SURFACE OBSERVATIONS, GROUND TRUTH AND DATA

NASA MISSION 144

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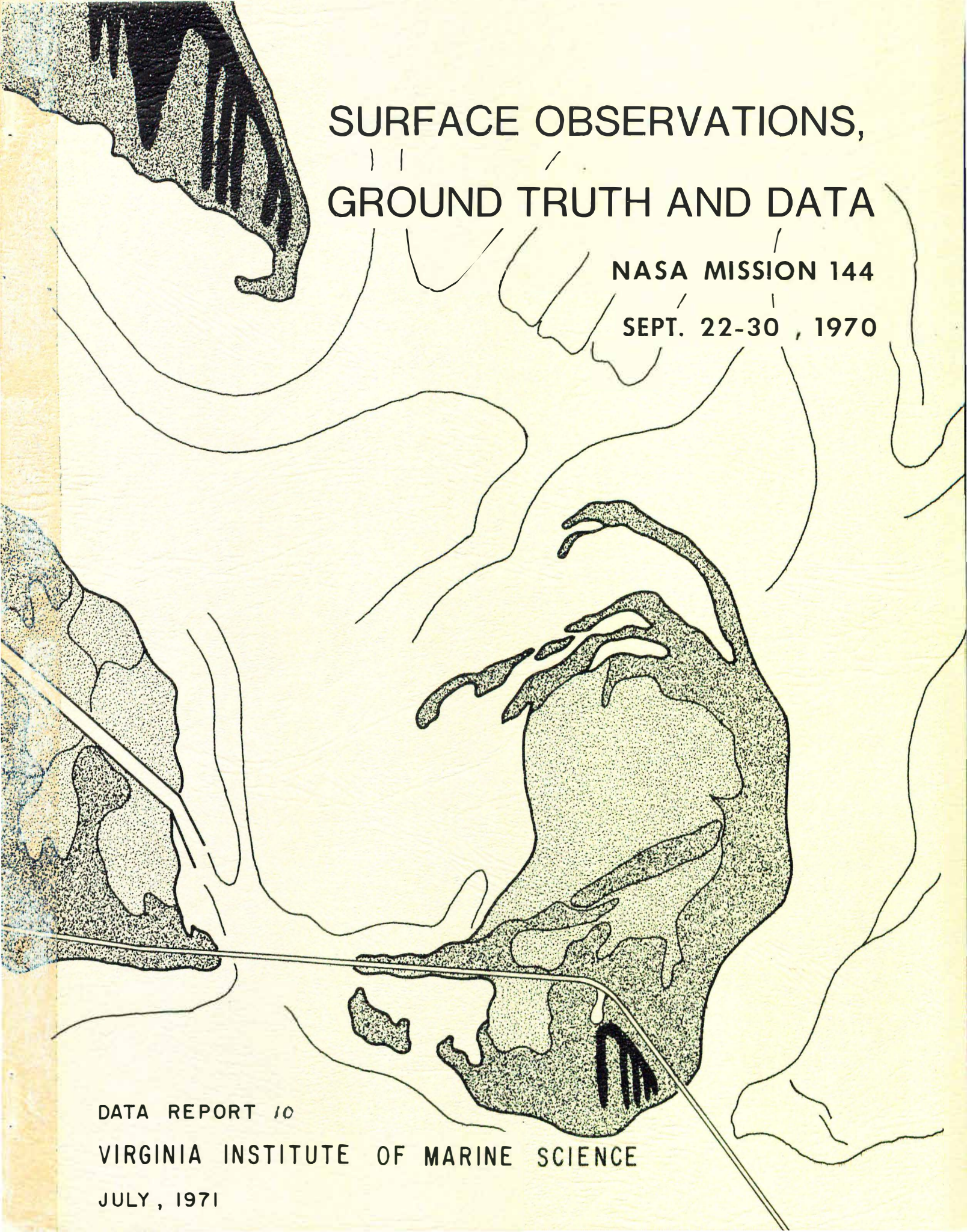

DATA REPORT 10

VIRGINIA INSTITUTE OF MARINE SCIENCE

JULY, 1971

SURFACE OBSERVATIONS, GROUND TRUTH AND DATA

NASA - USGS MISSION 144

Chesapeake Bay Region, Sept. 22-30, 1970

by

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Data Report Number 10

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INTRODUCTION

Surface observations of coastal waters and "ground truth" data were obtained to aid interpretation and analyses of overflight photography and imagery. Among the broad objectives of the mission was to investigate the potential of high-altitude, multispectral photography as a tool for the improved planning necessary to cope with multidisciplinary problems within the coastal zone, specifically with regard to:

1. The inventory and evaluation of the central Atlantic coastal area natural resources;
2. The assessment of human and natural degradation of these resources;
3. The feasibility of monitoring resource allocation and management, including land use categories and the impact of urbanization on the central Atlantic coastal area.
4. The evaluation of sources and extent of water pollution.

The site encompasses a major segment of the mid-Atlantic coast from Newark, New Jersey to Wilmington, North Carolina (Figure 2, inset). It includes the southern portion of Megalopolis, one of the world's major urban-industrial complexes which is under the pressure of land use. It encompasses the silt and pollutant laden Chesapeake drainage system, the largest on the U. S. East Coast. The site includes seaward reaches of the Delaware River system where water quality management is the chief problem. Additionally, it includes the coastal parts of North Carolina which offers a wide

range of physical environments and cultural development common to the east coast. The site is an area where large spatial and temporal variations occur in tidal waters.

OBSERVATIONS AND PLATFORMS

Because coastal waters and environments change so rapidly with time, tide and weather, ground truth operations were planned to make observations concurrent with RB-57 aerial photography over a broad area by deploying a fleet of 3 helicopters; 2 from the U.S. Army and one from the U.S. Coast Guard. The helicopters not only covered a large area within a relatively short time, but provided an aerial platform from which observers could view transient surface features from the same angle as the cameras. Moreover, these features could be selectively sampled while in hover. Coordination of observations and overflight photography was effected by air to air and ground to air radio communication. Observations from helicopters were augmented by observations from fixed-wing aircraft, from surface runabouts and vessels as well as from routine fixed stations throughout the area: e.g. tide gauge recorders of NOS, water quality stations of USGS and meterological stations of ESSA. Data of the fixed stations are compiled separately by USGS investigators.

Observations were planned to measure parameters that determine the quantity and quality of reflectance or emission. In coastal waters these included total suspended load, color of suspended material, optical ratio (scatterance:transmittance), secchi disk depth and temperature. Additionally, salinity was measured for reference.

OBSERVATIONAL PROCEDURES

Surface water was sampled from a helicopter with a weighted bucket while in hover 10-30 feet above the surface. Bucket samples of surface water were also taken over the side of vessels. Upon retrieval, temperature was measured with a stem thermometer brought to equilibrium within 30 seconds. Sample water was poured into a precleaned mason jar and returned to VIMS for laboratory analyses. Most samples were run within 8 hours after collection without being fixed with preservatives. A few were held over night in cold storage to deter decomposition of contained organic matter.

Stations over water areas were positioned by sighting on landmarks or ranging on buoys. They were plotted directly on a work chart at the time of sampling and later reduced to a master chart reproduced in Figures 1 and 2.

Visual observations of surface features like color boundaries, plankton blooms and sediment-pollution plumes, were made along the line of helicopter flight or "running path" of vessels between stations. Significant features were recorded on the work charts and photographed either in color with a hand-held 35 mm camera from helicopters or in color infra-red with a K-20 camera from fixed wing aircraft. One investigator, Dr. Marvin Wass, kept a detailed hand-written log of visual observations during flight mainly dealing with wetland conditions, Appendix V.

LABORATORY PROCEDURES

Suspended concentrations were measured gravimetrically and optically. Total concentrations were measured by filtering an aliquot of water through tared AA millipore filters having 0.8μ pore size. Procedural details are given in Appendix III. Color of suspended material collected on the filters was determined by comparing wet filters with color chips from the Munsell Book of Color. Each color is defined by hue, value and chroma. Hue refers to the primary colors of the spectrum; value refers to the property of lightness and chroma refers to the degree of saturation. Each color shade is defined by a specific letter and number code: e.g. 5Y 4/3 in which 5Y refers to hue, 4 refers to value and 3 to chroma. Because the thickness of material on the filters varied somewhat from sample to sample, color necessarily becomes darker with increased thickness. Optical ratio, or logarithmic ratio of scattered to transmitted light an indication of turbidity, was measured in a suspended solids analyzer. Procedural details are given in Appendix III. Salinity of sample water was determined to 0.05‰ with a Beckman model RS-7A inductive salinometer. Additionally, selected water samples were examined under a binocular microscope for species composition of algae and plankton.

RESULTS

A summary of spatial coverage by different observational teams and platforms is given in Appendix I. Each group is assigned a "source code" for referencing to station numbers and data listed in Appendix II.

Altogether observations were obtained from more than 4900 square miles of coastal water in the Chesapeake region and 3500 square miles in southern Virginia and North Carolina. Measurements of surface water temperature with time in the James River are given in Appendix IV and phytoplankton species composition is enumerated in Appendix VI. Of note, were large blooms of Trichodesmium observed as bands and lines in surface water of the Chesapeake Entrance off Cape Charles.

ACKNOWLEDGMENTS

This work was part of a larger project supported by NASA through the U.S. Geological Survey, Geographic Applications Program of EROS under research contract number 14-08-001-12540 to the University of Virginia. Many persons contributed the observations, collection and analyses of data: Dr. Grant Goodell, Charles Woolheater, Mr. Poche, William Van Horn, William Huber, Mr. Hopkins and Mr. Osburn of the Department of Environmental Sciences, University of Virginia; James Hudgins and Dr. David Adams of Coastal Zone Resources Corporation and six to eight students of the Cape Fear Technical Institute, N. C. Additionally, Dr. Marvin Wass, Dr. John Dupuy, William Huber, Curtis Leigh, Galen Thompson of the Virginia Institute of Marine Science. Miss Susan Moorlag, USGS, coordinated air-surface operations. Laboratory analyses were un by Galen Thompson and Bonnie Weaver, VIMS. Mrs. Jane Davis of VIMS drafted the figures. The mission was supported by helicopters from the U.S. Army, Ft. Belvoir, Va. and the U.S. Coast Guard, Portsmouth, Va.

