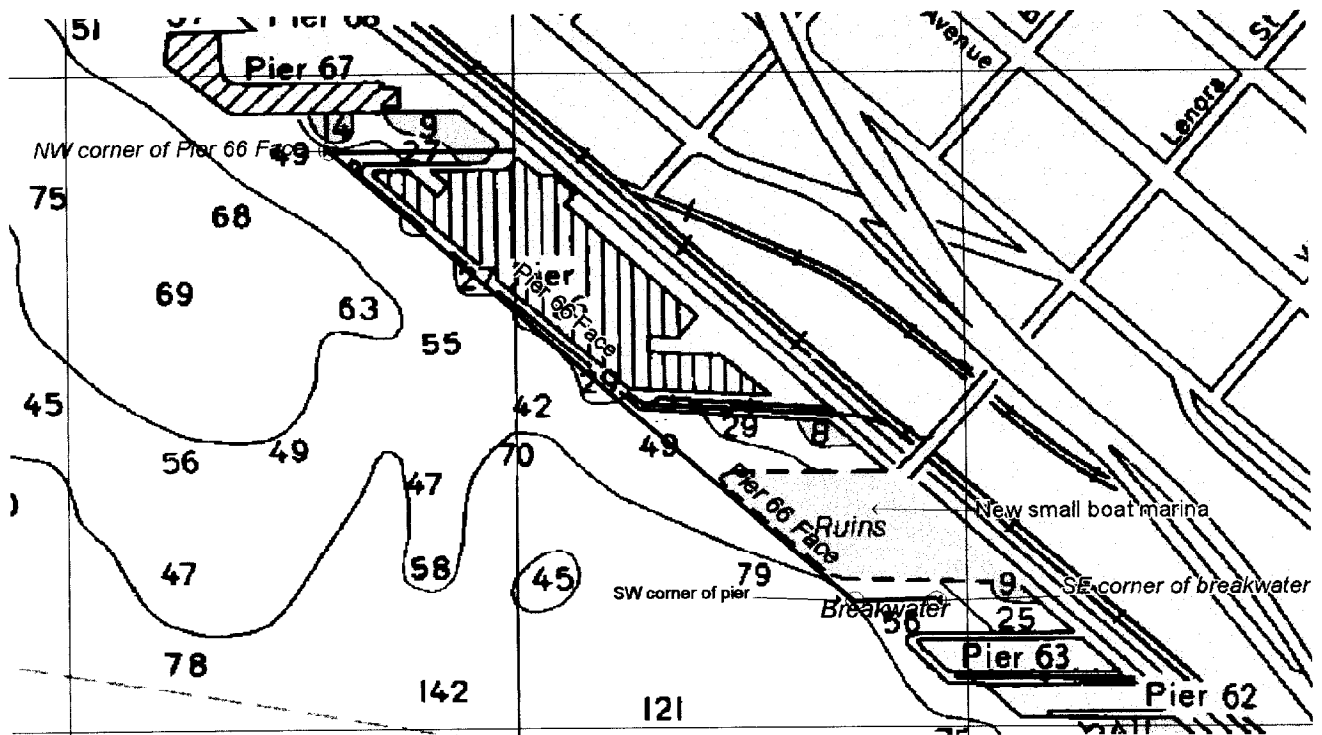
lat. Long.

The four corners of a floating fish pen centered at 47-37-20.63 N, 122-22-05.09 W were positioned (DP's 73062-73065). The Northwest corner was marked with an amber light (DP 73062). This light is already shown on the current chart. Chart recommendation: Chart as shown in figure below. Chart light, Put Maint.

see Eureka Report, section Q.



Significant changes in the vicinity of Pier 66 were noted. There is a new marina and breakwater extending south from Pier 66. The exterior face of the pier and breakwater was positioned (DP's 73066, 73067, 73069). It is suggested that HSB contact the Port of Seattle, which owns the marina, for engineering drawings of the interior of the marina (boat slips, floats, etc.). Charting recommendation: Chart pier face and break water as shown in figure below. *CONCUR*



Pier 71 (43-37 N, 122-21.5 W) is presently charted as a pier under construction or in ruins above high water. No evidence of ruins or construction was seen at the time of hydrography. A survey line was run over the position without any evidence of a pier or ruins. Additionally the hydrographer contacted the Hydrographic Survey Division for charting history on pier 71.

HSD provided the following information:

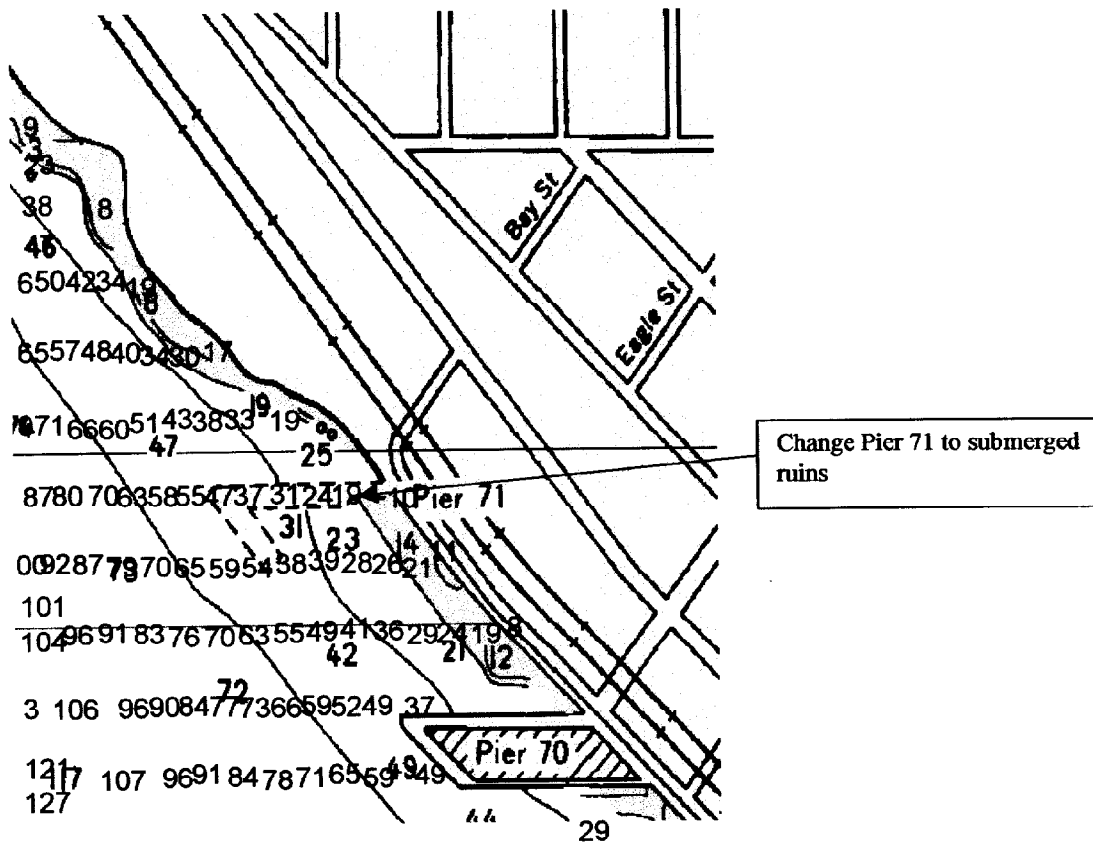
IT LOOKS LIKE PIER 71 WAS MADE INTO RUINS THROUGH CHART LETTER 94/1989. THIS LETTER ORIGINATES WITH CORRESPONDENCE OF COMMANDING OFFICER, COMMANDER J. DICKSON, HMCS KOOTENAY, VIA NATIONAL DEFENCE HEADQUARTERS, OTTAWA, CANADA.

DATE OF OBSERVATION: 9-11 DEC 1988

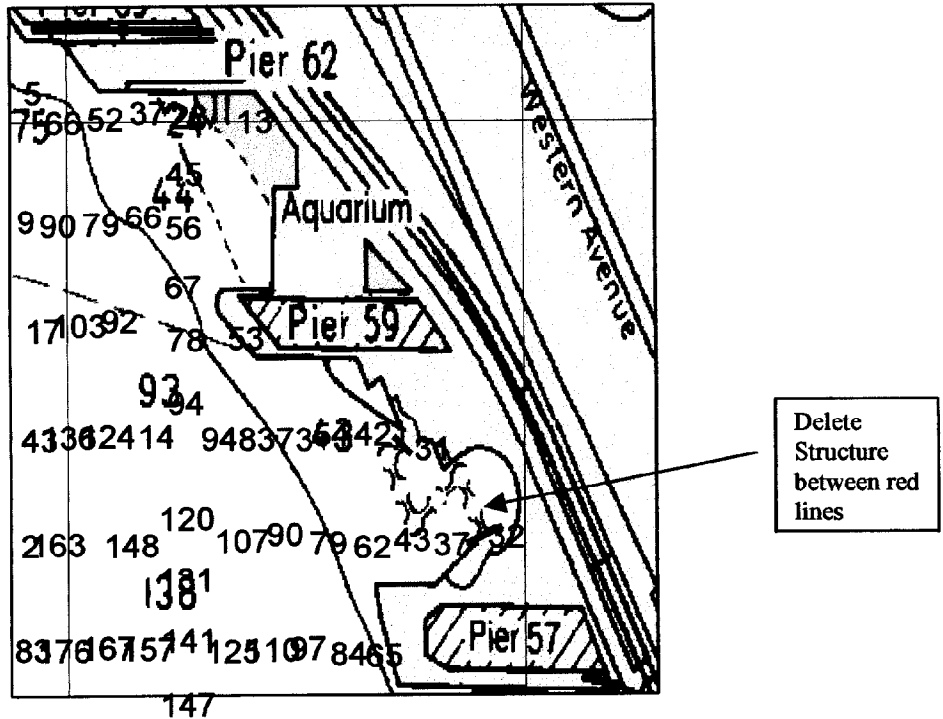
"PIER 71 HAS BEEN REMOVED"

RECOMMEND N TO M ACTION TO THAT EFFECT INDICATING DREDGED DEPTH IN AREA AND APPROPRIATE AMENDMENT TO USCP 7.

No exposed ruins were found. RAINIER did not disprove the existence of submerged ruins. The hydrographer suggests contacting the Port of Seattle for further disposition of Pier 71. Charting recommendation: Chart as submerged ruins. *Concur*



The feature (a series of round connecting structures) located between Pier 59 (Seattle Sea Aquarium) and Pier 57 does not exist. Hydro lines were run into the area. The hydrographer recommends that the Port of Seattle or the Seattle Sea Aquarium be contacted for a disposition of this item. Charting recommendation: Delete. *Do not concur. See Envr Report, section O.*



Cable areas on chart 18450 were not verified. It is recommended that these cable areas remain as charted. *concur*

Piers 52/53, located at ^{lat.} 47-36-10.18 N, ^{long.} 122-20-21.72 W, is the major ferry terminal for Seattle. Ferries run between Seattle-Winslow; Seattle Bremerton and Seattle-Vashon Island. Ferry lanes as charted are adequate. The hydrographer recommends contacting Washington State Ferries for any additional details. *Retain Ferry Routes as charted.*

Dangers to Navigation ✓

A notice to Mariners letter was sent regarding the two previously mentioned submerged wrecks. *See attached letter, dated June 19, 1998*

P. ADEQUACY OF SURVEY *See Envr Report, sections M and O*

Survey H-10798 is complete and adequate to supersede prior soundings and noted features in their common areas. *Do not concur*

Q. AIDS TO NAVIGATION ✓ *See Envr Rpt., section Q.*

Duwamish Head Light was positioned using static GPS procedures and found to be charted correctly. See section Q insert. *Fixed aid has been shown on the Smooth Sheet.*

R. STATISTICS ✓

Refer to the Survey Information Summary attached to this report.

S. MISCELLANEOUS ✓

Bottom samples were collected and sent to the Smithsonian. Many areas along pier faces could not be surveyed due to large ships and fishing fleets being moored at the time.

Weekly Notice to Mariners 18, dated 5 May 98, USCG 13th District, stated that pier construction has commenced on Pier 91 in Elliot Bay. The demolition and reconstruction will continue until mid April, 1999.

T. RECOMMENDATIONS ✓

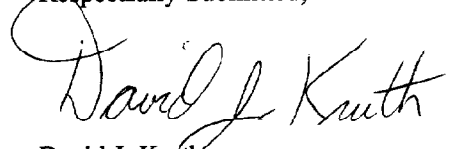
Many less significant changes to the shoreline were noticed but not addressed by the RAINIER. The shoreline on chart 18450 should be recompiled from more recent photography. If NOS photography is not available, the state of Washington Geographic Services, Planning and Programming Service Center in Olympia has recent horizontally controlled aerial photography. Contact the Port of Seattle for engineering drawings on Pier 66, 71, 91. Also suggest that the Sea Aquarium be contacted for the disposition of the structure between Pier 59 and Pier 57.

