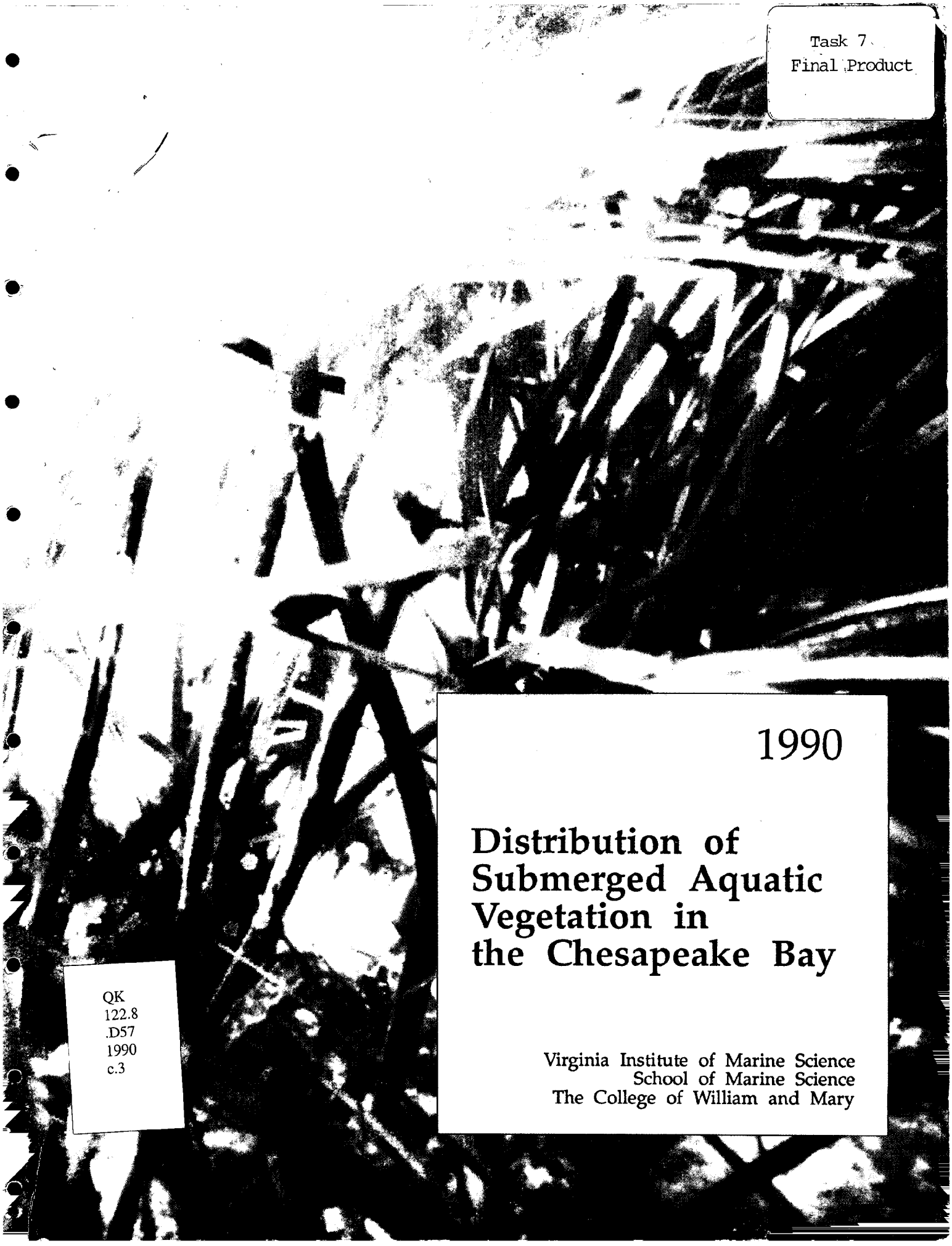

Task 7
Final Product

1990

Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay

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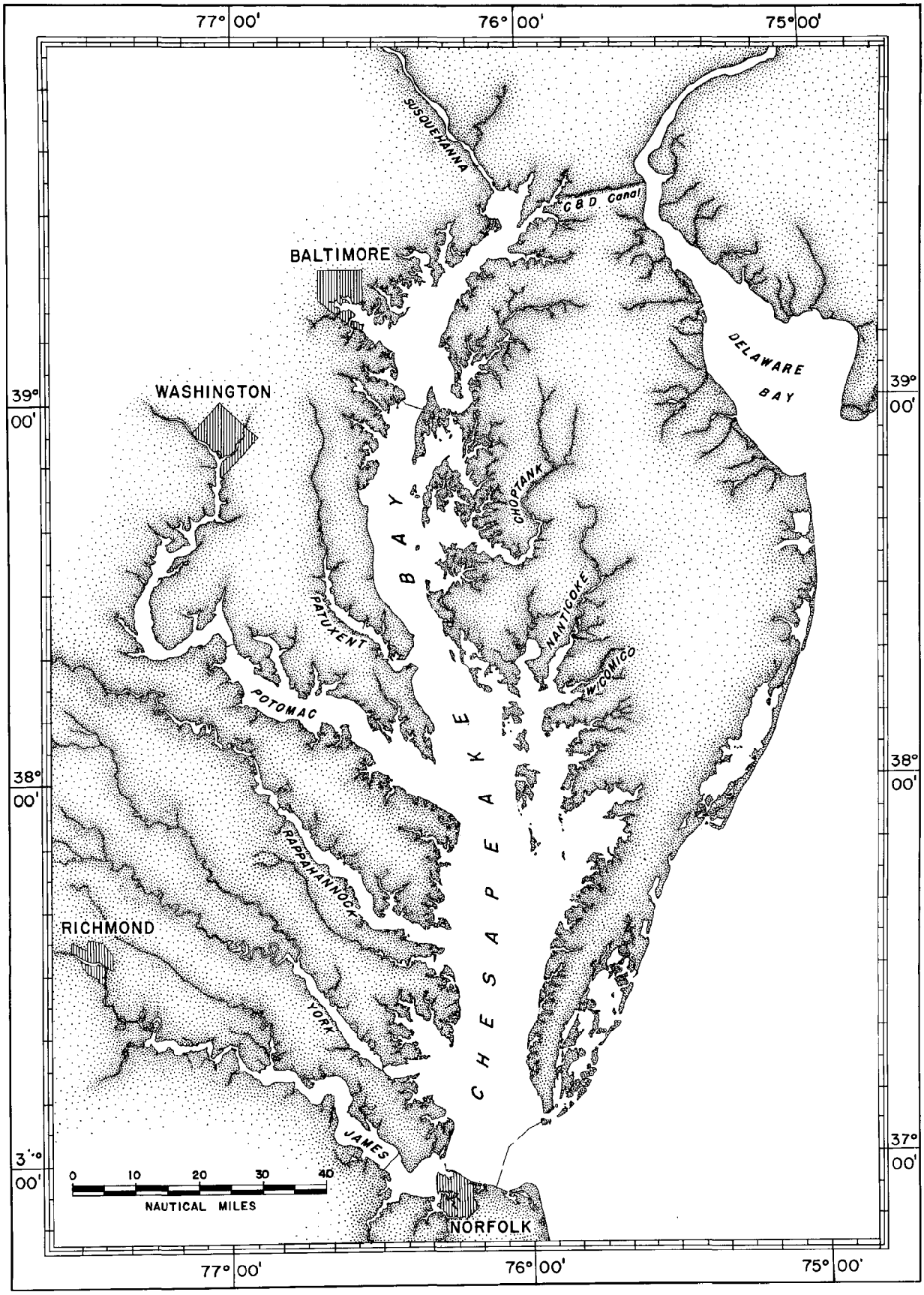
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Distribution of Submerged Aquatic Vegetation in the Chesapeake Bay and Tributaries and Chincoteague Bay - 1990

by

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Funded by: U.S. Environmental Protection Agency (Grant X00346502-0)
National Oceanographic Atmospheric Administration
(Grant No. NA90AA-H-CZ796)
Virginia Institute of Marine Science/School of Marine Science
Maryland Department of Natural Resources (C225-91-004)
U.S. Fish and Wildlife Service (14-16-0005-90-31)
Allied-Signal Foundation

Final Report Submitted to: U.S. Environmental Protection Agency
Chesapeake Bay Program Office
Annapolis, MD 21403
September, 1991

Cover Photograph: Eelgrass (*Zostera marina*) beds with blue crab (*Callinectes sapidus*) in lower York River, Virginia. (Photograph by Curtis Harper, Virginia Institute of Marine Science, School of Marine Science, College of William and Mary.)
Inside Cover: Map of the Chesapeake Bay and tributaries.