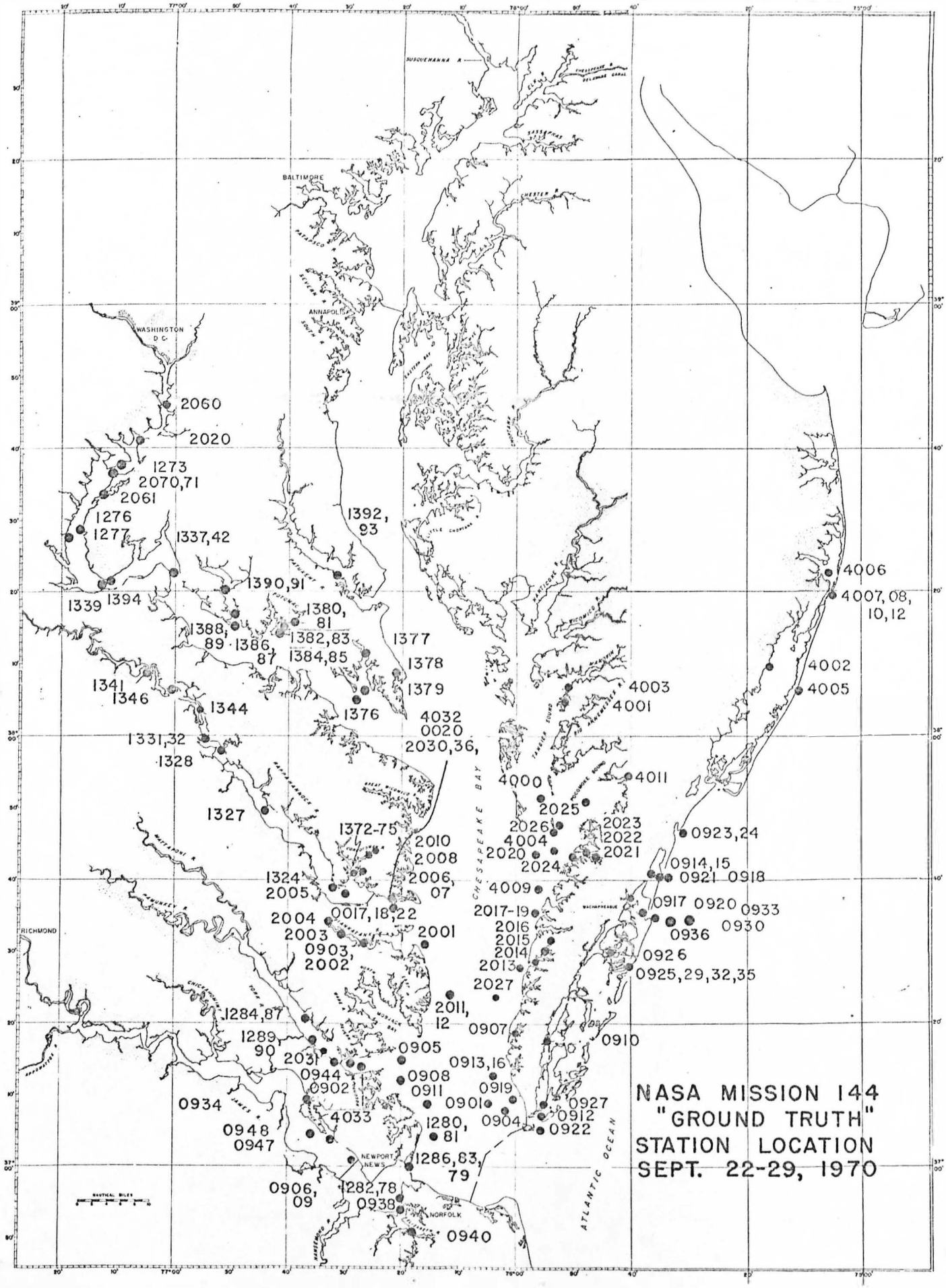

Figure 1. Location of sample stations in the Chesapeake Bay region. Numbers correspond to those for stations given in Appendix II.

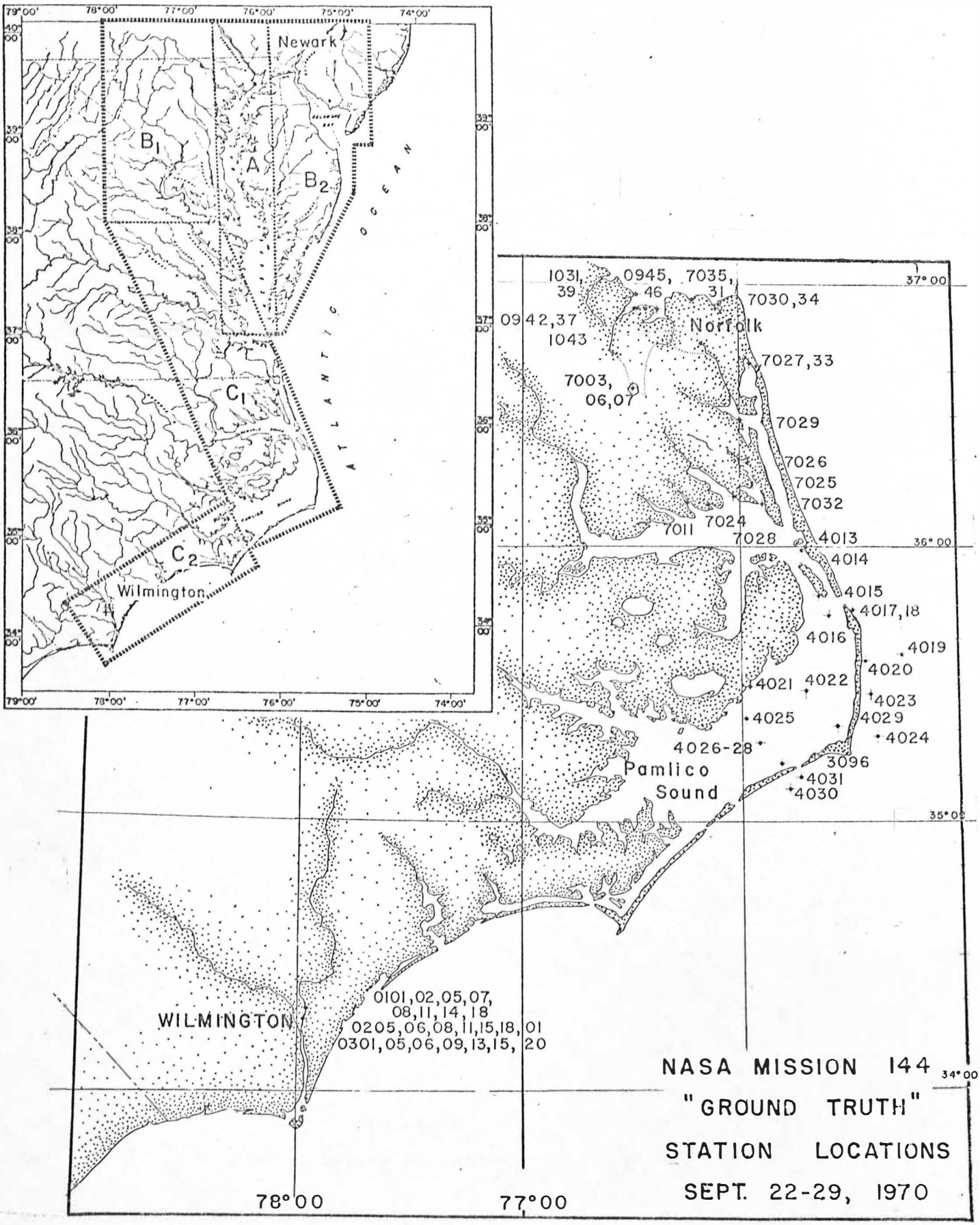

Figure 2. Location of sample stations in the Norfolk, Va., Pamlico Sound and Wilmington, N. C. area. Numbers correspond to those for stations given in Appendix II. Index to test area and subareas, upper left.

Appendix I

Summary of Observation Coverage

Mission 144, September 22-30, 1970

Area A, Lines 10 to 7. Sept. 22

Source Code

01 Fixed-Wing - Lower reaches of Area A
Goodell and crew
Hand-held photography

02 Belvoir Copter 1 - Lower Chesapeake Bay
Van Horn, Poche and crew
Time: 1108 - 1359, 1600
Bottle Nos: 0903 to 0912, 0934

03 Belvoir Copter 2 - Central lower Chesapeake, Piankatank, Rappahannock
Nichols, Wass and VIMS crew
Time: 1055 to 1500
Bottle Nos: 2001 to 2027

04 Skiff - Lower Rappahannock
Nichols and crew
Time: 1209 to 1305
Bottle Nos: 2036, 4032, 2030
0018-0022

Area B2 (east) Lines 2 to 6. Sept. 23

05 Fixed-Wing - Md. - Va. Eastern Shore
Goodell and crew
Hand-held photography

06 Belvoir Copter 1 - Cape Charles to Wallops, Wachapreague and Eastern Shore Bays and Inlets.
Nichols, Dupuy and VIMS crew
Time: 1000 to 1320
Bottle Nos: 0913 - 0933, 0935-0936

07 Belvoir Copter 2 - Cape Charles to Pocomoke Sd., Wallops and Chincoteague Bay
D.F.W. and U. Va. crew
Time: 1051-1446
Bottle Nos: 4000-4012

Appendix I, Cont'd.