U. REFERRAL TO REPORTS ✓

The following supplemental reports contain additional information relevant to this survey:

<u>Title</u>	<u>Date Sent</u>	<u>Office</u>
OPR-N903-RA Horizontal Control Report	April, 1998	N/CS34
Project related data for OPR-N903-RA	Incremental	N/CS34

Respectfully Submitted,



David J. Kruth
Lieutenant Commander, NOAA

Approved and Forwarded,



Alan D. Anderson
Captain, NOAA
Commanding Officer

Section Q: Descriptive Report Insert

Name of Aid: Duwamish Head Light
Light List #: 16910

Method of Positioning GPS: DGPS: Other: _____

Positioning Information

	<u>Latitude (N)</u>	<u>Longitude (W)</u>
Charted Pos.	47-35-56	122-23-17
Survey Pos.	47-35-55.98561	122-23-16.53899

	<u>Easting</u>	<u>Northing</u>
Charted Pos.	23418.26	11000.47
Survey Pos.	23427.91	11000.0

Difference between Charted and Surveyed Position: Distance: 10 meters
(Bearing from Surveyed to Charted Position) Bearing: 273 deg T

Characteristics Flashing White 2.5 seconds

Do characteristics match Light List? Yes No

If no, what are the characteristics? _____

Does the aid adequately serve its apparent purpose? Yes No

If no, why not? _____

New/Uncharted Aids

(if information is known or easily obtained)

Date Est: _____

Maintained By: Coast Guard

Private? Yes No

Is aid seasonally maintained? _____

Yes No

Frequency of Maintenance: _____

Apparent Purpose: _____

Other Information: Published position 47-35.9N; 122-23.3 W

List of Horizontal Control Stations ✓

NAME	STATE	TYPE	LATITUDE	LONGITUDE	SITEID	DEC_LAT	DEC_LON
ROBINSON POINT	WA	USCG Beacon	47 23.3N	122 22.5W	887	47.38833333	-122.37500000
WHIDBEY ISLAND	WA	USCG Beacon	48 18.8N	122 41.8W	888	48.31333333	-122.69666667



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of NOAA Corps Operations
Pacific Marine Center
1801 Fairview Avenue East
Seattle, Washington 98102-3767


May 15, 1998

Commander William Wiedenhoef
Commander (OAN)
13th Coast Guard District
915 2nd Avenue, Room 3510
Seattle, WA 98174-1067

Dear CDR Wiedenhoef,

Enclosed is a copy of our Horizontal Control Report discussing the positioning work performed in conjunction with the hydrographic surveys the NOAA Ship RAINIER conducted in Elliot Bay, Rich Passage, and Sinclair Inlet. Sixteen fixed aids were positioned to 3rd or commensurate standards.

Preliminary copies of the hydrographic surveys will be forwarded when field processing is complete.


Captain Alan D. Anderson
CO, NOAA Ship RAINIER

* Only one fixed aid was located DW 14-10798



U.S. Department
of Transportation

United States
Coast Guard



Commander
Thirteenth Coast Guard District

Staff Symbol: (oan)
Phone: (206)220-7270
FAX: (206)220-7285

16500

JUN 3 1998

A
Captain Alan D. Anderson
NOAA Ship RAINIER
Pacific Marine Center
1801 Fairview Avenue East
Seattle, Washington 98102-3767

Good Work Everyone!

Dear CAPT Anderson:

Thank you for taking the time to verify the position of several of our fixed Aids to Navigation (ATON) in Puget Sound. It has been an on-going project for our district units to verify the positions of all of the fixed ATON since discovering numerous errors in our database.

The use of your personnel and equipment is greatly appreciated and has contributed to our efforts by not only reducing the extra workload on our field units but by also providing survey data to 3rd order standards-an accuracy to which our personnel and equipment could not achieve. Your efforts have been invaluable in helping us in our mission to provide service to the mariner.

*Thanks to
LT Fletcher
and the survey
crew!*

A series of hand-drawn wavy lines, possibly representing a signature or a decorative flourish.

Sincerely,

A handwritten signature in cursive script, appearing to read "W. D. Wiedenhoef".

W. D. WIEDENHOEFT
Commander, U.S. Coast Guard
Chief, Aids to Navigation and Waterways
Management Branch
By direction of the District Commander



Bell Street Pier

A NEWSLETTER FOR FRIENDS & NEIGHBORS OF SEATTLE'S CENTRAL WATERFRONT - WINTER 1996

Port Commission

Executive Director

Director, Facilities Development

Editor

Light Tower Art Sculpture *by Shirley Edmiston*

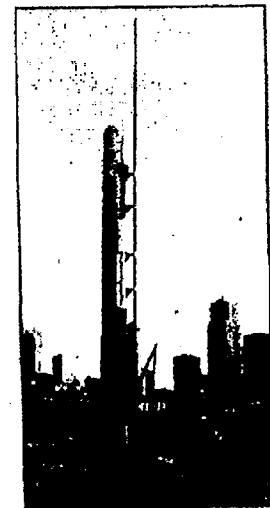
The first public art piece for the Bell Street Pier was installed the week of November 13-17, 1995. Prominent New York artist, R. M. Fischer, known for his illuminated light and fountain sculptures, has created a light tower sculpture that should soon become a welcoming beacon to Bell Street Pier and Elliott Bay.

The Light tower consists of a cluster of four steel columns, encircled by three steel bands with a "kick-arm" element that anchors them to the surface of the wave barrier. Three of the towers will emanate light at night from a variety of points once the tower is illuminated during opening festivities for the Bell Street Pier next summer. It will be a static light which at night will feel like an addition to the urban landscape that those of us who live downtown have come to appreciate.

The tower base is approximately 16' x 16'. The four towers are staggered heights of 39', 92', 102', and 138'. The tallest tower, similar to a flag pole, is painted red. The other elements of the sculpture are colored a metallic grey.

Fischer created the piece in response to aspects of lighthouses, shipping vessels, fishing equipment, and industrial/harbor imagery such as moorings, pilings, and buoys.

"Throughout history, the major port cities around the world have extended their welcome to incoming ships with a light house. These beacons have come to symbolize the spirit of the working waterfront. With the light tower created by R. M. Fischer, Seattle now joins that proud tradition with our own contemporary interpretation," said Port of Seattle Commission President, Paul Schell.



WHAT'S INSIDE

- Bell Harbor International Conference Center
- Construction Update
- Cruising Through the Season
- Arts in Education Program
- Odyssey Contemporary Maritime Museum
- Site Map



UNITED STATES DEPARTMENT OF COMMERCE
 National Oceanic and Atmospheric Administration
 Office of NOAA Corps Operations
 Pacific Marine Center
 1801 Fairview Avenue East
 Seattle, Washington 98102-3767

June 19, 1998

**ADVANCE
 INFORMATION**

Commander William Wiedenhoef
 Thirteenth Coast Guard District
 915 2nd Avenue, Room 3510
 Seattle, WA 98174-1065

Dear Commander Wiedenhoef,

Two uncharted wrecks were found in Elliot Bay and should be included in the Local Notice to Mariners. The wrecks were found and positioned by NOAA Ship RAINIER while conducting hydrographic survey H-10798. Due to their deep depths, they do not pose a danger to surface navigation. However they could pose problems for vessels anchoring or dragging a net.

Item	Least Depth	Latitude	Longitude	Fix #	Survey
Wreck	167 ft	47-35-16.1N	122-22-17.6W	50,357	H-10798
Wreck	208 ft	47-35-48.6N	122-21-05.5W	60,554	H-10798

Depths were reduced to MLLW based on predicted tides. Positions were acquired with differential GPS using NAD 83 horizontal datum. This is advance information subject to office review. Questions concerning this letter should be directed to the Chief, Pacific Hydrographic Branch, (206) 526-6836. Refer to survey project S-N903-RA-98 and Danger to Navigation message RA-04-98.

Sincerely,

Alan D Anderson
 Captain, NOAA
 Comanding Officer

Attachment (2)

cc: NIMA
 PMC
 N/CS261
 N/CS34



Survey Information Summary

Project: Project Name:

Instructions Dated: Project Change Info:

Sheet Letter: Registry Number:

Sheet Number:

Survey Title:

Data Acquisition Dates: From: To:

Vessel Usage Summary

VESNO	MS	SPLITS	DEV	XL	S/L	DP	BS	DIVE
2124	1	1						
2125	3			1			1	
2126	4	2	3	1		1		

Sound Velocity Cast Information

Tide Zone Information

Tide Gage Information

Statistics Summary

Type	Total:
BS	28
DEV	53.65
DP	12
MS	108.1
SPLIT	36.64
XL	15.36

Percent XL:	14.2%
SQNM:	3.73

APPROVAL SHEET

for

H-10798
RA-05-01-98

Standard procedures were followed in accordance with the Hydrographic Manual, Fourth Edition; the Hydrographic Guidelines; and the 1994 version of the Field Procedures Manual in producing this survey. The data were examined daily during data acquisition and processing.

The field sheet and accompanying records have been examined by me, are considered complete and adequate for charting purposes, and are approved.

Date: May 23, 1998



Alan D. Anderson
Captain, NOAA
Commanding Officer



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE: September 16, 1998

HYDROGRAPHIC BRANCH: Pacific

HYDROGRAPHIC PROJECT: S-N903-RA
HYDROGRAPHIC SHEET: H-10798

LOCALITY: East Portion of Elliott Bay, Seattle, Washington

TIME PERIOD: April 1 - April 13, 1998

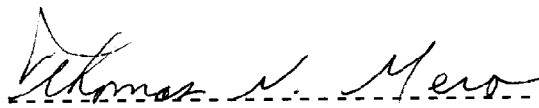
TIDE STATION USED: 944-7130 Seattle, Puget Sound, WA
Lat. 47° 36.2'N Lon. 122° 20.3'W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.198 meters

REMARKS: RECOMMENDED ZONING
Use zone(s) identified as: PS2.

Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units (meters), relative to MLLW and on Greenwich Mean Time.



CHIEF, REQUIREMENTS AND ENGINEERING BRANCH

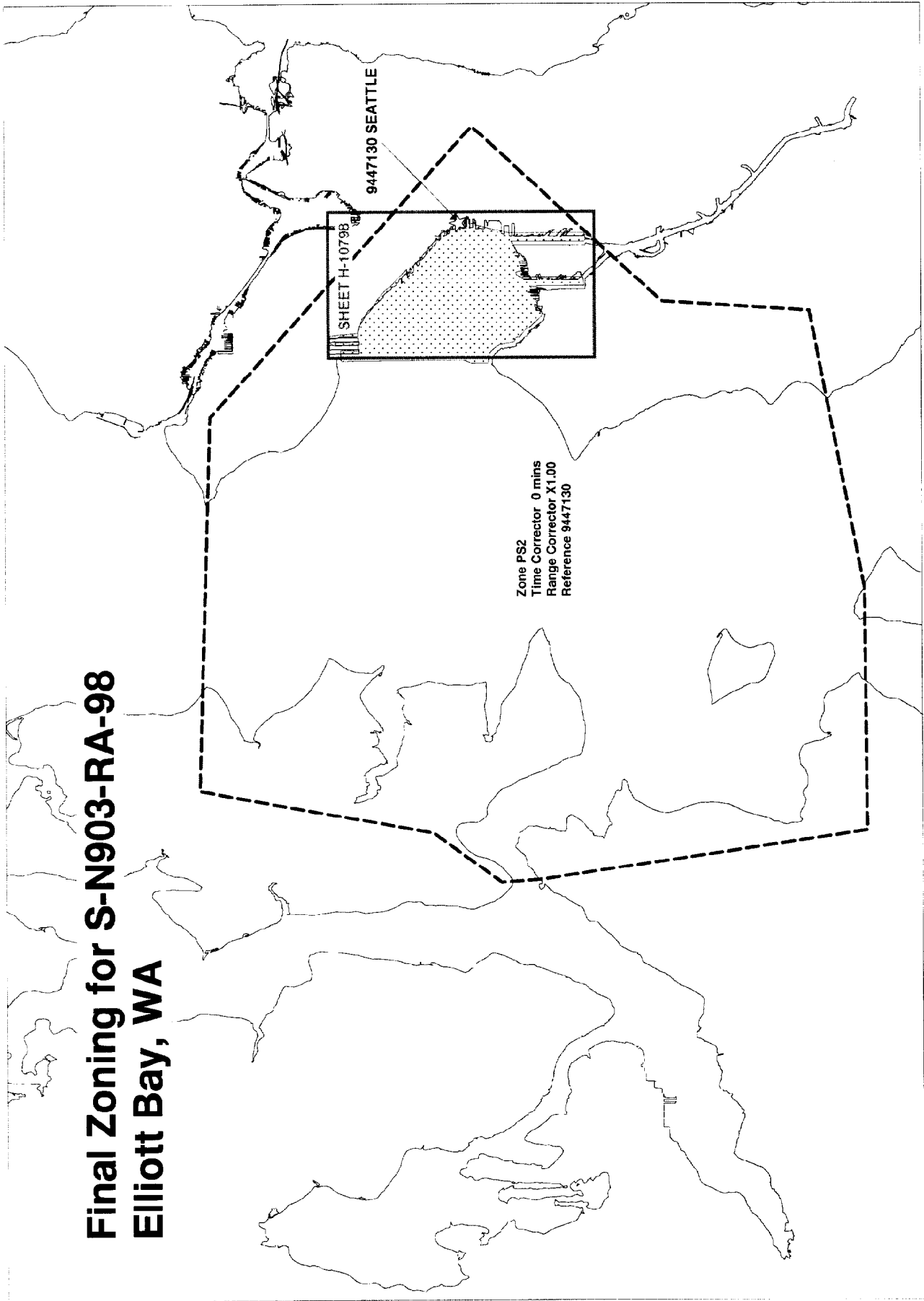


Final tide zone node point locations for OPR N903-RA-98,
Sheet H-10798.