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EXECUTIVE SUMMARY

The distribution of submerged aquatic vegetation, principally rooted vascular macrophytes, in the Chesapeake Bay, its tributaries, and Chincoteague Bay was mapped during May to October 1990 at a scale of 1:24,000 using black and white aerial photography. SAV bed perimeter information was digitized and stored in a computerized data base. Ground truth information was obtained from the U. S. Fish and Wildlife Service, the University of Maryland Horn Point Environmental Laboratories, the Metropolitan Washington Council of Governments, Maryland-National Capital Parks and Planning Commission - Patuxent River Park, the Maryland Department of Natural Resources, Harford Community College, Essex Community College SAV Research Group of Baltimore County, and the College of William and Mary/Virginia Institute of Marine Science/School of Marine Science. Citizen support via the U. S. Fish and Wildlife Service and Chesapeake Bay Foundation, as well as the Maryland Charterboat Association via the Maryland Department of Natural Resources Watermen's Assistance Program, provided additional ground truth information.

In 1990, the Chesapeake Bay had 24,313 hectares of SAV, compared to 24,138 hectares in 1989, with 2,353 hectares (10%), 11,328 hectares (47%), and 10,632 hectares (44%) occurring in the Upper, Middle, and Lower Bay zones, respectively (Figs. 1, 2, and 3).

In 1990 seventy-five percent (1,774 hectares) of the SAV within the Upper Bay zone was located in the Susquehanna Flats (Section 1). Eight species of SAV were documented by ground truth surveys in this section, with *Myriophyllum spicatum* being dominant. A recently introduced exotic species, *Hydrilla verticillata,* was found in the Flats but occurred in small isolated beds. Overall abundance of SAV declined from 1989 (1,945 hectares) and 1987 (2,219 hectares) levels , but the density of beds increased slightly from 1989. Ninety-two percent of all SAV beds in the Flats were classified as very sparse (0-10% coverage), and 5% of beds were classified as dense (70-100% coverage). This is a slight improvement over 1989 coverage when 95% were very sparse and no beds were classified as dense. In the Upper Eastern Shore (Section 2) there were 421 hectares of SAV (113 hectares more than in 1989) located principally in the Elk and lower Sassafras rivers, and Swan, Stillpond, and Churn creeks, with many of the same species as reported in the Susquehanna Flats section. The Upper Western Shore (Section 3) had 90 hectares of SAV, primarily *M. spicatum* and *Vallisneria americana,* concentrated in Saltpeter and Dundee creeks. This is an increase of 52 hectares over 1989 and approaches the 1987 level of 117 hectares. In the Chester River (Section 4) SAV abundance (67 hectares) was down 100 hectares from 1989 and 448 hectares from 1987. SAV was most abundant adjacent to Eastern Neck, Eastern Neck Island, and in the lower Chester River. In this region *Ruppia maritima* was the most abundant of seven species reported.

In 1990 forty-eight percent (5,405 hectares) of the SAV in the Middle Bay zone was found in the Mid-Bay Island Complex (Section 13) which includes the broad shoal area between Smith and Tangier Islands. This is an increase of 206 hectares over 1989. The two dominant species were *R. maritima* and *Zostera marina.* Twenty percent (2,287 hectares) of the SAV in this zone was present in the Middle Eastern Shore (Section 12), primarily in the Barren Island-Honga River area, the Big and Little Annemessex rivers, and the lower section of the Manokin River, with *R. maritima* being the dominant species reported. Little or no SAV was mapped or