Area C1, Lines 18-21. Sept. 24

Source Code

08 Fixed-Wing 1 - Outer Banks and Pamlico Sd.
Goodell and crew
Hand-held photography

09 Fixed-Wing 2 - U. S. Park Service Hatteras National Sea Shore Park - Photography

10 Belvoir Copter 1 - Lower James River, York River
Nichols and VIMS crew
Time: 1045-1148
Bottle Nos: 0937-0944, 1278-1286, 1039, 1043, 4033

11 Belvoir Copter 2 - Lower Chesapeake, Back Bay, Currituck Sound, Dismal Swamp
Dupuy and VIMS crew
Time: 1015-1320
Bottle Nos: 7003-7035

12 Coast Guard Copter
U. Va. Crew - Pamlico Sound and C. Hatteras vicinity
Time: 1015-1445
Bottle Nos: 4013-4031, 1274, 1276

Surface Temperatures, Thermal IR, Norfolk to Richmond - Sept. 24 .

13 Wm. Huber, Jamestown Ferry, James River
Time: 1856-2100

14 Thompson & Leigh, Skiff, James River Bridge, James River
Time: 1907-2015

15 Nichols, Yorktown, vicinity, York River
Time: 1910-2020

Surface Temperatures, Thermal IR, Wilmington to C. Lookout.

17 Hudgins and crew

Area B1 (west) Lines 11-15, Sept. 25

18 Belvoir Copter 1 - Upper Rappahannock River and Potomac South Bank
Dupuy, Wass and VIMS crew
Time: 1025-1253
Bottle Nos: 1324-1347, 1273-1277

19 Belvoir Copter 2 - Lower Rappahannock and Potomac, north bank.
Poche, Hopkins and Osburn
Time: 1040-1425
Bottle Nos: 1374-1394
2060Q, 2061, 2070Q, Q2020, 2071Q

Appendix I, Cont'd.

Area A, Areas B1, B2 (east) Sept. 24-28.

Source Code

20 Westinghouse Radar coverage

No ground truth acquired

Area C2 - Wilmington to Morehead City, N.C., Sept. 29.

21 Fixed-Wing
Hudgins and crew

22 Boat
Dr. David Adams and Cape Fear Institute crew
Time: 1030-1334
Bottle Nos: 0101-0119
0201-0219
0301-0320

Appendix II

Explanation of surface observations, ground truth and hydrographic data.

STAT NO	Station number corresponds to bottle number of sample water; for locations see Figures 1 and 2.
SR	Code indicating sampling team and platform as listed in Appendix I.
DA MO YR	Date; day, month and year
TIME	Hours and minutes, Eastern Daylight Time
LAT	Latitude position of sampling station in degrees and minutes
LONG	Longitude position of sampling station in degrees and minutes.
TEMP	Temperature in degrees Celcius from stem thermometer
SALN	Salinity in parts per thousand by conductivity measurements on a Beckman RS-7A salinometer.
OPT RATIO	Optical logarithmic ratio of scattered to transmitted light (turbidity).
CONC	Total concentration of suspended material in mg/l by filtration.
COLOR	Color of filtrate in Munsell notations: e.g. 5.0Y 8/2; hue, 5Y; value 8; chroma, 2.
OBSERVATIONS	Visual observations of surface conditions, notes and secchi disk depths in centimeters.

Appendix II. Surface Observations and hydrographic data, Sept. 22-29, 1970.

STAT NO	SR	DA MO YR TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
2001	03	22/09/70 1055	37 31.0	76 16.0	25.7	18.3		02.5	5.0Y8/1	NORTH STINGRAY LIGHT,100 YDS
2002	03	22/09/70 1108	37 31.1	76 26.4	26.6	16.6		13.0	5.0Y8/2	PIANKATANK RIVER
0903	02	22/09/70 1108	37 31.1	76 26.4	25.4	23.9		10.0	5.0Y7/1	INTERFACE
2003	03	22/09/70 1112	37 32.4	76 30.3	26.8	13.9		13.0	5.0Y8/2	INACTIVE DREDGE,200 YDS. DOWNSTR
2004	03	22/09/70 1117	37 32.9	76 33.0	26.4	06.2		08.0	5.0Y8/2	
2005	03	22/09/70 1126	37 37.5	76 29.5	26.1	17.3		01.3	7.5Y8/2	RED TIDE OFF PO. NET RAPPAHANNOCK
0906	02	22/09/70 1128	37 00.6	76 28.8	26.4	19.4		06.5	5.0Y8/2	INTERFACE-OIL VISIBLE N. SIDE
0909	02	22/09/70 1133	37 00.6	76 28.8	25.9	18.9		02.5	5.0Y8/2	OIL VISIBLE S. SIDE INTERFACE
2006	03	22/09/70 1138	37 41.0	76 28.4	26.4	16.6		02.5	5.2Y8/2	CORROTOMAN RIVER
2007	03	22/09/70 1140	37 41.2	76 27.2	26.4	16.5		11.0	7.5Y8/2	GREENISH CREEK WATER
2008	03	22/09/70 1142	37 43.3	76 26.1	27.1	14.9		03.0	5.0Y8/2	
2010	03	22/09/70 1145	37 44.2	76 24.7	27.4	13.2		10.0	2.5Y8/4	
0902	02	22/09/70 1152	37 14.2	76 28.8	27.0	22.3		05.0	5.0Y8/1	OIL SL. & WIND SLICKS
0018	04	22/09/70 1209	37 35.7	76 21.3	27.0	17.4	-0.53	04.3	10.0Y8/1	225.6 CM DISK DEPTH
0020	04	22/09/70 1215	37 35.9	76 21.4	27.0	17.8	-0.57	02.0	5.0Y8/2	218.0 CM DISK DEPTH
2011	03	22/09/70 1215	37 23.8	76 11.5	25.3	20.1				NORTH OF WOLF TRAP LG.
2012	03	22/09/70 1217	37 23.6	76 11.1	25.3	19.4		21.5	5.0Y8/2	EAST OF WOLF TRAP LG.
0017	04	22/09/70 1224	37 36.3	76 21.5	26.8	17.8	-0.55	03.8	7.5Y8/2	170.0 CM DISK DEPTH
4036	04	22/09/70 1234	37 36.5	76 21.6	26.9	18.0	-0.50	.	2.5Y8/2	112.2 CM DISK DEPTH
0022	04	22/09/70 1245	37 36.9	76 21.5	27.1	18.0	-0.50	04.9	5.0Y8/2	159.6 CM DISK DEPTH
4037	04	22/09/70 1253	37 37.1	76 21.6	27.3	18.2	-0.47	06.0	5.0Y7/2	132.0 CM DISK DEPTH
0905	02	22/09/70 1257	37 15.0	76 20.0	26.6	22.7		08.5	5.0Y8/1	BOATS BROWN-RED PLUME 2.5 FT WIDE
0908	02	22/09/70 1303	37 12.1	76 20.0	26.1	23.0				INTERFACE
2030	04	22/09/70 1305	37 37.4	76 21.9	27.8	18.1	-0.28	12.0	7.5Y8/4	180.1 CM DISK DEPTH
0911	02	22/09/70 1311	37 08.8	76 15.6	25.2	23.0		02.8	5.0Y8/1	INTERFACE WITH FOAM INTERFACE
0901	02	22/09/70 1316	37 09.0	76 05.6	26.0	23.2		01.3	5.0Y8/1	LINE SEPARATION
0904	02	22/09/70 1330	37 08.5	76 01.7	25.9	26.4		09.3	5.0Y8/1	SED. PLUME BROWN-RED ALGAE
2013	03	22/09/70 1335	37 28.0	75 59.0	25.9	20.2		02.5	5.0Y8/1	OFF NASSAWADOX CK.
0910	02	22/09/70 1339	37 17.8	75 54.3	25.7	31.9		20.5	5.0Y7/2	INLET SURROUNDED BY TIDAL MARSH
2014	03	22/09/70 1339	37 28.5	75 56.6	26.0	21.5			7.5Y7/2	JELLYFISH

Appendix II, Cont'd.