Format: Longitude in decimal degrees (negative value denotes
Longitude West),
Latitude in decimal degrees
Tide Station (in recommended order of use)
Average Time Correction (in minutes)
Range Correction

	Tide Station Order	AVG Time Correction	Range Correction
Zone PS2			
-122.465472 47.508708	944-7130	0	1.00
-122.369014 47.521458			
-122.365783 47.555867			
-122.304861 47.59997			
-122.405646 47.661072			
-122.535432 47.663657			
-122.55031 47.609259			
-122.567614 47.593518			
-122.566539 47.583886			
-122.549482 47.50828			
-122.465472 47.508708			

Final Zoning for S-N903-RA-98 Elliott Bay, WA



GEOGRAPHIC NAMES

H-10798

Name on Survey	<div style="display: flex; justify-content: space-between;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">A ON CHART NO. 18450</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">B ON PREVIOUS SURVEY NO.</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">C ON U.S. QUADRANGLE MAPS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">D FROM LOCAL INFORMATION</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">E ON LOCAL MAPS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">F P.O. GUIDE OR MAP</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">G RAND McNALLY ATLAS</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">H U.S. LIGHT LIST</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">K</div> </div>											
	DUWAMISH HEAD	X		X								
EAST WATERWAY	X		X									2
ELLIOTT BAY	X		X									3
HARBOR ISLAND	X		X									4
HARBOR ISLAND REACH	X		X									5
SEATTLE	X		X									6
SEATTLE HARBOR (title)	X											7
SMITH COVE	X		X									8
WASHINGTON (title)	X		X									9
WEST WATERWAY	X		X									10
WEST SEATTLE	X		X									11
												12
												13
												14
												15
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												17
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												23
												24
												25

Approved

Dennis J. Rasmussen
Chief Geographer

JUL 14 1998

EVALUATION REPORT

H-10798

A. PROJECT

The hydrographer's report contains a complete discussion of the project information.

B. AREA SURVEYED

The survey area is adequately described in the hydrographer's report.

The hydrographer has determined the inshore limits of safe navigation by defining a Navigable Area Limit Line (NALL) throughout the survey area. A page-size plot of the charted area depicting the specific limits of supersession accompanies this report as Attachment 1. Charted features and soundings inshore of this limit line have not been specifically addressed during survey operations and should be retained as charted. Many of these charted items originate from prior survey data and have been addressed in this report, section M. Charted miscellaneous data to be retained accompanies this report as Attachments 2-7.

The bottom consists mainly of mud and sand. Depths range from 0 to 551 feet.

C. SURVEY VESSELS

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

D. AUTOMATED DATA ACQUISITION AND PROCESSING

Survey data were processed using HYPACK, Hydrographic Processing System (HPS), and MicroStation 95.

Processed digital data for this survey exists in the standard HPS format, a database format using the .dbf 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. Database records forwarded are in the Internal Data Format (IDF) and are in compliance with specifications in existence at the time of survey processing.

The drawing files necessarily contain information that is not part of the HPS data set such as geographic name text, line-type data, and minor symbolization. In addition, those soundings deleted from the drawing for clarity purposes remain unrevised in the HPS 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 Survey Guideline No. 35 and No. 75.

The data is plotted using a Modified Transverse Mercator (MTM) projection and are depicted on a single sheet.

E. SONAR EQUIPMENT

Side scan sonar equipment was not used during survey H-10798.

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. These reducers have been reviewed and are consistent with NOS specifications.

Predicted tides were used for reduction of soundings during field processing. During office processing, tide reductions were derived from approved hourly heights zoned direct from the Seattle, Puget Sound, WA, tide gauge (944-7130).

H. CONTROL STATIONS

Sections H and I of the hydrographer's report contain adequate discussions 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:	-0.646 seconds	(-19.964 meters)
Longitude:	4.459 seconds	(93.132 meters)

I. HYDROGRAPHIC POSITION CONTROL

Differential GPS (DGPS) was used to control this survey. A horizontal dilution of precision (HDOP) not to exceed 1.8 was computed for survey operations. The quality of 33 positions exceeds limits in terms of HDOP. These positions are isolated and occur randomly throughout the survey area. A review of the data, however, suggests that none of these fixes are used to position dangers to navigation. The features or soundings located by these fixes are consistent with the surrounding information. These fixes are considered acceptable. DGPS performance checks were conducted in the field and found adequate.

NAD 83 is used as the horizontal datum for plotting and position computations.

Additional information concerning specific control system type, calibrations and system checks can be found in the hydrographer's report and in the separates related to horizontal position control and corrections to position data.

J. SHORELINE

Shoreline was digitized from a raster image of chart 18450, 15th edition, May 16, 1998 and has been shown on the smooth sheet in brown for orientation purposes only. The digital shoreline and the hydrographic data files were merged during smooth sheet compilation.

New pier construction in the vicinity of Piers 90 and 91 and from Piers 63 to 66 was found during survey operations. The specific areas have been shown on the smooth sheet in red and are listed below.

<u>Latitude(N)</u>	<u>Longitude(W)</u>
47/37/45	122/22/54
47/36/37	122/20/57
47/36/50	122/21/19
47/36/45	122/21/11

K. CROSSLINES

Crosslines are discussed in the hydrographer's report.

L. JUNCTIONS

Survey H-10798 does not junction with any contemporary survey.

M. COMPARISON WITH PRIOR SURVEYS

<u>Survey</u>	<u>Year</u>	<u>Scale</u>	<u>Datum</u>
H-5844	1935	1:5000	NAD27
H-5845	1935	1:5000	NAD27
H-5846	1935	1:5000	NAD27

Prior surveys H-5844, H-5845 and H-5846 cover the entire area of the present survey. Comparisons were made using digital copies of the above. The registration and legibility of these prior surveys to the present survey was good. However, with the exception of a few charted soundings and near shore features, survey work conducted in 1970 and 1995 and miscellaneous source data collected since 1935 have superseded these surveys. A few features, soundings and bottom characteristics were not investigated and or addressed during current survey operations and have been brought forward in color to the smooth sheet.

With the inclusion of soundings, features and bottom characteristics from the prior surveys, H-10798 is adequate to supersede the prior survey work within the common area.

<u>Survey</u>	<u>Year</u>	<u>Scale</u>	<u>Datum</u>
H-9167	1970	1:5000	NAD27
H-9169	1970	1:5000	NAD27
F00419	1995	1:5000	NAD83

Prior surveys H-9167, H-9169 and F00419 cover the entire area of the present survey. Comparisons were made using digital copies of the above. The registration and legibility of these prior surveys to the present survey was good. Sounding agreement is good from the deepest portions of Elliott Bay to along the dredged East and West Waterways in the southern portion of the survey area. Throughout most of Elliot Bay, differences in depths range from 1-4 feet with no consistent pattern of shoaling or an increase in depth. However, a consistent depth increase of 1-3 feet is readily evident in the East and West Waterway since the 1970 and 1995 survey work. Additionally, two items of note are mentioned here as a matter of interest.

- a.) An irregular shape shoal feature exists from along Piers 66-69 approximately 100-400 meters off the pier faces. Here, depths were found to rise approximately 25-30 feet from the general surrounding depths. This area was found to exist in 1935 and 1970 and is likely associated with dumping operations.
- b.) A 4-5 feet rise from surrounding depths was found to exist from along Piers 28-33 approximately 20-40 meters off the pier faces. This anomaly is likely associated with the large container ships, which stir up the mud bottom during docking operations.

Significant shoreline changes since 1970 are associated with cultural development and listed below.

- a.) Piers 35-46 on the 1970 survey have been filled in and now are associated with container ships activity. This area is now depicted as Terminals 37-46 on the present survey and current chart.

- b.) A new pier structure (Pier 66) and small boat marina have been constructed in the areas of Piers 64-66 as shown in 1970.
- c.) A new small boat marina and breakwater (Smith Cove) have been constructed west of Pier 91.
- d.) Piers 50-54 are centered in the area of the ferry terminal and have undergone extensive changes over the past twenty-eight years.

Differences with the prior surveys are largely attributed to cultural development and dredging operations. With the inclusion of soundings, features and bottom characteristics from the prior surveys, the present survey is adequate to supersede prior surveys within the common area.

There is an overall shift of between 5 to 10 meters with the compilation of prior information and the chart. All features originating from the prior surveys, which are located within the common area, have shown on the smooth sheet based on the prior survey location and recompiled positionally on the chart drawing. It is the recommendation of the evaluator that all prior source information outside the common area be checked for proper datum shift and scale.

N. ITEM INVESTIGATIONS

There were no AWOIS items assigned to this survey.

O. COMPARISON WITH CHART

Survey H-10798 was compared with the following chart:

<u>Chart</u>	<u>Edition</u>	<u>Date</u>	<u>Scale</u>
18450	15 th	May 16, 1998	1:10,000

a. Hydrography

Charted soundings originating with the miscellaneous source data reflects the same general differences as discussed with the prior surveys. Numerous features originating with miscellaneous source data was not investigated during survey operation and have been delineated on Attachments 2-7 following this report. The evaluator recommends to retain these features as charted. See Addendum.

All charted disposal areas should be retained.

The charted structure at approximately latitude 47/36/23.76N and longitude 122/20/31.92W is no longer visible. The source for this item should be investigated. The evaluator recommends removing this feature from the chart if the construction plans and or as-built drawings were not completed according to the original drawings. In the interim, this structure is recommended to be charted as submerged. See the figures below.

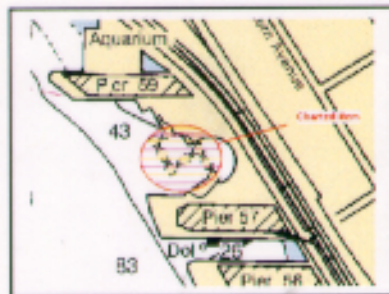


Chart 18450 15th ED



Aerial photo dated 1990



Photo dated 1995

With the exceptions noted above and on Attachments 2-7, survey H-10798 is adequate to supersede charted hydrography within the common area. See Addendum.

b. Dangers To Navigation

Two dangers to navigation were discovered during survey operations and reported to the U.S. Coast Guard on June 19, 1998. No additional dangers to navigation were found during office processing.

P. ADEQUACY OF SURVEY

Except as noted below, the hydrography contained on survey H-10798 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.

With the exception of the following 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, and the Field Procedures Manual, April 1994 Edition:

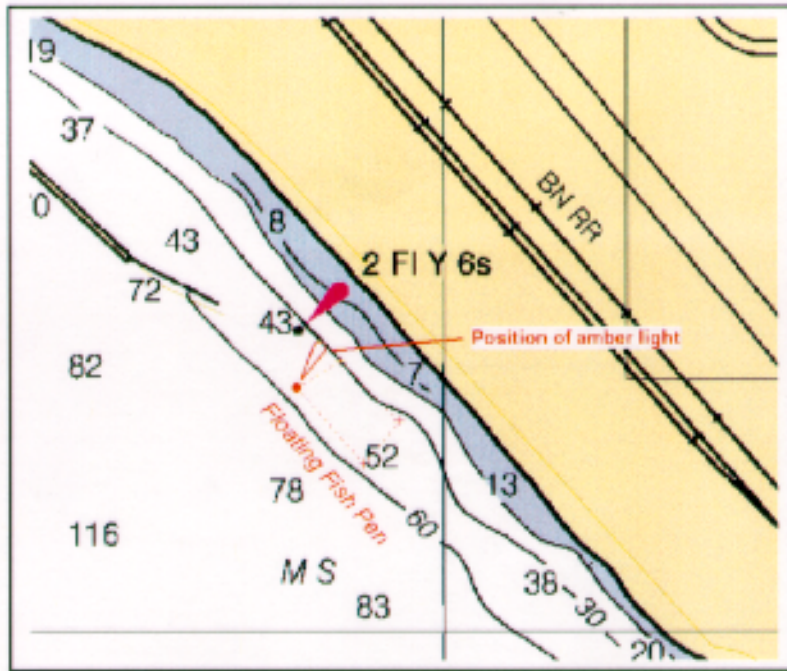
In the event that the field units submission of survey data will exceed four weeks from the completion of field work, the Chief of Party will submit a written explanation for the delay indicating the anticipated transmittal date to the Chief of the appropriate processing section. Marine Center ships will forward their explanation through the Marine Center Director. Fieldwork for survey H-10798 was completed on April 10, 1998 but not transmitted for office processing until June 30, 1998.

Charted and prior survey features seaward of the limit of safe navigation were not investigated and or addressed during survey operations. When conducting "limited" shoreline verification, the hydrographer shall verify all features within the limits of safe navigation and provide a detailed position(s) to include a sketch of the feature, height/depth information at the time of data acquisition. See Addendum.

Q. AIDS TO NAVIGATION

A number of fixed aids to navigation exist within the survey area. However, only the Duwamish Head Light was positioned during survey operations. This aid was adequately described and serves its intended purpose. The evaluator recommends retaining all other fixed aids to navigation as charted. There were 4 floating aids to navigation located in the survey area. Their aids were adequately located and serve their intended purpose.

There was one private floating aid located within the survey area. It is an amber light attached to a fish pen at latitude 47/37/20.65N and longitude 122/22/05.06W. The current charted position on chart 18450 15th Ed., May 16, 1998 is incorrect. The light should be charted according to this survey. See below.