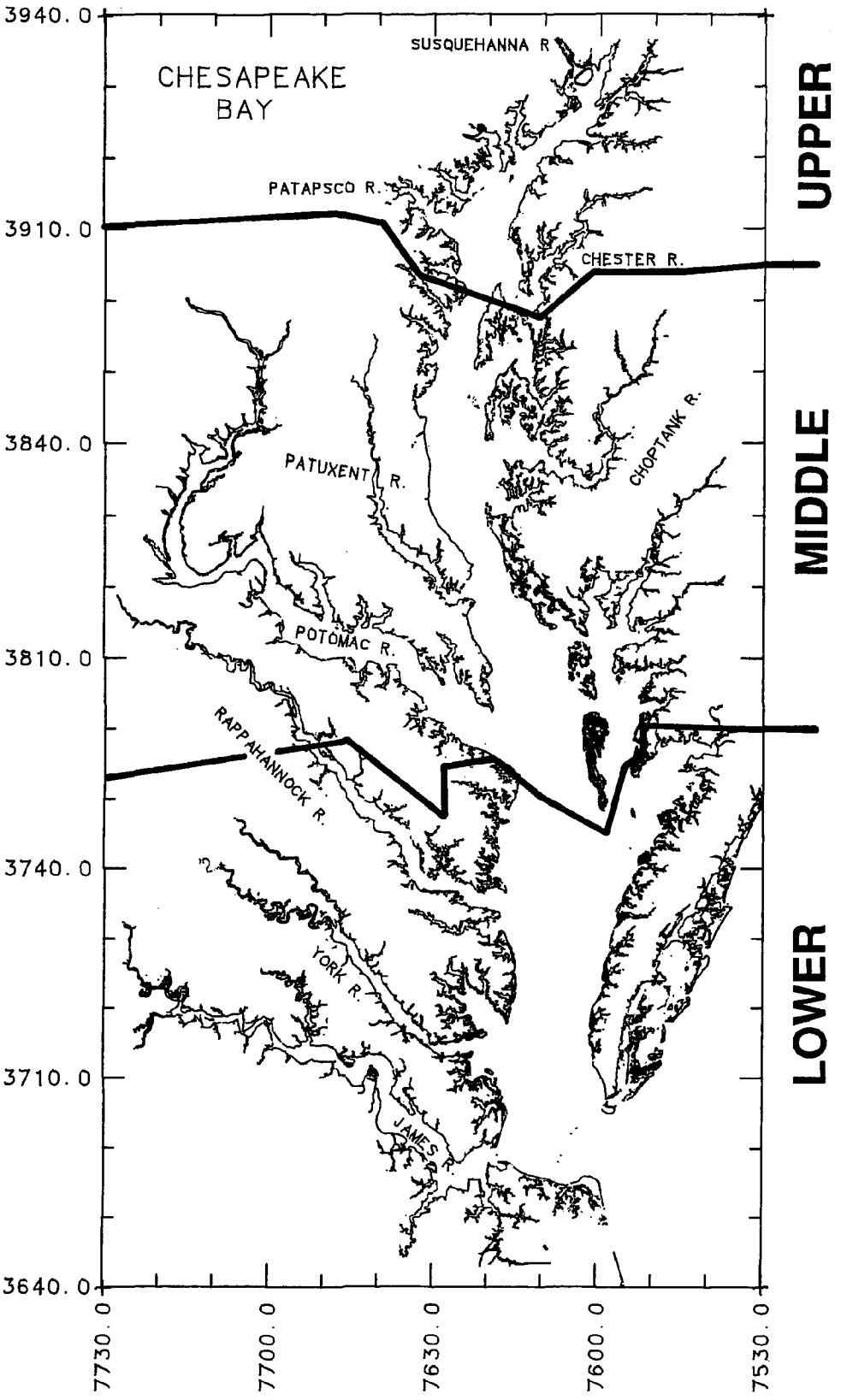

Figure 1. Map of the Chesapeake Bay and tributaries with Upper, Middle, and Lower zones and locations of all SAV beds in 1990. (SAV is shown in red. Latitude and longitude are in decimal degrees along the vertical and horizontal axes, respectively.)