STAT NO	SR	DA MO YR TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
0907	02	22/09/70 1340	37 18.8	76 00.0	26.0	22.4		17.0	5.0Y8/1	SED. PLUME BROWN-RED ALGAE
2015	03	22/09/70 1342	37 30.3	75 54.3	26.8	20.4		14.0	7.5Y7/2	
2016	03	22/09/70 1348	37 31.3	75 53.6	28.4	16.4	-0.45	38.0	5.0Y7/2	
2017	03	22/09/70 1355	37 35.0	75 57.0	26.0	22.4		6.0	07.5Y8/2	ORANGE-RED WATER SHEARED BY WIND
2018	03	22/09/70 1355	37 35.0	75 57.0		22.1		08.5		ORANGE-RED WATER, SURFACE
2019	03	22/09/70 1355	37 35.0	75 57.0				20.0		ORANGE-RED WATER, SURFACE
0912	02	22/09/70 1359	37 07.3	75 55.4	25.9	32.0		10.5	5.0Y8/2	PLUME, FINE SED. OR ALGAE ON SURF
2020	03	22/09/70 1405	37 43.7	75 46.2	27.2	19.2		7.5	5.0Y7/2	
2021	03	22/09/70 1406	37 43.2	75 47.3	26.9	19.6		12.5	7.5Y8/2	ONANCOCK CREEK
2022	03	22/09/70 1408	37 43.6	75 48.2	26.9	19.5		6.6	7.5Y8/2	
2023	03	22/09/70 1409	37 43.3	75 49.8	26.0	19.4		7.0	7.5Y8/2	
2024	03	22/09/70 1411	37 43.8	75 51.8	26.0	19.1		4.2	7.5Y8/2	
2025	03	22/09/70 1435	37 51.1	75 47.4	25.9	19.0		04.0	5.0Y8/2	POCOMOKE SOUND
2026	03	22/09/70 1440	37 47.7	75 52.5	25.8	18.3		05.3	10.0Y8/2	
2027	03	22/09/70 1500	37 24.1	76 03.6	26.1	19.2	-0.47	06.0	5.0Y8/2	WHITISH PATCHES, DEGAUSSING PIER
0934	02	22/09/70 1600	37 09.0	76 36.1		00.1		58.0	5.0Y3/4	GOLF COURSE PD. FT. EUSTIS
0913	06	23/09/70 1000	37 12.9	76 03.5	25.8		+0.08	48.0	5.0Y8/2	DENSE BROWNISH, FISH OIL&
0916	06	23/09/70 1007	37 12.6	76 04.3		24.7	+0.18	64.5	5.0Y7/4	DENSE BROWN
0919	06	23/09/70 1012	37 09.5	76 00.2	25.8	26.7	-0.13	12.0	2.5Y8/4	REDDISH ORANGE, SURF. TRICODESMIUM
0922	06	23/09/70 1030	37 05.0	75 55.7	24.6	30.0	-0.16	05.3	2.5Y8/2	REDDISH ORANGE, SURF. FOAM IN ROWS
4004	07	23/09/70 1051	37 47.1	75 53.2	25.9	18.6	-0.28	10.0	5.0Y7/2	YELLOW GREEN WATER
4011	03	23/09/70 1105	37 54.4	75 40.3	26.8	19.4	-0.02	09.5	5.0Y8/2	VERY BROWN WATER POTS
0923	06	23/09/70 1157	37 46.5	75 30.3	24.2	32.2	-0.36	08.0	5.0Y8/1	CLEAR, GARGATHY INLET
0924	06	23/09/70 1159	37 46.5	75 30.7	24.2	32.1	-0.07	10.0	5.0Y8/2	TURBID
0921	06	23/09/70 1205	37 40.2	75 33.2	24.0	32.2	-0.29	02.5	5.0Y8/2	CLEAR
0918	06	23/09/70 1207	37 40.2	75 33.9	23.6	32.1	-0.22	08.0	2.5Y8/4	METOMKIN INLET
0915	06	23/09/70 1209	37 40.4	75 34.7	22.6	32.1	-0.08	10.6	7.5Y7/2	
0914	06	23/09/70 1212	37 40.6	75 36.0	23.2	32.2	-0.01	19.0	5.0Y7/2	
4005	07	23/09/70 1214	38 06.4	75 10.6	21.5	31.4	-0.49	11.0	5.0Y8/1	DARK GREEN WATER OCEAN
0917	06	23/09/70 1217	37 36.6	75 40.0	26.0	32.9	-0.07	09.3	5.0Y7/2	EBB, WACHAPREAGUE CHANNEL
4012	07	23/09/70 1219	38 19.1	75 04.9	21.5	21.9	-0.12	14.0	5.0Y7/2	BROWN WATER

Appendix II, Cont'd.

STAT NO	SR	DA MO YR TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
0920	06	23/09/70 1220	37 35.4	75 37.7	25.4	32.4	-0.04	18.6	7.5Y8/2	
4010	07	23/09/70 1224	38 19.1	75 04.9	21.5	31.2	-0.35	07.0	10.0Y8/2	CLEAR WATER
0936	06	23/09/70 1225	37 34.8	75 35.6	24.4	32.2	+0.09	37.3	5.0Y6/2	INLET MOUTH, EARLY FLOOD
0933	06	23/09/70 1229	37 34.8	75 34.0	24.4	32.2	-0.23	06.0	7.5Y8/2	BELL BOUY A
4007	07	23/09/70 1229	38 19.1	75 04.9	22.5	31.3	-0.21	10.0	5.0Y8/2	DEEP RED STREAK
0930	06	23/09/70 1232	37 34.8	75 31.8	23.6	32.1	-0.32	02.0	5.0Y8/2	OCEAN, POSITION APPROXIMATE
4008	07	23/09/70 1239	38 19.4	75 04.9	22.9	31.2	-0.27	11.5	5.0Y8/2	
0925	06	23/09/70 1247	37 27.8	75 42.2		32.2	+0.01	30.5	5.0Y6/2	
0935	06	23/09/70 1248	37 27.9	75 42.7		32.2	-0.13	15.5	5.0Y7/2	TURBID SIDE
0932	06	23/09/70 1250	37 28.1	75 42.8		32.3	-0.15	13.5	5.0Y8/2	CLEAR SIDE
0929	06	23/09/70 1252	37 28.0	75 43.0		32.2	-0.07	25.0	5.0Y7/2	FOAM LINE
4006	07	23/09/70 1253	38 22.6	75 05.7	25.5	06.3	-0.13	19.0	7.5Y8/2	WHITE STREAKS
0926	06	23/09/70 1300	37 29.4	75 43.2		32.0	-0.15	11.5	5.0Y7/2	REDDISH-BROWN(NOT TRICODESMIUM)
4002	07	23/09/70 1310	38 09.5	75 15.9	26.6	03.3	-0.04	17.0	5.0Y8/2	
0927	06	23/09/70 1315	37 08.7	75 54.9		31.5	-0.16	11.0	5.0Y8/2	REDDISH ORANGE ON SURFACE
4003	07	23/09/70 1403	38 13.3	75 51.1	28.0	11.9	+0.00	33.0	5.0Y7/2	FOAM SLICK
4001	07	23/09/70 1409	38 14.4	75 51.3	27.2		-0.21	14.0	5.0Y8/2	BROWN COLOR FOAM SLICK
4000	07	23/09/70 1427	37 58.0	75 55.7	25.8	17.6	-0.52	04.5	10.0Y7/1	
4009	07	23/09/70 1446	37 38.6	75 57.0	26.5	20.3	+0.25	54.0	2.5Y8/2	PLUME SUSPENDED RED PARTICLES B/G
4030	12	24/09/70	35 07.4	75 47.0	27.5	33.1	-0.60	01.4	5.0Y8/1	
0948	10	24/09/70 1010	37 04.5	76 34.8	27.0	15.1	-0.14	17.3	5.0Y8/4	
0947	10	24/09/70 1014	37 03.6	76 32.2	27.0	17.7	-0.05	16.0	2.5Y8/2	DARK RED TIDE
4013	12	24/09/70 1015	35 58.5	75 42.3	27.4		-0.13	35.0	7.5Y8/2	FOAM SLICK
4014	12	24/09/70 1015	35 56.5	75 43.5	27.4	30.3	-0.41	19.0	7.5Y8/2	FOAM SLICK
7035	11	24/09/70 1015	36 56.1	76 10.6	25.4	24.6	-0.58	50.0		OIL SLICK IN CANAL & EBBING
7031	11	24/09/70 1018	36 56.1	76 10.1	25.2	24.9	-0.51	07.5	7.5Y8/2	
0946	10	24/09/70 1020	36 57.9	76 26.8	26.4	21.8	-0.18	11.5	5.0Y7/2	
0945	10	24/09/70 1023	36 58.3	76 26.6	26.2	20.4	-0.20	08.5	5.0Y7/2	
7034	11	24/09/70 1025	36 55.3	76 04.9	25.4	25.3	-0.36	05.0	5.0Y8/2	SHARP BOUNDARY CLEAR SIDE
7030	11	24/09/70 1028	36 55.1	76 04.9	25.4	25.3	-0.19	07.0	5.0Y7/2	TURBID SIDE, DREDGING
1039	10	24/09/70 1029	36 54.9	76 27.1	26.4					
0942	10	24/09/70 1030	36 54.8	76 27.1	26.4	22.3	-0.15	05.5	7.5Y8/2	
4015	12	24/09/70 1030	35 48.6	75 39.5	27.7	32.7	-0.45	08.5	5.0Y8/2	CLEAR WATER ALGAL PATCHES ON BOTTOM
1043	10	24/09/70 1032	36 54.9	76 24.5	26.2					

Appendix II, Cont'd.