There were no landmarks located and or verified within the area of this survey. The evaluator recommends retaining all landmarks as charted. One new feature (spire) located on the new breakwater for the Bell Street Pier Marina (Pier 66) is recommended to be charted as a new landmark. The approximate location is latitude 47/36/32.76N and longitude 122/20/46.32W. It has a height of 158 feet. This landmark is very important for small boaters trying to locate the entrance to the marina. The approximate location on chart 18450 and a photo is below. A description of this feature is attached to this report. It is recommended that a photogrammetric position be obtained for this feature.

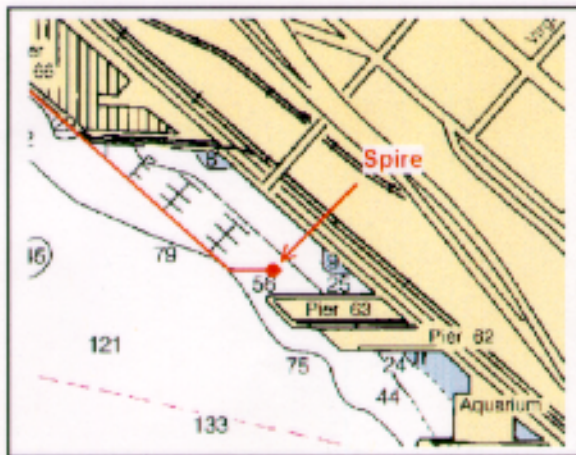


Chart 18450 15th Ed., May 16, 1998



Looking west

R. STATISTICS

Statistics are adequately itemized in the hydrographer's report.

S. MISCELLANEOUS


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

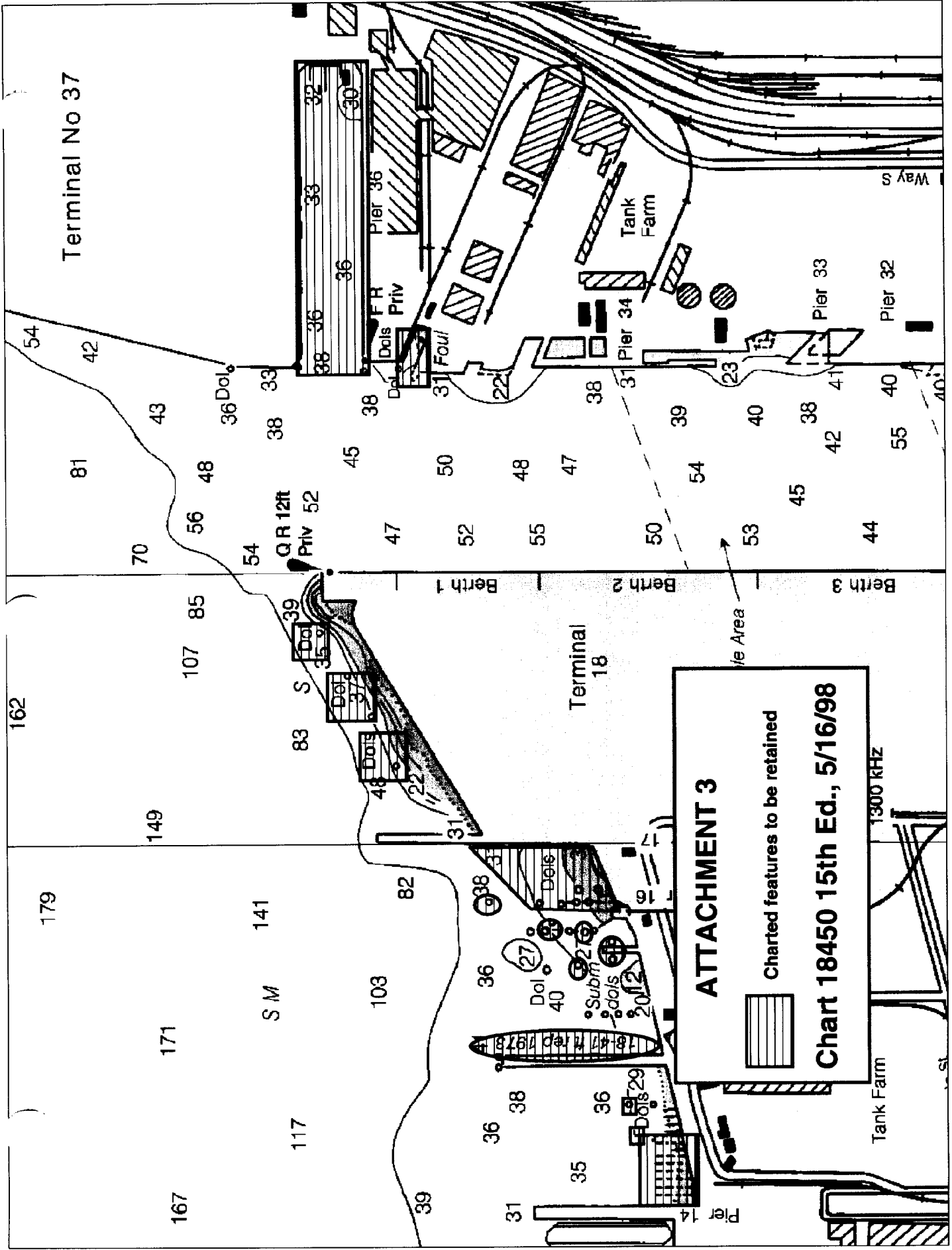
T. RECOMMENDATIONS

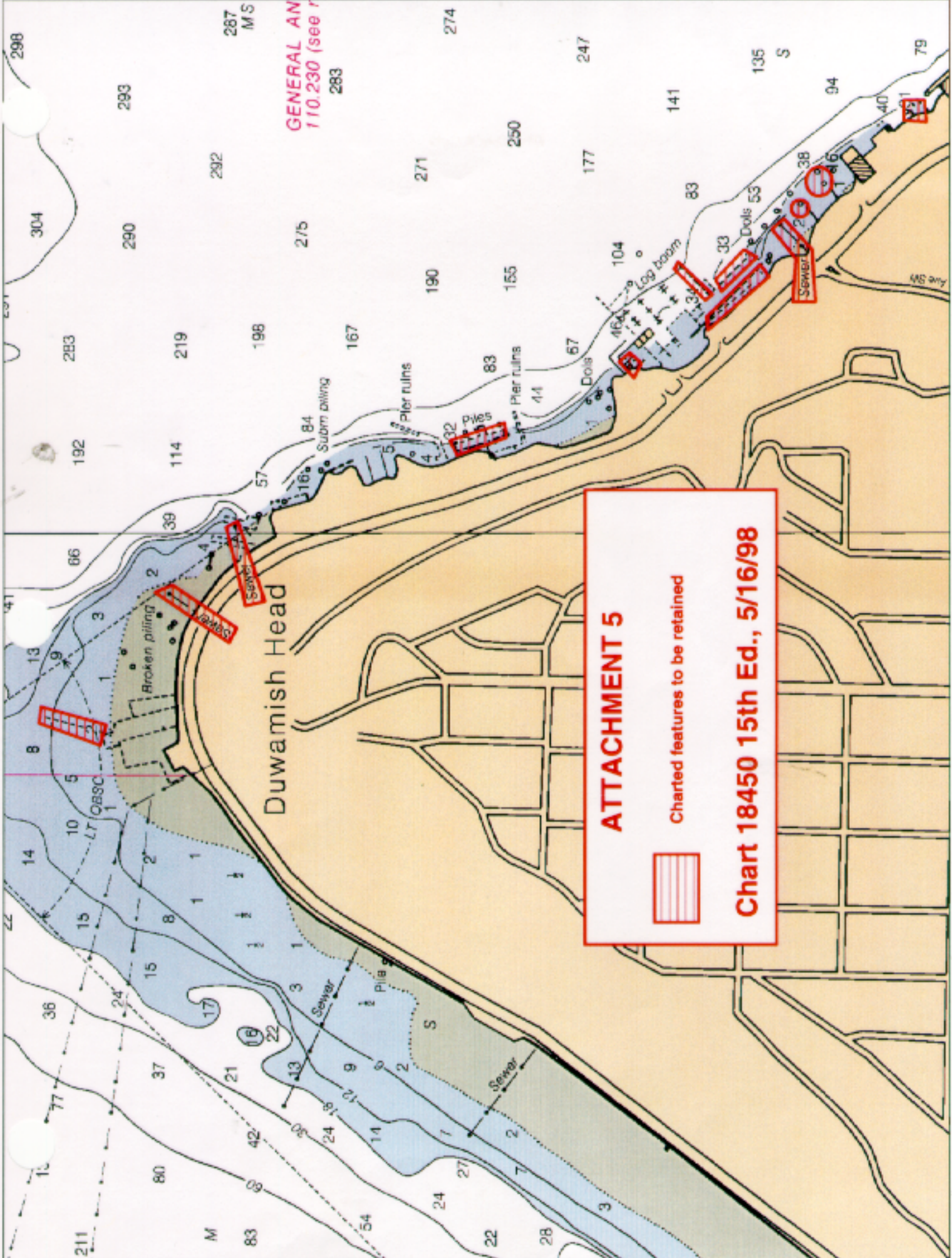
This is an adequate hydrographic survey to update the nautical chart. Several charted and prior survey features and soundings within the limits of the assigned survey area were not investigated and/or addressed by the hydrographer. Additional fieldwork, on a low priority basis is recommended, to verify or disprove all these features. Refer to attachments 2-7 for specific miscellaneous charted data not investigated during this survey. Additional recommendations are found in the hydrographer's report, section T and the evaluation report, section O and Q. See Addendum.

U. REFERRAL TO REPORTS

Referral to reports is adequately discussed in the hydrographer's report.


Charles R. Davies
Cartographer

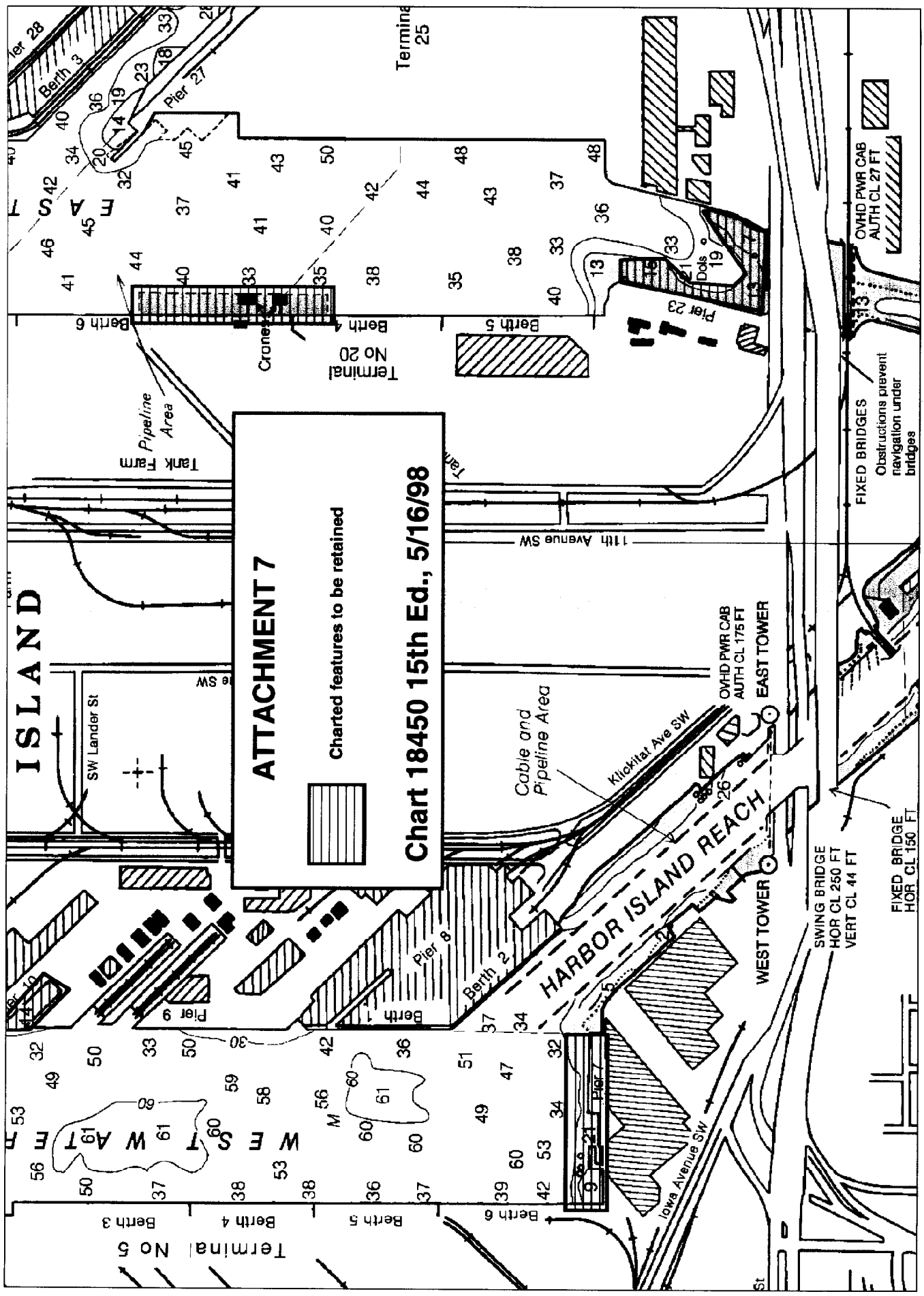




ATTACHMENT 5

 Charted features to be retained

Chart 18450 15th Ed., 5/16/98



ISLAND

ATTACHMENT 7

Charted features to be retained

Chart 18450 15th Ed., 5/16/98

HARBOR ISLAND REACH

WEST TOWER

EAST TOWER

SWING BRIDGE
HOR CL 250 FT
VERT CL 44 FT

FIXED BRIDGE
HOR CL 150 FT

FIXED BRIDGES
Obstructions prevent
navigation under
bridges

Terminal No 5
Berth 3
Berth 4
Berth 5
Berth 6

SW Lander St
SW

Terminal No 20
Berth 6
Crane
Terminal 25
Berth 5
Berth 2
Berth 3
Berth 4
Berth 5
Berth 6
Pier 1
Pier 2
Pier 3
Pier 4
Pier 5
Pier 6
Pier 7
Pier 8
Pier 9

11th Avenue SW

Klickitat Ave SW

Iowa Avenue SW

Tank Farm
Pipeline Area

Cable and
Pipeline Area

OMHD PWR CAB
AUTH CL 175 FT

OMHD PWR CAB
AUTH CL 27 FT

Termin
25

41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62

Addendum to Hydrographic Survey H-10798

Field Number RA-05-01-98

Elliott Bay, Washington

Scale 1:5,000

March, 1999

NOAA Ship RAINIER

Chief of Party: Captain Alan D. Anderson, NOAA

A. PROJECT ✓

This navigable area survey was amended to Project Instructions S-N903-RA, Elliott Bay, Washington dated April 17, 1998 as change number one dated March 2, 1999. A number of items requiring special investigation have been identified by N/CS341. The results of these item investigations will be included as an addendum to the 1998 survey.