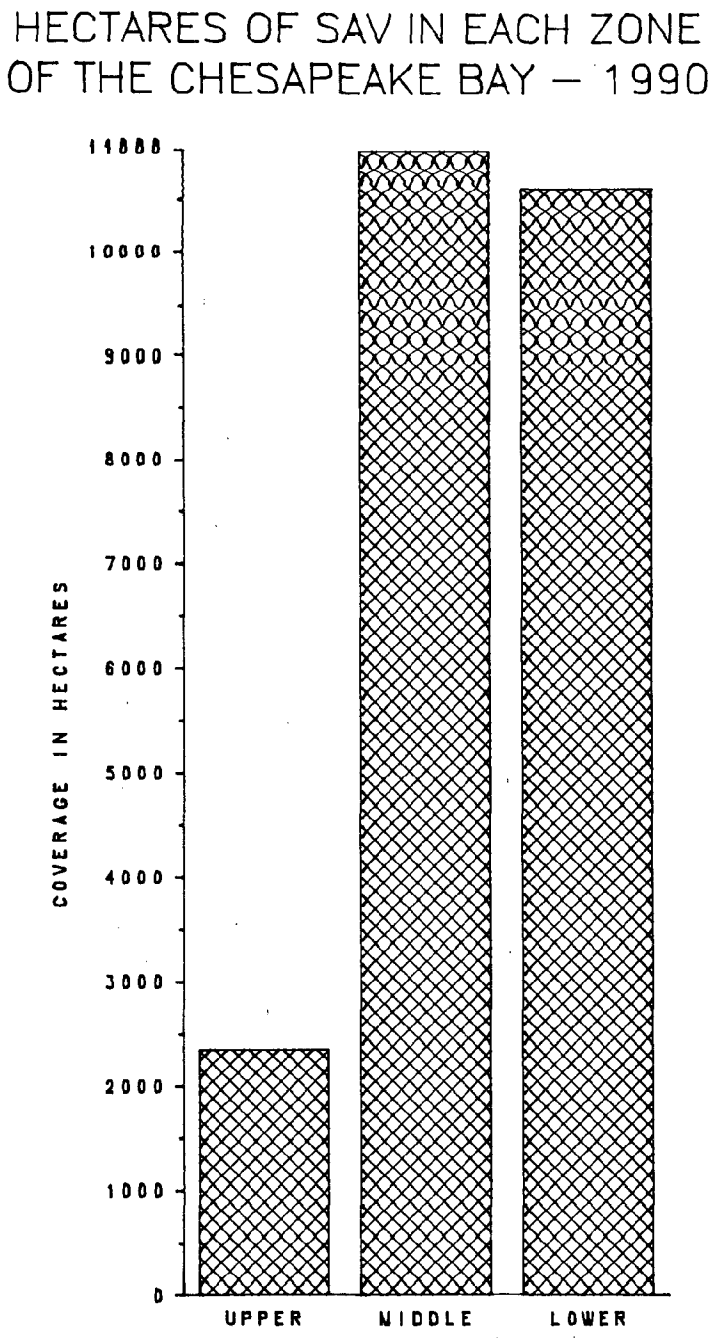

Figure 2. Total hectares of SAV for the Upper, Middle, and Lower zones of the Chesapeake Bay in 1990. (Refer to Figures 1 and 7 for zone locations.)