STAT NO	SR	DA MO YR TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
0937	10	24/09/70 1036	36 54.1	76 23.2	26.4	26.4	+0.15	28.0	7.5Y7/4	SHOAL GRASS INSIDE OF OPENING
4016	12	24/09/70 1044	35 45.3	75 36.3	26.5	20.2	-0.55	04.0	7.5Y8/2	MID CHANNEL FOAM SLICKS CLEAR
0940	10	24/09/70 1045	36 50.8	76 18.1	27.4	22.7	-0.14	10.5	7.5Y8/2	2 CARGO SHIPS (NAVY) ON WEST, OYSTE
7027	11	24/09/70 1047	36 42.3	75 56.9	26.8	04.4	-0.06	13.0	10.0Y8/1	WIND STREAKED
7033	11	24/09/70 1050	36 42.4	75 55.3	22.4	31.6	-0.34	05.0	5.0Y8/2	
0938	10	24/09/70 1051	36 54.1	76 20.0	26.8	22.7	-0.02	13.0	5.0Y7/2	BROWN BAND
1282	10	24/09/70 1055	36 55.0	76 20.3		22.9	-0.10	08.7	7.5Y8/2	CLEAR
1278	10	24/09/70 1055	36 55.4	76 20.3		18.6	+0.22	29.3	5.0Y7/2	POLLUTED
7029	11	24/09/70 1055	36 28.8	76 00.2	26.7	01.5	-0.32	06.5	5.0Y8/2	
4019	12	24/09/70 1055	35 36.0	75 15.6	24.9	32.3	-0.55	03.1	5.0Y8/1	OFF PIER, WATER EMERALD GREEN
4020	12	24/09/70 1058	35 34.6	75 25.0	24.8	32.5	-0.58	01.6	5.0Y8/2	RED TIDAL BLOOM S. OF PIER
1286	10	24/09/70 1103	37 00.0	76 18.6	26.4	23.9	-0.16	11.3	7.5Y8/2	
1283	10	24/09/70 1104	37 00.0	76 18.7	26.6	23.0	-0.23		5.0Y8/2	
1279	10	24/09/70 1104	36 59.9	76 18.7	25.6	23.2	-0.23	06.0	5.0Y8/2	
1280	10	24/09/70 1109	37 04.1	76 14.3	26.2	23.9	-0.12	11.0	5.0Y8/2	BROWN ZONE
1281	10	24/09/70 1109	37 04.1	76 14.3	26.2	23.9	-0.14	08.7	5.0Y8/1	BROWN ZONE
4023	12	24/09/70 1115	35 28.3	75 23.5	25.2	32.8	-0.45	04.3	5.0Y7/2	WIND SLICKS
4033	10	24/09/70 1125	37 13.8	76 26.7	26.6	22.5	-0.26	06.0	7.5Y8/2	EBB
4024	12	24/09/70 1125	35 19.3	75 22.4	25.0	32.4	-0.43	03.2	3.0Y8/2	WIND STREAKS AND ALGAL BRN SCUM
0944	10	24/09/70 1132	37 14.8	76 31.7	26.6	21.7	-0.18	10.0	7.5Y8/2	BROWN WATER
4031	12	24/09/70 1135	35 10.2	75 44.0	25.9	32.8	-0.43	03.2	5.0Y8/2	EEL GRASS BEDS CLEAR WATER
2031	10	24/09/70 1138	37 16.0	76 33.5	26.8	21.7	-0.28	18.5	5.0Y7/2	BROWN PLUME
1290	10	24/09/70 1140	37 17.8	76 35.2		21.0	-0.23	07.3	5.0Y8/2	
1289	10	24/09/70 1140	37 17.8	76 35.2		21.1	-0.25	05.3	7.5Y8/2	RED
1284	10	24/09/70 1148	37 20.6	76 36.6	27.2	19.4	-0.21	06.5	7.5Y8/2	
1287	10	24/09/70 1148	37 20.6	76 36.6	27.2	19.3	-0.16	08.0	5.0Y8/2	
4029	12	24/09/70 1155	35 21.1	75 32.6	27.5	22.2	+0.13	18.0	7.5Y8/4	ALGAL BLOOM IN WIND STREAKS
4021	12	24/09/70 1204	35 30.6	75 56.5	27.3	20.2	-0.40	07.5	7.5Y8/2	YELLOW WATER
4022	12	24/09/70 1204	35 29.5	75 42.7	27.0	21.4	-0.45	11.2	5.0Y8/2	TRAWLER SEDIMENT
4025	12	24/09/70 1204	35 22.7	75 58.5	27.4	20.2	-0.45	00.0	5.0Y7/2	TRAWLER KICKUP

Appendix II, Cont'd.

STAT NO	SR	DA MO YR TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
4026	12	24/09/70 1230	35 18.0	75 55.4		23.0	-0.60	04.3	5.0Y8/2	SOUTH SIDE INTERFACE
4027	12	24/09/70 1230	35 18.0	75 55.4	27.4	22.7	-0.54	00.5	5.0Y8/1	IN INTERFACE
4028	12	24/09/70 1230	35 18.0	75 55.4		21.8	-0.55	08.5	5.0Y8/1	NORTH OF INTERFACE
7026	11	24/09/70 1235	36 18.9	75 58.3	28.0	01.6	-0.26	27.5	5.0Y8/2	BROWN WATER
7025	11	24/09/70 1245	36 14.5	75 56.6	27.7	02.0	-0.53	03.8	5.0Y8/2	BROWN WATER
3096	12	24/09/70 1245	35 12.8	75 47.9		23.4	+0.24	34.0	10.0Y8/4	RED COLOR IN WATER
7032	11	24/09/70 1247	36 10.2	75 54.4	26.8	01.9	-0.59	02.3	7.5Y7/2	
7028	11	24/09/70 1256	36 11.9	76 02.0	27.2	02.0	-0.51	06.0	5.0Y8/2	
7024	11	24/09/70 1300	36 09.1	76 08.3	28.2	01.7	+0.05	27.0	7.5Y8/4	VERY TURBID
7011	11	24/09/70 1305	36 09.5	76 14.2	27.6	21.3	-0.53	02.7	7.5Y8/2	
7003	11	24/09/70 1320	36 36.4	76 27.0	28.9	00.1		18.0	10.0Y6/4	VERY DARK BROWN, LOOKS ORANGE
7006	11	24/09/70 1320	36 36.4	76 27.0	28.9	00.1		18.0	10.0Y5/4	VERY DARK BROWN, LOOKS ORANGE
7007	11	24/09/70 1320	36 36.4	76 27.0	28.9	00.1	-0.10	16.0	10.0Y6/4	VERY DARK BROWN, LOOKS ORANGE
4017	12	24/09/70 1445	35 46.3	75 30.0	26.4	26.3	-0.50	03.7	5.0Y8/1	BROWN SIDE OF SED PLUME
4018	12	24/09/70 1445	35 46.3	75 30.0	25.5	32.7	-0.62	05.0	5.0Y8/1	CLEAR SIDE OF INTERFACE
1324	18	25/09/70 1025	37 38.4	76 32.1		16.9	-0.43	05.0	5.0Y8/1	RED TIDE
1374	19	25/09/70 1040	37 38.0	76 32.0	27.1	16.7	-0.50	02.0	7.5Y8/4	RAPPAHANNOCK POSITION APPROXIMATE
1375	19	25/09/70 1040	37 38.0	76 32.0	27.3	16.7	-0.35			RAPPAHANNOCK POSITION APPROXIMATE
1327	18	25/09/70 1040	37 49.7	76 43.9		12.7	-0.35	06.0	7.5Y7/2	RED TIDE
1372	19	25/09/70 1045	37 46.0	76 38.0	27.6	14.7	-0.45	07.0	5.0Y8/2	RAPPAHANNOCK POSITION APPROXIMATE
1373	19	25/09/70 1045	37 42.0	76 34.0	27.5	15.9	-0.45	04.0	5.0Y8/2	RAPPAHANNOCK POSITION APPROXIMATE
1328	18	25/09/70 1045	37 57.8	76 51.6	27.2	08.0	-0.32	09.0	2.5Y8/2	TURBID PATCHES AND STREAKS
1331	18	25/09/70 1050	37 59.4	76 54.3	26.6	05.5	-0.29	08.7	5.0Y8/2	TURBID PATCHES AND STREAKS
1332	18	25/09/70 1054	37 59.3	76 54.8	26.6	05.3	-0.19	11.3	2.5Y8/2	
1344	18	25/09/70 1057	38 03.7	76 55.4	26.6	03.1	-0.40	06.0	5.0Y8/2	
1346	18	25/09/70 1102	38 06.3	77 00.5	26.7	01.4	-0.32	11.0	5.6Y8/2	
1341	18	25/09/70 1106	38 08.7	77 04.9		04.1	-0.14	15.0	10.0Y7/4	
1337	18	25/09/70 1220	38 22.6	77 00.4	26.5	07.9	-0.24			
1342	18	25/09/70 1222	38 22.7	77 00.3	26.5	08.8	+0.04	34.0	2.5Y7/2	
1339	18	25/09/70 1223	38 21.3	77 12.0	26.5	07.3	-0.04	14.0	5.0Y8/2	

Appendix II, Cont'd.

STAT NO	SR	DA	MO	YR	TIME	LAT	LONG	OPT TEMP	SALN	RATIO	CONC	COLOR	OBSERVATIONS
1376	19	25	09	70	1225	38 11.7	76 28.2	28.5	14.1	-0.35	13.0	7.5Y8/2	
1377	19	25	09	70	1230	38 11.6	76 26.3	27.8	14.6	-0.50	07.0	5.0Y8/2	
1378	19	25	09	70	1230	38 09.3	76 21.7	27.4	15.1	-0.55	10.0	10.0Y8/2	
1379	19	25	09	70	1235	38 06.5	76 26.5	27.0	15.4	-0.58		10.0Y8/2	
1277	19	25	09	70	1239	38 27.7	77 18.7	26.5	01.7	-0.11	10.0	10.0Y8/2	
1274	18	25	09	70	1244	38 31.1	77 16.9	26.7	01.5	+0.02	08.0	10.0Y8/2	
1275	19	25	09	70	1244	38 31.1	77 16.9	26.7					
1380	19	25	09	70	1245	38 15.8	76 39.1	28.9	12.5	-0.45	11.3	5.0Y8/2	
1381	19	25	09	70	1245	38 15.8	76 39.1	28.9	12.4		02.0	7.5Y8/4	
1382	19	25	09	70	1250	38 15.3	76 40.5	28.2	12.8	-0.50	02.7	5.0Y8/2	
1383	19	25	09	70	1250	38 15.3	76 40.5	28.2	12.9	-0.52	15.3		
1384	19	25	09	70	1250	38 14.1	76 41.8	28.2	13.2	-0.48	02.0	5.0Y8/2	
1385	19	25	09	70	1250	38 14.1	76 41.8	28.2	13.2	-0.52	29.0	5.0Y8/2	
1273	19	25	09	70	1253	38 37.6	77 10.2	27.5	00.2	+0.29	15.3	10.0Y8/2	HEAVY GREEN AREA
1386	19	25	09	70	1300	38 15.3	76 49.5	27.4	11.6	-0.54	11.0	7.5Y8/2	
1387	19	25	09	70	1300	38 15.3	76 49.5	27.4	11.7	-0.54	25.5	7.5Y8/2	
1388	19	25	09	70	1300	38 17.0	76 49.8	27.4	12.3	-0.47	36.0	5.0Y8/2	
1389	19	25	09	70	1300	38 17.0	76 49.8	27.4	12.1	-0.42	08.0	5.0Y8/2	
1390	19	25	09	70	1305	38 20.4	76 51.0	27.5	12.1	-0.34	07.0	2.0Y8/2	
1391	19	25	09	70	1305	38 20.4	76 51.0	27.5	12.0	-0.38	04.0	5.0Y8/2	
1392	19	25	09	70	1309	38 22.2	76 51.5	29.5	10.3	-0.35	10.5	7.5Y8/2	
1393	19	25	09	70	1309	38 22.2	76 51.5	29.5	10.3	-0.35	18.0	7.5Y8/2	
1394	19	25	09	70	1310	38 21.7	77 11.4	27.4	05.8	-0.15	13.0	7.5Y8/4	
2070	19	25	09	70	1410	38 36.7	77 11.2	27.4					
2061	19	25	09	70	1410	38 33.7	77 12.8	27.5					
2071	19	25	09	70	1410	38 36.7	77 11.2	27.4	00.3				
2020	19	25	09	70	1418	38 41.2	77 06.4	28.8					
2060	19	25	09	70	1425	38 46.0	77 02.0	28.3	00.2	+0.22			
0211	22	29	09	70	0210	34 17.0	79 59.5	32.0	01.6	+0.06	17.3	2.5Y7/4	DISK40CM
0101	22	29	09	70	1030	34 17.0	79 59.5	27.0	00.8	-0.05	08.0	2.5Y8/2	DISK50CM TURBID,100YDS ABOVE POWER
0301	22	29	09	70	1030	34 14.5	77 57.3	26.0	08.7	-0.23	12.0	2.5Y8/2	DISK40CM
0201	22	29	09	70	1030	34 17.0	79 59.5	25.0	02.0	+0.00	10.6	2.5Y8/2	DISK50CM DISTURBANCE ON SURFACE
0102	22	29	09	70	1040	34 17.0	79 59.5	26.0	00.8	-0.05	08.0	2.5Y8/2	DISK50CM TURBID