C. SURVEY VESSELS ✓

Data were acquired by the Rainier survey launches (vessel numbers 2122, 2123, 2124 and 2125) as noted in the Survey Information Summary printout appended to this report. Data acquisition was conducted from March 15 to March 18, 1999 (DN 074 to DN 077).

Launch Shallow Water Multibeam (SWMB) (VN 2123): ✓

The Reson SeaBat 8101 is a multibeam echosounder system that measures relative water depths across a wide swath perpendicular to the vessel's path. The Reson SeaBat 8101 ensonifies the seafloor with a 150° swath consisting of 101 individual 1.5° x 1.5° beams. The system was designed to meet International Hydrographic Organization standards to measure the seafloor at a maximum range of 320 meters. The system's maximum depth range under actual field conditions has proven to be much less. RAINIER has discovered that maximum attainable depths are approximately 80-150 meters, depending on sea conditions and bottom topography.

Line "29_2100" was removed due to suspected DGPS multi-path errors. All other multibeam lines match up well with one another. *CONCUR*

D. AUTOMATED DATA ACQUISITION AND PROCESSING ✓

Shallow water multibeam (SWMB) echosounder data were acquired using the Reson SeaBat 8101 with ISIS version 3.41 and processed using CARIS software. Raster image and shoreline data in MapInfo facilitated charted and prior survey comparisons. Final Detached Positions and soundings based on predicted tides were saved in MapInfo 5.0 format.

G. CORRECTIONS TO ECHO SOUNDINGS ✓

Sound Velocity Correctors:

The following sound velocity cast was used for corrections to the SWMB data and detached positions for this survey:

DN	Time (UTC)	Position	TABLE No.	TABLE DEPTH
074	1708	47° 37' 48" N 122° 23' 00" W ✓	02	22.2 m

The following sound velocity casts were used for corrections to the SWMB data only:

DN	Time (UTC)	Position	TABLE No.	TABLE DEPTH
074	1805	47° 36' 02" N 122° 20' 37" W ✓		56.8 m
074	2121	47° 35' 06" N 122° 21' 35" W ✓		23.9 m

Sound velocity casts were acquired with SBE SEACAT Profiler (S/N 2477), calibrated November 13, 1998. Velocity correctors were computed using the PC program VELOCWIN, version 4.0 (1999), in accordance with Field Procedures Manual (FPM) section 2.1.2 and Hydrographic Survey Guideline (HSG) No. 69

Vessel Offset Correctors ✓

The following table shows when the vessel offset correctors used for this survey were last measured:

Vessel No.	Date of static draft and transducer offset measurements	Method of Settlement and Squat Measurement	Date of Settlement and Squat Measurement	Location of Settlement and Squat Measurement
2122	March 26, 1998	Rod leveling	June 11, 1998	Shakan Strait, AK
2123	March 26, 1998	OTF	July, 1998	Shilshole, WA
2124	March 26, 1998	Rod leveling	June 11, 1998	Shakan Strait, AK
2125	March 26, 1998	Rod leveling	June 21, 1998	Chilkat Inlet, AK

Predicted Tidal Correctors: ✓

Predicted tidal correctors for this survey were generated from commercial Tides and Currents software (version 2.5b) into HPS.

Real Tidal Correctors: ✓

The operating tide station at Seattle (944-7130) served as control for datum determination. Preliminary Unverified Tides were applied to the SWMB data during Caris processing, however, due to a gap in tide data on March 16 (DN 075), predicted tides were used after the data was

converted to HPS, as well as to all Detached Positions. This gap did not affect the multibeam data *Concur* during the processing stage.

A request dated March 19, 1999 for approved tides was forwarded to N/CS41 in accordance with FPM 4.2.3. *Approved tide note dated July 8, 1999 is attached*

H. HYDROGRAPHIC POSITION CONTROL ✓

The horizontal datum for this project is NAD 83.

All soundings were positioned using differential GPS (DGPS). The USCG Beacon at Robinson Point was the primary horizontal control for this project.

The following is a list of all Detached Positions taken during the survey:

FIX NUMBER	REMARK	POSITION Of DP	DEPTH/HEIGHT (FT)		RECOMMENDATIONS
			DEPTH (m)	(corrected with predicted tides)	
20013	Dive Sewer Outfall Disproval	47-36-13.1 N ✓ 122-20-27.3 W	16.8	54.6 ft	Remove from chart <i>Dive Form not submitted</i>
20015	Floating Concrete Barrier for Ferries with Two Amber Lights	47-36-09.7 N ✓ 122-20-27.4 W	N/A		New feature Chart as surveyed
20017	Floating Concrete Barrier for Ferries	47-36-10.2 N ✓ 122-20-26.7 W	N/A		New feature Chart as surveyed
20018	Floating Concrete Barrier for Ferries - East Side	47-36-09.9 N ✓ 122-20-25.8 W	N/A		New feature Chart as surveyed
20020	Floating Concrete Barrier for Ferries - South Side	47-36-07.3 N ✓ 122-20-26.4 W	N/A		New feature Chart as surveyed
20022	Floating Concrete Barrier for Ferries with Two Amber Lights West Side	47-36-07.6 N ✓ 122-20-27.3 W	N/A		New feature Chart as surveyed
20024	Floating Concrete Barrier for Ferries East Side	47-36-08.0 N ✓ 122-20-25.8 W	N/A		New feature Chart as surveyed
20025	Floating Concrete Barrier	47-36-08.2 N ✓ 122-20-26.7 W	N/A		New feature Chart as surveyed
20026	Floating Concrete Ferry Barrier	47-36-09.4 N ✓ 122-20-26.6 W	N/A		New feature Chart as surveyed
20027	Dive - Submerged Horizontal Pile	47-36-20.4 N ✓ 122-20-29.8 W	7.5 m	24.6 ft	Chart as surveyed <i>Chart 24 Obstrn (pile)</i>
20030	Derelict Pier	47-35-09.3 N ✓ 122-22-31.0 W	4.29 m	14.1 ft	Chart as surveyed <i>Chart Pier Ruins</i>
41970	Dive - Shoal	47-35-13.0 N ✓ 122-21-47.4 W	8.95 m	27.89 ft	Chart as surveyed <i>Chart 28 Obstrn (cement block)</i>
41971	Dive 33 Obstrn (piles) Submerged Pile Ruins	47-35-12.6 N ✓ 122-21-46.7 W	10.50 m	32.8 ft	Chart as surveyed <i>Due to chart scale cannot plot on chart.</i>
41972	Six Pile Dolphin	47-35-12.2 N ✓ 122-21-49.9 W	6.3	(4)	Retain as charted <i>Remove from chart. Chart 201 according to survey</i>
41973	Concrete Dolphin <i>SAME AS 51159</i>	47-34-59.7 N ✓ 122-21-40.9 W	7.6	(4)	Retain as charted <i>Remove from chart. Chart 101 according to survey</i>
41976 <i>(no position)</i>	Dive Submerged Pilings	47-35-06.7 N ✓ 122-21-57.0 W	0.5		Retain as charted <i>Ruins transferred from prior survey H-5844</i>

FIX NUMBER	REMARK	POSITION OF DP	DEPTH/HEIGHT (FT)		RECOMMENDATIONS
			DEPTH (m)	HEIGHT (ft)	
41977	Concrete Dolphin "B" SAMEAS 51166	47-35-02.9 N 122-22-15.8 W	5.0 4.2 m Height not used		Remove Retain as charted light (dol) "B"
41979	Concrete Dolphin "A" SAMEAS 51167	47-35-02.2 N 122-22-12.8 W	5.0 3.7 m Height not used		Remove Retain as charted light (dol) "A"
41980	Concrete Dolphin SAME AS 51168	47-35-01.1 N 122-22-13.2 W	5.0 (1)		Remove Retain as charted dol chart dol according to survey.
41981	Three Pile Iron Dolphin	47-35-00.3 N 122-22-13.5 W	6.0 2.9 m (1) -9.5 ft		Remove Retain as charted Chart dol from survey
42000	Dive Ruins Disproval	47-35-49.8 N 122-23-13.8 W	2.8 6 m 8.5 ft		Remove Remove from chart Concur
42001	Dive Submerged Pile	47-35-41.1 N 122-23-00.5 W	0.41 m -0.5 Obstr		Remove Retain as charted Ruling transferred from prior survey H-5244 Concur
42002	Ruin Verified Seawardmost	47-35-29.4 N 122-22-52.3 W	3.6 0.8 m -3.0 ft		Remove Retain as charted Chart ruins as transferred from H-9167 Concur
42003	Ruin Verified Southernmost	47-35-27.5 N 122-22-51.3 W	3.7 0.9 m -3.0 ft		Remove Retain as charted Chart ruins from survey
42004	Ruin Verified Northern Seaward	47-35-23.4 N 122-22-47.5 W	3.4 0.6 2 -11.1 ft		Remove Retain as charted Chart pier as according to this survey.
42005	Pier Verified Southern	47-35-21.7 N 122-22-45.8 W	3.4 m 6.2 -11.1 ft		Remove Retain as charted Chart pier according to survey.
42006	Sewer Outfall Verified	47-35-15.4 N 122-22-38.4 W	0.7 2 m 0.6 ft		Remove Retain as charted Chart sewer according to survey.
42007	Dolphin	47-35-13.6 N 122-22-35.2 W	8.5 m 11.9 (15)		Remove Retain as charted Chart dol according to survey.
42008	Dolphin	47-35-14.7 N 122-22-36.8 W	8.5 m 11.9 (15)		Remove Retain as charted Chart dol according to survey.
42009	Dolphin	47-35-14.5 N 122-22-37.2 W	8.5 m 11.9 (15)		Remove Retain as charted Chart dol according to survey.
42010	Dolphin	47-35-14.0 N 122-22-36.7 W	8.5 m 11.9 (15)		Remove Retain as charted Chart dol according to survey.
42011	Dolphin	47-35-13.5 N 122-22-35.9 W	8.5 m 11.8 (15)		Remove Retain as charted Chart dol according to survey.
42012	Dolphin	47-35-13.1 N 122-22-35.2 W	8.6 m 11.8 (15)		Remove Retain as charted Chart dol according to survey.
51131	Buoy G C "3"	47-37-46.8 N 122-23-04.3 W	N/A		Remove Retain as charted Chart according to survey.
51132	Buoy G C "1"	47-37-42.3 N 122-23-05.2 W	N/A		Remove Retain as charted Chart according to survey
51134	Rock Pile	47-37-57.4 N 122-22-44.8 W	1.9 m 1.6 -7.0 ft		Chart as surveyed * (2) Concur
51135	Piling	47-37-56.6 N 122-22-43.7 W	1.8 m 1.4 -6.0 ft		Chart as surveyed o pile (4) Concur
51136	Buoy W Or C	47-37-32.5 N 122-22-31.7 W	N/A		Chart as surveyed New location Concur
51137	Buoy W Or C	47-37-30.1 N 122-22-26.9 W	N/A		Chart as surveyed New location Concur
51138	Piling	47-36-03.6 N 122-20-14.0 W	3.6 m 6.0 (2)		Chart as surveyed Row of piles Concur

FIX NUMBER	REMARK	POSITION OF DP	DEPTH/HEIGHT (FT)		RECOMMENDATIONS
			DEPTH (m)	(corrected with predicted tides)	
51139	Ferry Ramp	47-36-02.2 N 122-20-15.2 W	No associated Depth/Height		Chart as surveyed Retain as charted Concur
51140	Piling	47-35-22.4 N 122-20-35.0 W	-1.1m -3.5 4.0ft (4)		Retain as charted Remove dol, chart piles Concur
51141	Pier Ruins	47-35-20.0 N 122-20-35.1 W	-1.2m -3.5 4.0ft (4)		Remove Retain as charted Chart ruins according to survey. Concur
51142	Pier Ruins	47-35-18.9 N 122-20-35.0 W	-1.2m -3.5 4.0ft (4)		Remove Retain as charted Chart ruins according to survey. Concur
51143	Dolphin	47-35-25.6 N 122-20-48.9 W	-0.8m -3.1 -3.0ft (3)		Remove Retain as charted Chart dol according to survey. Concur
51144	Dolphin	47-35-24.8 N 122-20-51.1 W	-2.3m -4.6 -8.0ft (8)		Remove Retain as charted Chart dol according to survey. Concur
51145	Dolphin	47-35-23.7 N 122-20-53.2 W	-2.4m -4.6 -8.0ft (8)		Remove Retain as charted Chart dol according to survey. Concur
51146	Dolphin	47-35-22.6 N 122-20-56.1 W	-1.9m -4.7 7.0ft (7)		Remove Retain as charted Chart dol according to survey. Concur
51147	Disproval of Concrete Apron	47-34-43.6 N 122-20-45.4 W	15.8		Chart as surveyed (SWMB data) Remove Apron Concur
51148	Disproval of Concrete Apron	47-34-42.1 N 122-20-45.3 W	14.6		Chart as surveyed (SWMB data) Remove Apron Concur
51149	Disproval of Concrete Apron	47-34-40.7 N 122-20-45.3 W	15.9		Chart as surveyed (SWMB data) Remove Apron Concur
51150	Dolphin	47-35-18.6 N 122-21-04.0 W	-5.3m -7.6 (6)		Remove Retain as charted Chart row of dols according to survey. Concur
51152	Dolphin	47-35-18.1 N 122-21-02.5 W	-4.3m -6.6 (4)		Retain as charted Chart row of dols according to survey. Concur
51153	Concrete Dolphin with Walkway to Pier	47-34-59.1 N 122-21-30.0 W	-2.5m -4.8 Delete height info		Remove Retain as charted Chart dol according to survey. Concur
51154	Concrete Dolphin with Walkway to Pier	47-34-54.7 N 122-21-30.1 W	-2.5m -4.8 Delete height info		Remove Retain as charted Chart dol according to survey. Concur
51157	New Concrete Pier	47-34-53.8 N 122-21-40.9 W	-2.5m -4.8 Delete height info		New feature Chart as surveyed Concur
51159	New concrete Dolphin (SAME AS 41973)	47-34-59.8 N 122-21-41.2 W	-5.4 (4)		New feature Chart as surveyed Concur
51160	New concrete Dolphin	47-34-58.7 N 122-21-40.9 W	-3.1m -5.4 -10.0ft (10)		New feature Chart as surveyed Concur
51161	Dolphin	47-34-57.8 N 122-21-41.4 W	-3.1m -5.5 -10.0ft (10)		New feature Chart as surveyed Concur
51162	New Concrete Pier	47-34-59.1 N 122-21-41.2 W	4.0		New feature Chart as surveyed Retain as charted Concur
51163	Dolphin (SAME AS 41972)	47-35-12.2 N 122-21-50.0 W	-6.0		Remove Retain as charted Chart according to survey. Concur
51164	Mooring Buoy	47-35-28.8 N 122-22-07.7 W	N/A		Chart as surveyed New location Concur
51165	Mooring Buoy	47-35-26.2 N 122-22-25.8 W	N/A		Chart as surveyed New location Concur
51166*	Lighted Concrete Dolphin "B" (SAME AS 41977)	47-35-03.0 N 122-22-16.0 W	-6.8		Remove Retain as charted Chart dol according to survey. Concur
51167*	Lighted Concrete Dolphin "A" (SAME AS 41977)	47-35-02.6 N 122-22-13.0 W	-5.3		Remove Retain as charted Chart dol according to survey. Concur

* Positions 41977 and 41979 were used to plot these Fixed aids on the smooth sheet.

FIX NUMBER	REMARK	POSITION OF DP	DEPTH/HEIGHT (FT)	RECOMMENDATIONS
			DEPTH (m) (corrected with predicted tides)	
51168	Concrete Dolphin (SAMEAS 41980)	47-35-01.2 N ✓ 122-22-13.2 W	-4.6	Remove Retain as charted Chart according to survey.
51169	Concrete Dolphin	47-35-01.3 N ✓ 122-22-16.7 W	-1.9 m -4.6 -7.0 ft (7)	Remove Retain as charted Chart dol according to survey
51170	Dolphin	47-35-02.9 N ✓ 122-22-22.0 W	-3.4 m -6.1 (1)	Remove Retain as charted Chart dol according to survey
51171	Dolphin	47-35-03.7 N ✓ 122-22-22.9 W	-3.4 m -6.2 (1)	Remove Retain as charted Chart dol according to survey
51172	Dolphin	47-35-05.3 N ✓ 122-22-24.9 W	-3.4 m -6.2 (1)	Remove Retain as charted Chart dol according to survey

Note: Detached positions 41970 and 41971 are from the same dive. The shoal at 41970 is shallower than the nearby submerged pile ruins at 41971.

N. COMPARISON WITH THE CHART *SEE Envr Report, section N*

Chart 18450
15th Ed. May 16, 1998
Scale: 1:10,000

The survey was compared with Chart 18450 and was in good agreement, generally within one to two feet. There is some shoaling at the inshore end of Pier 91 and by the eastern bank at the south end of East Waterway. There also appears to be some natural scouring in the center of the channel at the south end of East Waterway. Final sounding comparisons will be made at PHB after reduction to final vertical datum.

The following table lists the major discrepancies between charted depths and those of the current survey:

Chart 18450 14th Ed.


Charted Depth (ft.)	SWMB Depth (ft.)	Position	Fix Number	Comments
32	26.2 28.7	47-37-53.2 N ✓ 122-23-03.5 W	80010-382	
27	13.1 11.8	47-37-58.4 N ✓ 122-23-02.2 W	80142 80547	
22	31.8 32.0	47-37-34.5 N ✓ 122-22-57.9 W	80457-630	Off end of pier 24.9 ft. found at edge of pier
27	35.8 31.7	47-37-34.8 N ✓ 122-22-49.7 W	80251-716	Off end of pier
9 <i>Not on 15th Ed.</i>	-1.3	47-34-19.4 N ✓ 122-20-40.7 W	81063	Sounding taken at high tide
13 <i>Not on 15th Ed.</i>	28.5	47-34-21.0 N ✓ 122-20-42.2 W	81132	Scouring in east waterway
25 <i>Not on 15th Ed.</i>	30.8	47-34-22.1 N ✓ 122-20-40.2 W	81150	Scouring in east waterway <i>or dredging</i>

SWMB soundings from 1999 agree very favorably with singlebeam soundings from 1998 in common areas, generally within one to two feet. *Concur*


T. RECOMMENDATIONS *See Enx Report, section T*

As mentioned in the original descriptive report, the shoreline on chart 18450 needs to be recompiled from more recent photography. It is recommended that this area be reflowed every 3 to 5 years to update the shoreline. *Concur*

Respectfully Submitted,


Mark T. Lathrop
Rotating Hydrographer, NOAA

Approved and Forwarded,


Alan D. Anderson
Captain, NOAA
Commanding Officer

Survey Information Summary

Project: OPR-N903-98 Project Name: ELLIOT BAY

Instructions Dated: 3/2/99 Project Change Info:

Sheet Letter: A Registry Number: H-10798

Sheet Number: RA-05-01-98

Survey Title: East Portion of Elliot Bay

Data Acquisition Dates: From: ~~01-Apr-98~~ ~~74~~ To: 18-Mar-99 400

Vessel Usage Summary

VESNO	MS	SPLITS	DEV	XL	S/L	DP	BS	DIVE
2122						2		
2123								
2124	1	1				3		2
2125	3			1		1	1	
2126	4	2	3	1		1		

*Summary of
1998 and 1999
work*

Sound Velocity Cast Information

Tide Zone Information

Tide Gage Information

Statistics Summary

Type	Total:
BS	28
DEV	53.65
DIVE	3
DP	78
MS	108.1
SPLIT	36.64
SWMB	2.66
XL	15.36

Percent XL:	14.2%
SQNM:	3.73

APPROVAL SHEET

for

H-10798

RA-05-01-98

Standard field surveying and processing procedures were followed in producing this survey in accordance with the Hydrographic Manual, Fifth Edition; the Hydrographic Survey Guidelines; and the Field Procedures Manual, as updated for 1998.

The field sheet and accompanying records have been examined by me, 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,



Alan D. Anderson
Captain, NOAA
Commanding Officer
NOAA Ship RAINIER



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE: July 8, 1999

HYDROGRAPHIC BRANCH: Pacific

HYDROGRAPHIC PROJECT: OPR N903-RA-99

HYDROGRAPHIC SHEET: H-10798

LOCALITY: Elliott Bay, Washington

TIME PERIOD: March 15 - March 18, 1999

TIDE STATION USED: 944-7130 Seattle, Puget Sound, WA
Lat. 47° 36.2'N Lon. 122° 20.3'W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters

HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 3.198 meters

REMARKS: RECOMMENDED ZONING
Use zone(s) identified as: PS2.

Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units
(meters), relative to MLLW and on Greenwich Mean Time.

Thomas V. Gero 7/8/99
CHIEF, REQUIREMENTS AND DEVELOPMENT DIVISION



Printed on Recycled Paper



Final tide zone node point locations for OPR N903-RA-99,
Sheet H-10798.

Format: Longitude in decimal degrees (negative value denotes
Longitude West),
Latitude in decimal degrees
Tide Station (in recommended order of use)
Average Time Correction (in minutes)
Range Correction

	Tide Station Order	AVG Time Correction	Range Correction
Zone PS2			
-122.465472 47.508708	944-7130	0	1.00
-122.369014 47.521458			
-122.365783 47.555867			
-122.304861 47.59997			
-122.405646 47.661072			
-122.535432 47.663657			
-122.542999 47.629764			
-122.502568 47.628413			
-122.492258 47.621062			
-122.500756 47.616752			
-122.512004 47.612822			
-122.539749 47.620597			
-122.56219 47.597286			
-122.554147 47.589174			
-122.549482 47.50828			
-122.465472 47.508708			

NOAA FORM 77-27(H) (9-83)	U.S. DEPARTMENT OF COMMERCE	REGISTRY NUMBER H-10798					
HYDROGRAPHIC SURVEY STATISTICS							
RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed.							
RECORD DESCRIPTION	AMOUNT	RECORD DESCRIPTION	AMOUNT				
SMOOTH SHEET	1	SMOOTH OVERLAYS: POS., ARC, EXCESS	N/A				
DESCRIPTIVE REPORT	1	FIELD SHEETS AND OTHER OVERLAYS	N/A				
DESCRIP-TION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS		
ACCORDION FILES	1						
ENVELOPES	1						
VOLUMES							
CAHIERS							
BOXES				1			
SHORELINE DATA							
SHORELINE MAPS (List):		N/A					
PHOTOBATHYMETRIC MAPS (List):		N/A					
NOTES TO THE HYDROGRAPHER (List):		N/A					
SPECIAL REPORTS (List):		N/A					
NAUTICAL CHARTS (List):		Chart 18450 15th Ed., May 16, 1998					
OFFICE PROCESSING ACTIVITIES <i>The following statistics will be submitted with the cartographer's report on the survey</i>							
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				224		224	
COMPARISON WITH PRIOR SURVEYS AND CHARTS							
EVALUATION OF SIDE SCAN SONAR RECORDS							
EVALUATION OF WIRE DRAGS AND SWEEPS							
EVALUATION REPORT					73	73	
GEOGRAPHIC NAMES							
OTHER (Chart Compilation)					52	52	
*USE OTHER SIDE OF FORM FOR REMARKS				TOTALS	224	125	349
Pre-processing Examination by M. Bigelow				Beginning Date 6/30/98	Ending Date 8/6/99		
Verification of Field Data by M. Bigelow, R. Mayor, E. Domingo, R. Davies				Time (Hours) 224	Ending Date 8/10/99		
Verification Check by B. Olmstead				Time (Hours) 13	Ending Date 8/11/99		
Evaluation and Analysis by R. Davies				Time (Hours) 73	Ending Date 8/12/99		
Inspection by B. Olmstead				Time (Hours) 20	Ending Date 8/12/99		

ADDENDUM TO EVALUATION REPORT

H-10798

A. PROJECT

This project was initiated following a review of survey results from the 1998 season. That review disclosed several deficiencies, which required additional work to resolve. The evaluation report for the previous survey contains further information on the specific nature of the deficiencies while the hydrographer's report details the additional work conducted to resolve them.

B. AREA SURVEYED

The survey area is graphically depicted in the hydrographer's report, section A. A page-size plot of the charted area depicting the limits of supersession accompany this report as Attachment 1. Additional information is found in the evaluation report of the previous survey work and in attachments 2 - 7.

C. SURVEY VESSELS

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

D. AUTOMATED DATA ACQUISITION AND PROCESSING

Survey data were processed using HYPACK/HPS, USL CARIS/HIPS and MicroStation 95.

Processed digital data for this survey exists in the standard HPS format, a database format using the .dbf 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. Database records forwarded are in the Internal Data Format (IDF) and are in compliance with specifications in existence at the time of survey processing.

The drawing files necessarily contain information that is not part of the HPS data set such as geographic name text, line-type data, and minor symbolization. In addition, those soundings deleted from the drawing for clarity purposes remain unrevised in the HPS 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 Survey Guideline No. 35 and No. 75.