Appendix II, Cont'd.

STAT NO	SR	DA	MO	YR	TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
0305	22	29	09	70	1110	34 14.5	77 57.3	26.0	08.9	-0.22	12.0	2.5Y8/2	TUGBOAT-BARGE PASSED 10 YDS
0105	22	29	09	70	1110	34 17.0	79 59.5	27.0	01.6	-0.13	12.0	2.5Y7/2	DISK50CM
0205	22	29	09	70	1110	34 17.0	79 59.5	30.0	02.5	+0.08		2.5Y7/4	DISK40CMBRIETD IN FRONT OF DISCHAR
0306	22	29	09	70	1120	34 14.5	77 57.3	26.0	08.9	-0.22	12.0	2.5Y8/2	
0206	22	29	09	70	1120	34 17.0	79 59.5	31.5	01.4	+0.08	14.6	2.5Y7/4	DISK30CM 100 YDS BELOW POWER PLT
0107	22	29	09	70	1130	34 17.0	79 59.5	27.0	01.6	-0.11	08.0	2.5Y8/2	DISK40CM PASSED BY TUG AND BARGE
0108	22	29	09	70	1140	34 17.0	79 59.5	27.0	01.6	-0.11	08.0	2.5Y8/2	DISK40CMCHANGE IN TIDE
0208	22	29	09	70	1140	34 17.0	79 59.5	31.5	01.1	+0.08	08.0	2.5Y7/4	DISK40CM
0309	22	29	09	70	1150	34 14.5	77 57.3	26.0	09.0	-0.25	08.0	2.5Y8/2	
0111	22	29	09	70	1210	34 17.0	79 59.5	26.8	00.7	-0.12	05.0	2.5Y8/2	DISK40CM
0313	22	29	09	70	1230	34 14.5	77 57.3	26.0	09.4	-0.23	13.3	2.5Y8/2	
0114	22	29	09	70	1240	34 17.0	79 59.5	27.0	00.6	-0.12	01.3	2.5Y8/4	DISK50CM
0315	22	29	09	70	1250	34 14.5	77 57.3	26.0	06.6	-0.18	08.0	5.0Y8/2	
0215	22	29	09	70	1300	34 17.0	79 59.5	32.0	02.1	+0.06	10.6	2.5Y7/4	DISK40CM
0118	22	29	09	70	1320	34 17.0	79 59.5	26.4	00.4	-0.06	05.0	2.5Y8/4	DISK40CM
0218	22	29	09	70	1330	34 17.0	79 59.5	29.0	01.6	+0.00	14.0	2.5Y7/4	DISK40CM
0320	22	29	09	70	1340	34 14.5	77 57.3	26.0		-0.24	12.8	5.0Y8/2	DISK40CM

Appendix II, Cont'd.

STAT NO	SR	DA	MO	YR	TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
1376	19	25	09	70	1225	38 11.7	76 28.2	28.5	14.1	-0.35	13.0	7.5Y8/2	
1377	19	25	09	70	1230	38 11.6	76 26.3	27.8	14.6	-0.50	07.0	5.0Y8/2	
1378	19	25	09	70	1230	38 09.3	76 21.7	27.4	15.1	-0.55	10.0	10.0Y8/2	
1379	19	25	09	70	1235	38 06.5	76 26.5	27.0	15.4	-0.58		10.0Y8/2	
1277	18	25	09	70	1239	38 27.7	77 18.7	26.5	01.7	-0.11	10.0	10.0Y8/2	
1274	18	25	09	70	1244	38 31.1	77 16.9	26.7	01.5	+0.02	08.0	10.0Y8/2	
1276	19	25	09	70	1244	38 31.1	77 16.9	26.7					
1380	19	25	09	70	1245	38 15.8	76 39.1	28.9	12.5	-0.45	11.3	5.0Y8/2	
1381	19	25	09	70	1245	38 15.8	76 39.1	28.9	12.4		02.0	7.5Y8/4	
1382	19	25	09	70	1250	38 15.3	76 40.5	28.2	12.8	-0.50	02.7	5.0Y8/2	
1383	19	25	09	70	1250	38 15.3	76 40.5	28.2	12.9	-0.52	15.3		
1384	19	25	09	70	1250	38 14.1	76 41.8	28.2	13.2	-0.48	02.0	5.0Y8/2	
1385	19	25	09	70	1250	38 14.1	76 41.8	28.2	13.2	-0.52	29.0	5.0Y8/2	
1273	19	25	09	70	1253	38 37.6	77 10.2	27.5	00.2	+0.29	15.3	10.0Y8/2	HEAVY GREEN AREA
1386	19	25	09	70	1300	38 15.3	76 49.5	27.4	11.6	-0.54	11.0	7.5Y8/2	
1387	19	25	09	70	1300	38 15.3	76 49.5	27.4	11.7	-0.54	25.5	7.5Y8/2	
1388	19	25	09	70	1300	38 17.0	76 49.8	27.4	12.3	-0.47	36.0	5.0Y8/2	
1389	19	25	09	70	1300	38 17.0	76 49.8	27.4	12.1	-0.42	08.0	5.0Y8/2	
1390	19	25	09	70	1305	38 20.4	76 51.0	27.5	12.1	-0.34	07.0	2.0Y8/2	
1391	19	25	09	70	1305	38 20.4	76 51.0	27.5	12.0	-0.38	04.0	5.0Y8/2	
1392	19	25	09	70	1308	38 22.2	76 51.5	29.5	10.3	-0.35	10.5	7.5Y8/2	
1393	19	25	09	70	1308	38 22.2	76 51.5	29.5	10.3	-0.35	18.0	7.5Y8/2	
1394	19	25	09	70	1310	38 21.7	77 11.4	27.4	05.8	-0.15	13.0	7.5Y8/4	
2070	19	25	09	70	1410	38 36.7	77 11.2	27.4					
2061	19	25	09	70	1410	38 33.7	77 12.8	27.5					
2071	19	25	09	70	1410	38 36.7	77 11.2	27.4	00.3				
2020	19	25	09	70	1418	38 41.2	77 06.4	28.8					
2060	19	25	09	70	1425	38 46.0	77 02.0	28.3	00.2	+0.22			
0211	22	29	09	70	0210	34 17.0	79 59.5	32.0	01.6	+0.06	17.3	2.5Y7/4	DISK40CM
0101	22	29	09	70	1030	34 17.0	79 59.5	27.0	00.8	-0.05	08.0	2.5Y8/2	DISK50CM TURBID.100YDS ABOVE POWER
0301	22	29	09	70	1030	34 14.5	77 57.3	26.0	08.7	-0.23	12.0	2.5Y8/2	DISK40CM
0201	22	29	09	70	1030	34 17.0	79 59.5	25.0	02.0	+0.00	10.6	2.5Y8/2	DISK50CM DISTURBANCE ON SURFACE
0102	22	29	09	70	1040	34 17.0	79 59.5	26.0	00.8	-0.05	08.0	2.5Y8/2	DISK50CM TURBID

Appendix II, Cont'd.

STAT NO	SR	DA	MO	YR	TIME	LAT	LONG	TEMP	SALN	OPT RATIO	CONC	COLOR	OBSERVATIONS
0305	22	29	09	70	1110	34 14.5	77 57.3	26.0	08.9	-0.22	12.0	2.5Y8/2	TUGBOAT-BARGE PASSED 10 YDS
0105	22	29	09	70	1110	34 17.0	79 59.5	27.0	01.6	-0.13	12.0	2.5Y7/2	DISK50CM
0205	22	29	09	70	1110	34 17.0	79 59.5	30.0	02.5	+0.08		2.5Y7/4	DISK40CMDRIFTD IN FRONT OF DISCHAR
0306	22	29	09	70	1120	34 14.5	77 57.3	26.0	08.9	-0.22	12.0	2.5Y8/2	
0206	22	29	09	70	1120	34 17.0	79 59.5	31.5	01.4	+0.08	14.6	2.5Y7/4	DISK30CM 100 YDS BELOW POWER PLT
0107	22	29	09	70	1130	34 17.0	79 59.5	27.0	01.6	-0.11	08.0	2.5Y8/2	DISK40CM PASSED BY TUG AND BARGE
0108	22	29	09	70	1140	34 17.0	79 59.5	27.0	01.6	-0.11	08.0	2.5Y8/2	DISK40CMCHANGE IN TIDE
0208	22	29	09	70	1140	34 17.0	79 59.5	31.5	01.1	+0.08	08.0	2.5Y7/4	DISK40CM
0309	22	29	09	70	1150	34 14.5	77 57.3	26.0	09.0	-0.25	08.0	2.5Y8/2	
0111	22	29	09	70	1210	34 17.0	79 59.5	26.8	00.7	-0.12	05.0	2.5Y8/2	DISK40CM
0313	22	29	09	70	1230	34 14.5	77 57.3	26.0	09.4	-0.23	13.3	2.5Y8/2	
0114	22	29	09	70	1240	34 17.0	79 59.5	27.0	00.6	-0.12	01.3	2.5Y8/4	DISK50CM
0315	22	29	09	70	1250	34 14.5	77 57.3	26.0	06.6	-0.18	08.0	5.0Y8/2	
0215	22	29	09	70	1300	34 17.0	79 59.5	32.0	02.1	+0.06	10.6	2.5Y7/4	DISK40CM
0118	22	29	09	70	1320	34 17.0	79 59.5	26.4	00.4	-0.06	05.0	2.5Y8/4	DISK40CM
0218	22	29	09	70	1330	34 17.0	79 59.5	29.0	01.6	+0.00	14.0	2.5Y7/4	DISK40CM
0320	22	29	09	70	1340	34 14.5	77 57.3	26.0		-0.24	12.8	5.0Y8/2	DISK40CM

Appendix III

VIMS LAB PROCEDURES FOR GRAVIMETRIC DETERMINATION OF TOTAL SUSPENDED MATERIAL

A. Pre-filtration preparation:

1. Number filters on the extreme outer edge (bottom side facing observer) with a permanent (non-water soluble) ball point ink pen. A 0.80μ gridded Gilman filter of 47mm size (GA-4) is used.

2. Soak filters in dishes of distilled water for 1-hour to remove soluble extracts.

3. Remove filters from dishes and place on sheet pans of aluminum foil. Air dry one hour. Curl up edges to prevent sticking.

4. Place in oven and dry 12 hours at 55°C. Transfer to a dry dessicator and store for 12 hours.

5. Weigh in dehumidified (instrument)room. Remove 15 filters at a time, wait 5 minutes until they come into atmospheric equilibrium of the weighing room established by pre-drying the room with dehumidifier set on "maximum".

6. Weigh filters on balance. Zero and center balance every 5th filter. Record number and weight.

7. Reweigh filters following storage (for one hour) in petri dishes under dehumidification in strument room.

8. Store filters in petri dishes for future use.

B. Filtering:

1. Hook up vacuum pump and milipore filter chain.

2. Place white porous pad between on base of filter holder and wet under vacuum. Use new pad after every 5 filtrations.

3. Place control filter on pad and wet under vacuum; then add sediment collecting filter and wet under vacuum to rid of trapped air.

4. Place funnel on holder and clamp firm.

5. Shake sample water well and measure a 100-250 ml. aliquot in graduate cylinder. Pour into cylinder immediately after shaking (to deter settling of coarse material). Read bottom of miscus.

6. Record volume of sample water used.

7. Filter an additional 100-250 ml of sample water as necessary. A maximum amount of water should yield greater precision.

8. Rinse funnel 3 times with distilled water to remove sea salt. Work around the rim. Remove funnel.

9. Rinse pad with distilled water around edges with vacuum applied.

10. Remove filters and transfer to an aluminum foil pan.

11. Dry in oven for 12 hours at 55°C. Transfer to a dry dessicator and store for 12 hours.

12. Weigh and reweigh under the same drying condition used for pre-weighing as in items A 5 thru A 7.

13. Calculate weight difference of sample filter and apply correction of weight difference calculated by control filter.

NOTES:

Samples were processed within 24 hours and most were filtered within 10 hours..

Keep instrument room and filtering spaces free of contaminating dust, hair and cigarette ashes.

Clean lab table and floor prior to processing with wet sponge and mop.

Handle filters with forceps throughout processing.

VIMS OPERATING PROCEDURES FOR SOUTHERN ANALYTICAL SUSPENDED SOLIDS ANALYZER

Reference: Instruction Manual
Southern Analytical Suspended Solids Analyzer

I. Read Instruction Manual before operating analyzer and insure that all of the systems are connected and operating properly. If time does not permit a complete coverage of the Instruction Manual, assure proper setup of equipment by some member of Geological Oceanography Department.

II. The following outline is intended as a guide to prevent damage to instrument and to improve the quality of results:

A. Environmental factors -

1. Insure that the water to be sampled is at the same temperature as the analyzer.

2. Insure that direct or strong reflected light does not enter the observation window on the analyzer unit.

B. Electrical requirements -

1. The system requires 110 volts A.C., 60 cps. power supply. It is very sensitive to voltage fluctuation.

2. Electrical connections:

a. Main power cord to power supply.

b. 12 pole mail connector from analyzer unit to 12 pole female socket on lower right front of electronic unit.

c. Male coaxial connector from analyzer unit to lower right front of electronic unit.

C. Sample connections -

The water sample can be "standing" or "flowing." The first description will be for a "standing" sample.

1. Standing samples will require a minimum of 600 ml.

2. Connect one hose to bottom of optical chamber and support other end at a point higher than the top of the chamber. The sample is to be entered through this hose so that it flows into the chamber from the bottom.

3. Attach a clear or translucent hose to the top of the optical chamber so that it can be seen when the chamber is flooded without spillage.

4. Connections for the "flowing" sample are the same as for "standing" samples except that the hose to the bottom of the optical chamber supplies a continuous flow by means of a pump. The pump should supply sample at a rate of 4 l/min. The hose from the top of the chamber should carry the water well away from the unit. If samples are to be taken for determination of concentration by gravimetric method it should be taken as close to the optical chamber, on the outflow hose, as possible.

D. Visual check during operation -

1. Observe interior of optical chamber through observation window for air bubbles in the water; also for condensation on windows. Either condition must be corrected before continuing.

2. Observe meter occasionally for excessive fluctuation. It could be natural from the water, from the power supply, or internal to the instrument. If the first two conditions do not seem to be the cause of the fluctuation, cease operation.

3. Place the "Peak Signal/Log Ratio" switch in the Peak Signal position occasionally to check electrical components. Meter should read between -0.15 and 0.0.

4. If the meter pegs to either side of the dial, the internal filters will have to be changed. Obtain help from some one in the Sediment Lab.

5. Some "standing" samples will undergo considerable fluctuation before assuming a constant reading. The exact time to read the meter will have to be determined individually.

E. Calibration Control -

1. A supply of distilled water or some other known, constant concentration of water should be entered to determine the repeatability of the instrument.

Appendix IV. Surface water temperatures in degrees Celcius at different points and along traverses in the James River estuary, Sept. 24, 1970, in support of thermal infrared scanner imagery.

Station	Time	Surface Temp. ^{o}C	Location
#1	1907	27.4	James River Bridge along line of towers on west side of bridge. Station numbers correspond to pole number beginning on Newport News side off Red's Pier.
#3	1911	26.5	
#5	1915	26.2	
#6	1919	26.2	
#8	1923	26.8	
#10	1927	27.0	
#12	1931	27.5	
#14	1935	27.6	
#16	1939	28.2	
#18	1943	28.2	
#17	1947	27.9	
#13	1951	27.6	
#11	1955	26.8	
#9	1959	26.6	
#7	2003	26.1	
#5	2007	26.2	
#3	2011	26.5	
#2	2015	26.5	

Collectors: G. Thompson &
C. Leigh

Appendix IV, Cont'd.

Station	Time	Surface Temp.°C	Location
#1	1856	27.7	Jamestown dock
#2	1859	27.7	"
#3	1901	27.7	"
#4	1904	27.7	"
#5	1906	27.4	Scotland + 200 yds
#6	1908	26.9	"
#7	1912	26.7	"
#8	1914	26.6	"
#9	1917	27.2	"
#10	1920	27.4	"
#11	1924	27.2	Jamestown dock
#12	1927	27.0	"
#13	1930	26.9	"
#14	1934	26.9	"
#15	1936	26.9	"
#16	1939	27.3	"
#17	1942	26.6	"
#18	1945	26.7	"
#19	1947	26.7	"
#20	1950	27.1	"
#21	1953	27.4	"
#22	1955	27.6	Scotland dock
#23	1958	27.6	"
#24	2001	27.6	"
#26	2004	27.6	"

Appendix IV, Cont'd.

Station	Time	Surface Temp. ^{o}C	Location
#27	2007	27.0	Scotland dock
#28	2010	26.7	"
#29	2013	26.8	"
#30	2016	26.7	"
#31	2018	26.6	"
#32	2021	27.1	"
#33	2024	27.1	Jamestown dock
#34	2027	27.1	"
#35	2030	27.1	"
#36	2033	27.1	"
#37	2036	26.7	"
#38	2039	26.7	"
#39	2042	26.6	"
#40	2045	26.6	"
#41	2048	26.9	"
#42	2051	27.1	"
#43	2054	27.5	Scotland dock
#44	2057	27.5	"
#45	2100	27.5	"

Collected by Wm. Huber
Sept 24, 1970

Appendix V. Log of visual observations from a helicopter by Dr. Marvin Wass

Sept. 21, 1970, by Dr. M. Wass

Left Ft. Eustis 1030

Larger creek entering James River below mothball fleet (Skiffes Creek), two arms of creek had marshes predominantly S. alt. Passed a sand loading wharf, pond at head of creek, highway, railroad, 4-lane highway and bare fields.

York River, strip of yellow rolls in woods at Naval Weapons Station.