The data is plotted using a Modified Transverse Mercator (MTM) projection and are depicted on a single sheet.

E. SONAR EQUIPMENT

Side scan sonar equipment was not used during survey H-10798.

F. SOUNDING EQUIPMENT

Sounding equipment has been adequately addressed in the addendum.

G. CORRECTIONS TO SOUNDINGS

Soundings and elevations below Mean High Water (MHW) have been reduced to Mean Lower Low Water (MLLW) using verified tide correctors obtained from the CO-OPS website for station 944-7130 (Seattle). These correctors were subsequently compared to the similar correctors provided by CO-OPS in response to a request for approved tides. The datasets were identical therefore no remedial corrective processing was required to update survey soundings reduced with correctors obtained from the website.

Other corrections to soundings include static draft, heave, roll and pitch, dynamic draft (settlement and squat) and sound velocity. These reducers have been reviewed and are consistent with NOS specifications.

H. CONTROL STATIONS

Sections H of the hydrographer's report contain adequate discussions 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.

Additional information is found in the evaluation report for the 1998 survey work.

I. HYDROGRAPHIC POSITION CONTROL

Differential GPS (DGPS) was used to control this survey. A horizontal dilution of precision (HDOP) not to exceed 1.8 was computed for survey operations. No positions exceeded the limits in terms of HDOP. These positions are isolated and occur randomly throughout the survey area. DGPS performance checks were conducted in the field and found adequate.

NAD 83 is used as the horizontal datum for plotting and position computations.

Additional information concerning specific control system type, calibrations and system checks can be found in the hydrographer's report and in the separates related to horizontal position control and corrections to position data.

J. SHORELINE

Reference the evaluation report for the 1998 survey work and the hydrographer's report, section J.

A new pier was found on the west side of the West Waterway in the vicinity of latitude 47°34'52N, longitude 122°21'42W. *Also, two new ferry fenders are located at lat. 47°36'10" long. 122°20'26" and lat 47°36'08", long 122°20'26". These stamps are shown in red on the present survey.*

K. CROSSLINES

There were no crosslines conducted during the additional work.

L. JUNCTIONS

Reference the evaluation report for the 1998 survey work.

*GKM
9-14-99*

M. COMPARISON WITH PRIOR SURVEYS

Reference the evaluation report for the 1998 survey work.

N. ITEM INVESTIGATIONS

There were no AWOIS items assigned to this survey.

O. COMPARISON WITH CHART

Survey H-10798 was compared with the following chart:

<u>Chart</u>	<u>Edition</u>	<u>Date</u>	<u>Scale</u>
18450	15 th	May 16, 1998	1:10,000

a. Hydrography

Charted soundings originating with the miscellaneous source data reflects the same general differences as discussed with the prior surveys. Numerous features originating with miscellaneous source data was not investigated during survey operation and have been delineated on Attachments 8-13 following this report. The evaluator recommends to retain these features as charted.

With the exceptions noted in the evaluation report for the 1998 survey work and on Attachments 8-13, survey H-10798 is adequate to supersede charted hydrography within the common area.

b. Dangers To Navigation

No additional dangers to navigation were found during office processing.

P. ADEQUACY OF SURVEY

Except as noted below, the hydrography contained on survey H-10798 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.

With the exception of the following 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, and the Field Procedures Manual, April 1994 Edition:

Some charted and prior survey features seaward of the limit of safe navigation were not investigated and or addressed during survey operations. When conducting "limited" shoreline verification, the hydrographer shall verify all features within the limits of safe navigation and provide a detailed position(s) to include a sketch of the feature, height/depth information at the time of data acquisition.

Q. AIDS TO NAVIGATION

Four floating aids to navigation exist within the survey area. These aids were adequately located and serve their intended purpose. Refer to section J of the hydrographer's report for specific positional information and descriptions.

There were two additional private fixed aids to navigation, *Alaska Hydro-Train Light "B"* and *Alaska Hydro-Train Light "A"*, located during survey operations at latitude 47/35/02.9N, longitude 122/22/15.8W and latitude 47/35/12.2N, longitude 122/22/12.8W. The current charted positions on chart 18450 15th Ed., May 16, 1998 are incorrect. These lights should be charted according to this survey.

R. STATISTICS

Statistics are adequately itemized in the hydrographer's report.

S. MISCELLANEOUS


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

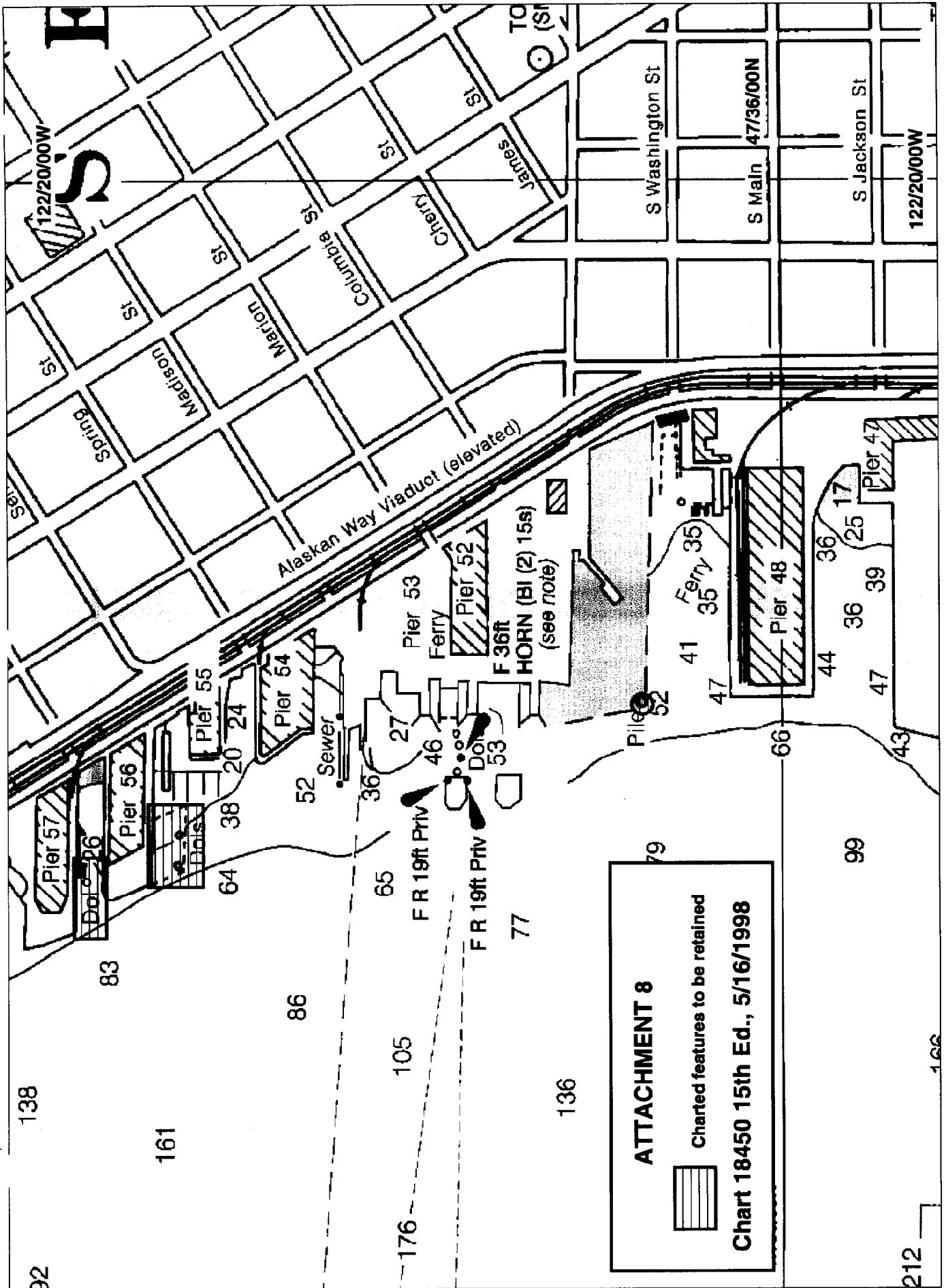
T. RECOMMENDATIONS

This is an adequate hydrographic survey. Refer to attachments 8-13 for specific items that will be retained on the chart and warrant additional field work.

U. REFERRAL TO REPORTS

Referral to reports is adequately discussed in the hydrographer's report.