Pond pea-green with Lemna near Gant home before Sarahs Creek.

Ellen Island have shrub ridges with only fringing S. alt.

Area of tall pines killed by fire in lower Guinea; perhaps 7 acres of yellow flowers to left.

Island marshes off Guinea mostly high marsh with barrier beaches probably supporting Iva.

New Point Island very eroded on Mobjack side, probably 20-35 ft.; some accretion on opposite side.

Above New Point a fish house? was over water about 200 ft. from shore.

Bethel Beach has one long house facing beach, good sandbars submerged along shore, large number of cedars back of beaches. Marsh most short S. alt., large Juncus patch in middle. Road leads out to beach and 3 cabins were built above its terminus. Many ponds behind barriers on islands below Gwynns Island (Juncus dark gray below maintained road). Sandy hooks below Gwynns Island appear to be building. Inside of these there are large beds of eel grass. A new development at lower end of inhabited part of Gwynns Island had groins with seawalls at 2-3 lots, with a lot being filled by car bodies? above last groin.

About 50 cormorants took off from rocks surrounding lite at next sample site. Some erosion above entrance to Piankatank in spite of extensive seawalling. Noted dredging at one lot from below MLW to fill behind seawall - poor job. Many bluffs slowly eroding along Piankatank. Large eel grass beds below Piankatank bridge.

Above bridge: Creek on right has no homes, no marsh, ruins of home (brick walls, etc.) in barren field. Fancy new home below bay with small island. Next - a beautiful island with large pines on each end. River here bordered with grass (S. alt.) (Stop #2). Marsh with matted grass (S. patens) - eroded bluffs - erect alt. in creek marsh - 3 small creeks in quick succession - alt. followed by matted S. patens.

High marsh bordering bay below newer housing development (nice homes) - dredged channel adjoining (between development and marsh). Long seawall (1/4 mile) by largest home (an older one - quite long). Four people loading bales in field. Marshes much more extensive here at entrance to Dragon Run. Marshes mainly S. cyno., 2nd crop arrow arum, cypress trees in back - alt. and cyno. turning quite brown. Flying over power lines, some dead cypress, gum trees getting quite bare. Pasture with racing tracks - Christchurch School on Rappahannock Island with woods and marshes.

Barnhart duck farm - has 8 sewage lagoons. On same side of river, a dredged sand area with iron scaffold framework across creek.

Marsh surrounding old home on island (back to river for sample near pound net). On northeast side of river a tiny pond surrounded by marsh.

Great Wicomico: creeks on right side very green, first is small with bar almost entirely across mouth; eel grass beds very dark; four points with sand bars located on left banks by left arm (small creek between this arm and mouth). About 20 acres being cleared for agriculture, very weedy bean field to right of creek, good cornfield across road. Tiny islet midmouth of sampled creek. Osprey nest atop tall pole - considerable erosion.

Eastern Branch of Corrotoman (water sample) - rather severe bank erosion, nice pine plantation, badly eroded bank down to creek, small fringing marshes.

Two nice farms with aluminum buildings, large grain elevator on right.

Indian Field Creek Estates - large structure being built. Grass flats prominent before crossing to Windmill Point sandbar marshes along shores of Rappahannock. Large diked area here, possibly 30 acres, with house in center.

Gwynn's Island has many pines on upper half of hook at lower end of island. Large patches of Juncus marsh here. Below channel - new road out to bare sand hooks.

Red lighthouse with two men present. Sand beach very prominent as we come back to Gwynns Island. Marshes all alterniflora behind barrier beach, with Juncus interiors further in.

Pond very brown on New Point Island; about 12 live oaks in water on Mobjack Bay side, water color blue in inner hook. Guinea marshes pocked with many ponds. Perrin River has marsh at upper end. Dump on Warwick River near creek; landed at Ft. Eustis at 1310.

1237 airborne toward bayside of east shore. Dammed creek pond below Skiffes Creek is very dark green.

Basin newly dredged at Patteson's old home on York River, just below mouth of Perrin River.

Guinea islands now covered with brown grass, with 30-100 foot belt of green showing along outer beach facing Mobjack Bay.

Marsh above New Point very narrow and showing evidence of old ditching and diking.

Crossing bay: Barge and tug going down bay leave a white wake for almost a mile.

Cherrystone Inlet: Westcott Point building southward. Above this are sand dunes backed by pine forest. Pond covered with duckweed on upper half.

Offshore are emergent sandbars with some eel grass on inside; 2 pilings on one bar. Three islets at mouth of Mattawoman Creek. Reddish water or sand occurs above mouth of Mattawoman. Erosion along bluffs; extensive marsh at mouth of Church Neck Creek.

Mouth of Nassawaddox much as shown on chart. Creek loaded with Chrysaora. Large field of soybeans. Cukes being pickled. Sample taken about 300 feet from duck blind freshly covered with cedar in creek.

Marsh mainly S. alt., with Juncus and Iva in upper end. Marsh hen took flight. Bank erosion at several points. S. patens lodged (in situ) in several places.

Mouth of Occohannock Creek moving south. Road made by dredging and an old ditch above mouth of creek (in creek?).

Long plume of reddish-brown water (sample taken in middle of this). Heat outside makes chopper blast refreshing. Water brown due to presence of blue-green algae in prominent streak.

Sandy Point Marsh very meandering, with many ponds.

Road runs to shoreline up thru marsh above Nandua Point. In next marsh, pine trees grow on outer shore. Two cabins on an outer island above Pungoteague Creek.

Big mounds of sand dredged up on point up Onancock Creek - evidently filled some marsh, creek arm bordered by alt. and cedar below and opposite the dredged site. Long wood breakwater below it has caught sand. Tall pines in marshy islands. Very colorful marsh above mouth of creek with a great many irregular "pockings" in the short alt.-patens marsh. Once had roadway running to wooded area on shore.

Beautiful marshy area above this. Grass beds offshore very extensive. Outer islands eroding. Very large stingray over grass beds. New wood frame duck blind. About 10 egrets in roost on outer island. Cabin on nearby island with 4-5 groups in front (upper side). Road out to water thru marsh seems rather new -- marsh seems to be mostly Juncus. Scattered pine islands in marsh. Overwashed grass makes conspicuous brown belt.

Venetian development north of Saxis (on road to Saxis) has dredging nearly completed, but no more buildings than the original one.

Marsh grass quite lush, tussocky where Major Goldberg set copter down on marsh in back of Saxis. A mint, Pluchea purpurascens, with globular pink flowers was conspicuous. Marsh seemed mainly dominated by patens. One long row of pines below Saxis. Public landing below Saxis. Island below Saxis has large island in center. Peninsula below Saxis has green building with sand beach on 3 sides. Water temperature at offshore buoy 25.9.

Watts Island covered with dense growth of trees for about 1/2 of length, 1/4 of area.

Two forest fires burning above Saxis, one near Occohannock. Many bare fields evident. Water aquamarine at mouth of creek above Hungar Creek. Marshes in Hungar Creek probably all S. alt.

Mathews Co.: Row of pines leads west northwest from long beach cabin at Bethel Beach. Time 1509 - air rather cool. Eel grass shows very well.

Four Point Marsh is about 1/2 ponds not connected with creeks. Only sizable creek at upper end. Considerable dredging this side of upper end of Four Point March.

Catlett Islands have long rows of trees, mostly pine (on old sand beaches?).

Good alt. marsh on Skiffes Creek below dam. Island (Goose Island) below Skiffes Creek about 1/2 wooded. Ft. Eustis dump scarcely a sanitary land fill - at edge of marsh.

Appendix VI

Preliminary Phytoplankton Identifications and Notes

Dr. J. Dupuy & V. Gibson

Station Number	Description and Species
0913	red color Sample decomposing - heavy fish oil, oil globules and detritus contained remains of what may have been Cochlodinium but can't be sure.
0919	Small protozoan (probably Bodo), colorless dinoflag, Trichodesmium sp. Peradinium sp. - red color
0922	Mixture of diatoms, no one species dominant: Rhizosolenia, Leptocylindricus, Biddulphia, Nitzschia - Trichodesmium* sp. - red color, heavy density.
0926	Mixture of diatoms, Lithodesmium + Nitzschia closterium dominant
0927	Rhizosolenia - best represented genus (4 or 5 species), Coscinodiscus, light density, no color; Trichodesmium sp., red color, dense.
4008	(1) Gymnodinium splendens red color (2) Gonyaulax, Peradinium
2031	Gonyaulae digitale (almost pure culture) - red color, heavy density
4003	(1) Glenodinium, Gymnodinium splendens no color (2) diatoms, esp. Skeletonema
4002	(1) Gymnodinium - 2 species, 1 large (probably splendens), 1 small (probably simplex)
4006	Very small round cells (about 2μ diameter) - flagellated Tintinnids no color
4007	Gonyaulax digitale (almost pure culture) - red color, heavy density.
1273	Anabaena sp., Oscillatoria sp., Pediastrum sp.
1277	Heavy density - mixed Oscillatoria sp., Anabaenopsis sp., Melosira sp., Microcystis sp.* Coscinodiscus sp., Scenedesmus sp.
1276	Melosira, Anabaenopsis sp., Microcystis sp., Pediastrum sp.

Appendix VI, Cont'd.

Station Number

1341	Oscillatoria sp., Pediastrum sp., Anabaena sp., Scenedesmus sp., Melosira sp., Anabaenopsis sp., Microcystis sp.,* Spirulina sp., Asterionella sp.
1342	Gonyaulae sp., Gymnodinium splendens, Melosira sp., Coscinodiscus sp.
1344	Light mix Oscillatoria sp., Anabaena sp., Scenedesmus sp., Coscinodiscus sp.
7026	(1) Gymndinium simplex light red color (2) Glenodinium, Asterionella
7033	Gymnodinium simplex, Ceratium furca no color

* Dominant