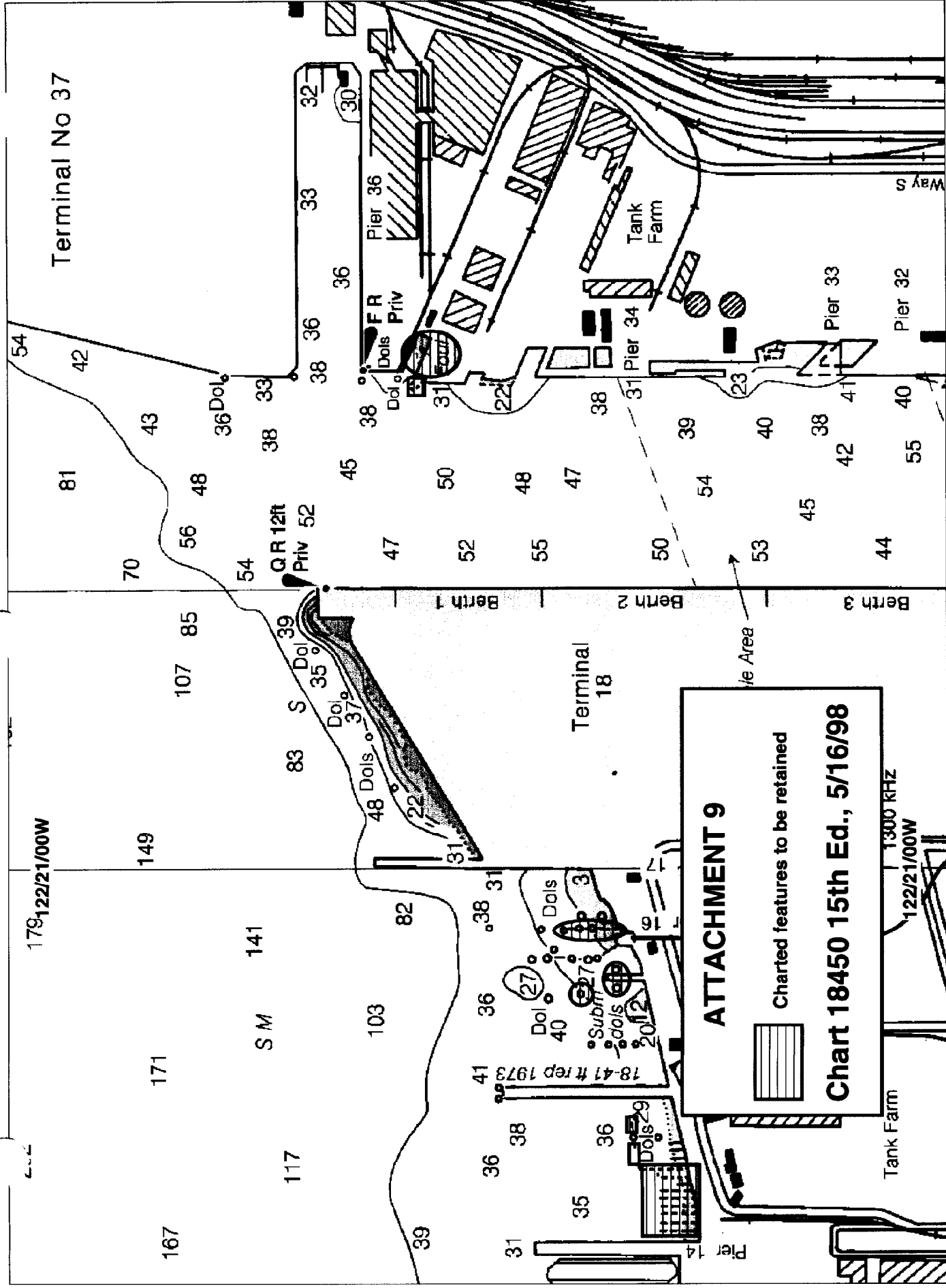

Charles R. Davies
Cartographer



ATTACHMENT 8

Charted features to be retained

Chart 18450 15th Ed., 5/16/1998



Terminal No 37

Terminal 18

ATTACHMENT 9

Charted features to be retained

Chart 18450 15th Ed., 5/16/98

1300 RHZ

122/21/00W

Tank Farm

179 122/21/00W

149

141

S M

117

103

171

107 85

70

54

83 S

Dols

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QR 12ft

Priv 52

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36 Dols

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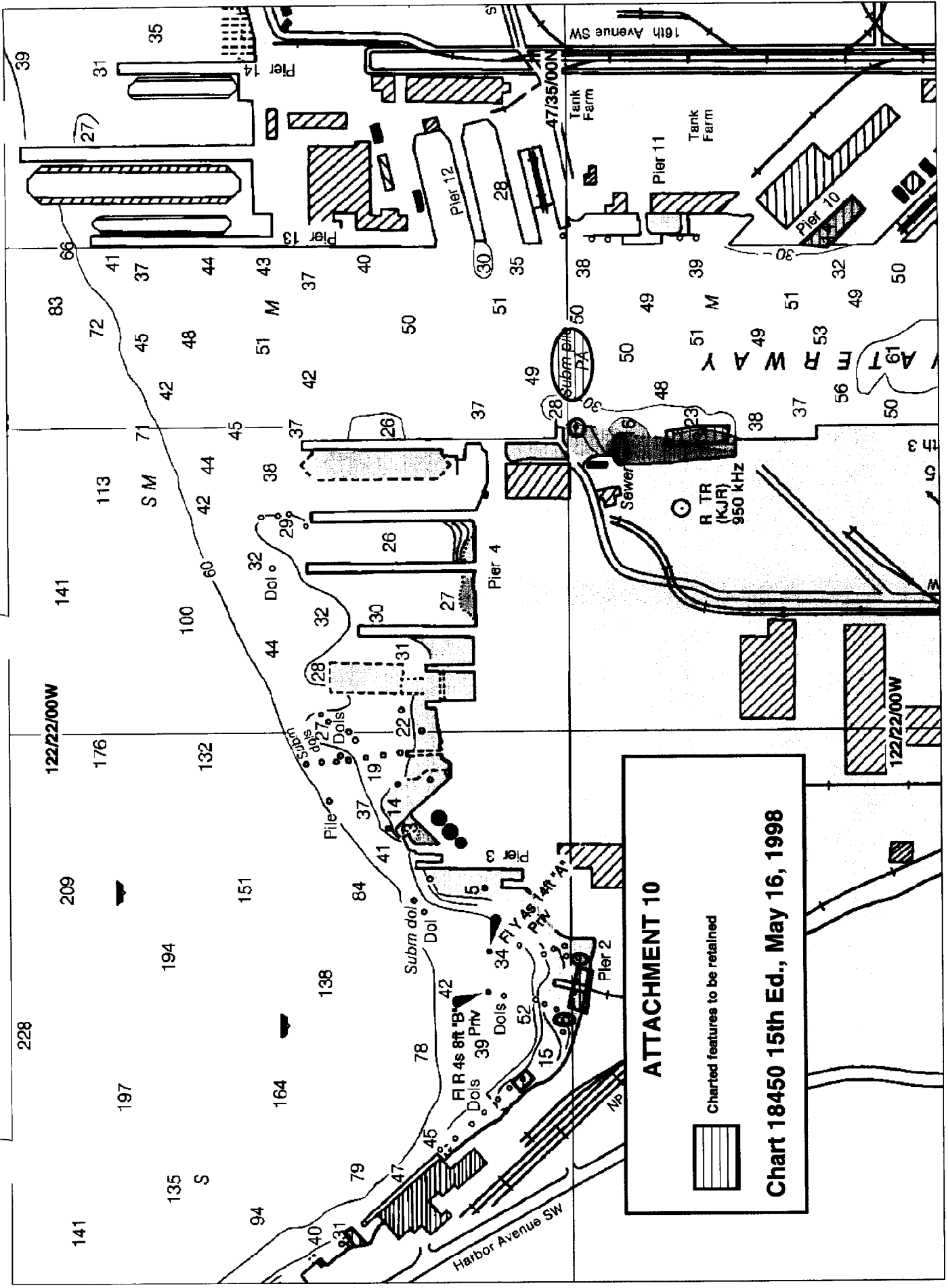
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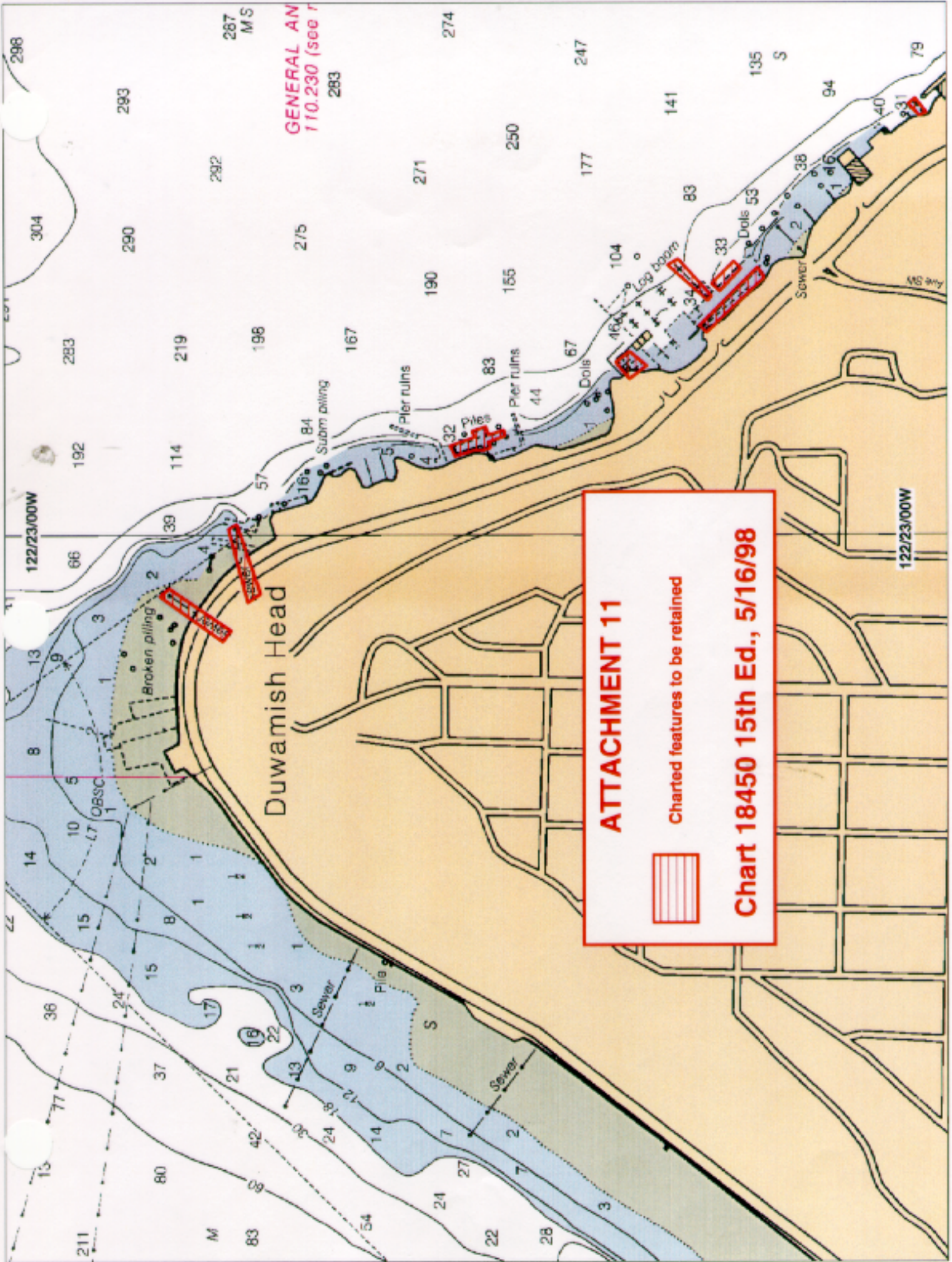
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ATTACHMENT 10

Charted features to be retained

Chart 18450 15th Ed., May 16, 1998



GENERAL AN
110.230 (see r
283

287
MS

ATTACHMENT 11

Charted features to be retained



Chart 18450 15th Ed., 5/16/98

Duwamish Head

ATTACHMENT 11

Charted features to be retained

Chart 18450 15th Ed., 5/16/98

APPROVAL SHEET
H-10798

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 disapproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

Bruce A. Olmstead Date: 8/13/99
Bruce A. Olmstead
Senior Cartographer, Cartographic Section
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.

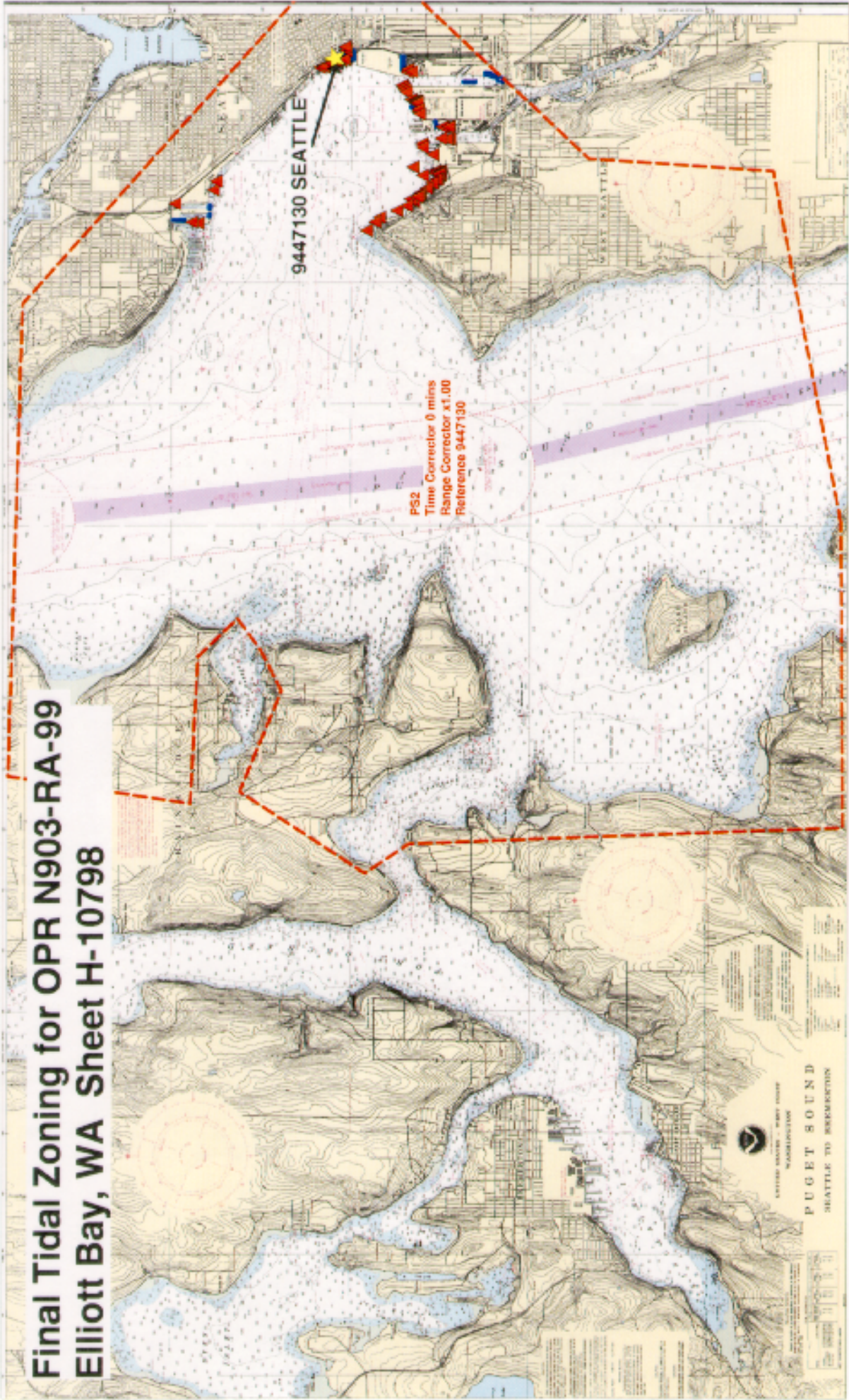
James C. Gardner Date: 8-19-99
James C. Gardner
Commander, NOAA
Chief, Pacific Hydrographic Branch

Final Approval

Approved:

Samuel P. De Bow Date: September 16, 1999
Samuel P. De Bow
Commander, NOAA
Chief Hydrographic Surveys Division

**Final Tidal Zoning for OPR N903-RA-99
Elliott Bay, WA Sheet H-10798**



H-10798

ELLIOTT BAY

SOURCE	
SI 1800-1988	NCE SURFACE
SI 1800-1988	NCE SURFACE
SI 1800-1988	NCE SURFACE

Single beam
4/1 - 4/10, 1998

Multibeam
3/15 - 3/18, 1999

NOTE: A detailed description of the data is provided in the "SOURCE" column of the table above. The data is presented in the form of a grid of numbers representing depth in meters. The grid is oriented with North at the top of the page. The data is presented in the form of a grid of numbers representing depth in meters. The grid is oriented with North at the top of the page.

MARINE CHART BRANCH
RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-10798

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
18450	2/9/99	Rued Jarvis	Full Part Before After Marine Center Approval Signed Via <u>Full Application</u> Drawing No. <u>of soundings, curves and features from smooth sheet.</u>
18450	11/18/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Applied snags</u> Drawing No. <u>features to chart thru BP TLW</u>
18449	11/29/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Applied snags</u> Drawing No. <u>features to chart thru 18450 TLW</u>
18474	11/30/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Applied Snags</u> Drawing No. <u>features to chart thru 18449 TLW</u>
18445B	11/30/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Appld Snags</u> Drawing No. <u>features to chart thru 18474 TLW</u>
18441	11/30/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Appld Snags</u> Drawing No. <u>features to chart thru 18445 TLW</u>
18445A	11/30/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Appld Snags</u> Drawing No. <u>features to chart thru 18441 TLW</u>
18440	11/30/99	Matt Kroll	Full Part Before After Marine Center Approval Signed Via <u>Appld Snags</u> Drawing No. <u>features to chart thru 18445 TLW</u>
			Full Part Before After Marine Center Approval Signed Via Drawing No.
			Full Part Before After Marine Center Approval Signed Via Drawing No.