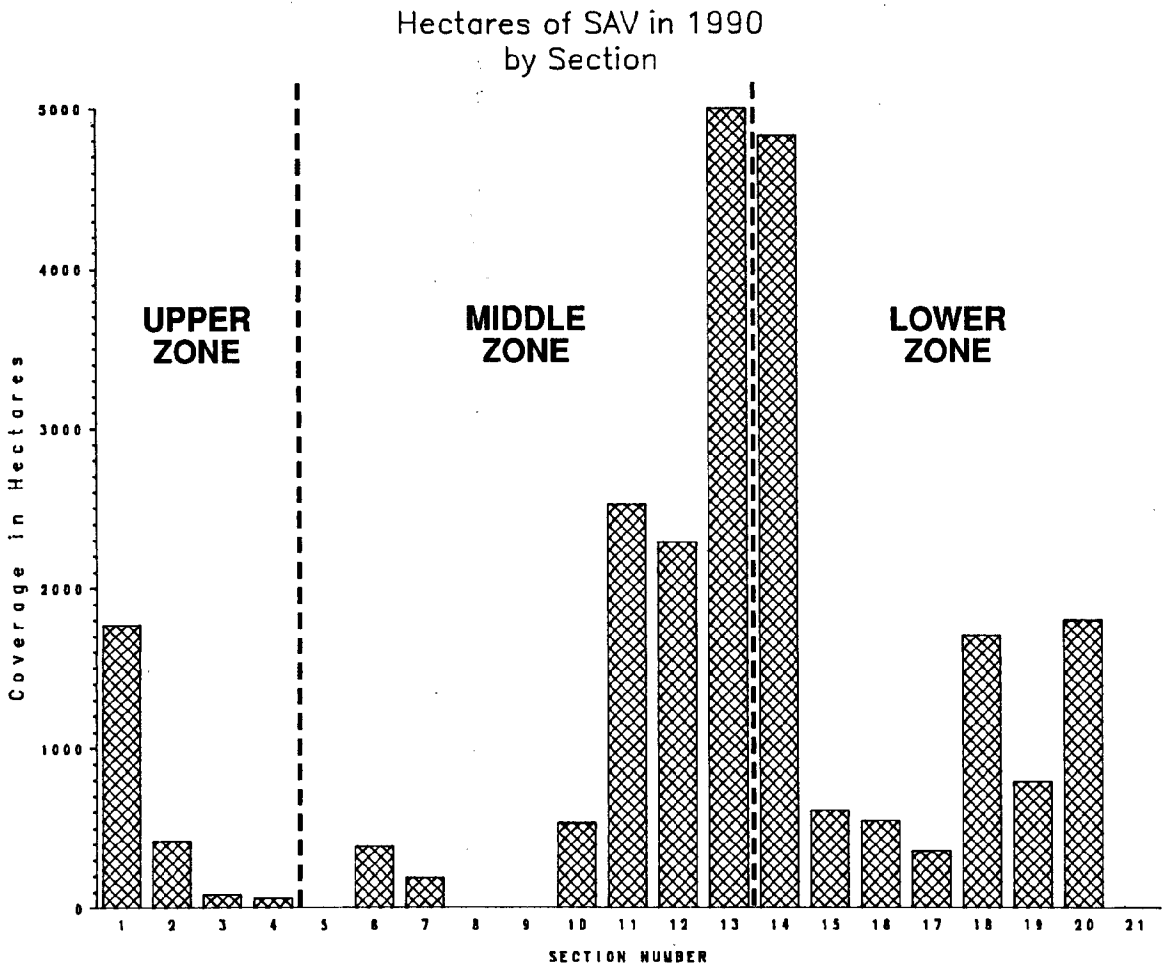

Figure 3. Total hectares of SAV in 1990 by section of the Chesapeake Bay. (Refer to Figure 7, Table 3, and Appendix B for section locations and boundaries.)

reported from the Central Western Shore (Section 5), Middle Western Shore (Section 9), and Patuxent River (Section 8).

The Middle Bay zone also includes the entire Potomac River, where 3,054 hectares of SAV were present in 1990. SAV was concentrated in two distinct regions: 1. the Upper Potomac River (Section 11) with 2,522 hectares, where *Hydrilla verticillata* remained the numerically dominant species (eight other species were reported by the COG, VIMS, USFWS, and Citizen's surveys); and 2. the upper portion of the Lower Potomac River (Section 10) with 532 hectares, including Nanjemoy Creek and Port Tobacco River, with *V. americana* and *M. spicatum* being the most frequently reported species. Although the total abundance of SAV in the Upper Potomac section increased from 1989 by 524 hectares, it decreased in the Lower Potomac section by 83 hectares. SAV in the Eastern Bay (Section 6) decreased 443 hectares from 1989 to a total of 389 hectares in 1990, while in the Choptank River (Section 7) it declined 672 hectares from 1989 to a total of 193 hectares in 1990.

Distribution and abundance in 1990 in the Lower Bay zone were similar to 1989. Forty-five percent (4,829 hectares) of SAV in this zone was found in the Lower Eastern Shore (Section 14) around the Fox Islands and the mouths of major creeks (i.e. Cherrystone Inlet and Hungars, Mattawoman, Occahannock, Craddock, Pungoteague, and Onancock creeks. Along the western shore of the Chesapeake Bay, SAV was abundant in Mobjack Bay (Section 18) (16% of SAV in the Lower Bay zone), in the lower York River (Section 19) (7% of SAV in the Lower Bay zone), and in the Lower Western Shore (Section 20), specifically Back River and Drum Island Flats area adjacent to Plum Tree Island (17% of SAV in the Lower Bay zone). There were 609 hectares of SAV mapped in the Reedville Region (Section 15) in 1990, a 24% increase over 1989. There were 357 hectares of SAV identified in 1990 in the New Point Comfort Region (Section 17) compared to 346 hectares in 1989. Both *R. maritima* and *Z. marina* were abundant throughout this zone. SAV abundance was down slightly from 1989 in both the Piankatank and Rappahannock rivers (Section 16). *Ruppia maritima* was the dominant species in those rivers, with *Zostera marina* also present as a result of previously successful transplant efforts. The James River (Section 21) had less than 3 hectares of SAV in 1990, which is one hectare less than in 1989.

SAV in Chincoteague Bay increased slightly in distribution from 1989, with 2,494 hectares mapped in 1990. All of the SAV consisted of *R. maritima* and *Z. marina*, and was located along the eastern side of the bay behind Assateague Island.

ACKNOWLEDGEMENTS

We would like to gratefully acknowledge all federal and state agencies who financially supported this project: the U. S. Environmental Protection Agency (USEPA); the U. S. Fish and Wildlife Service (USFWS); the Virginia Council on the Environment's and MD-DNR's Coastal Resources Management Program of the National Oceanographic and Atmospheric Administration (NOAA), under the Coastal Zone Management Act of 1972 as amended by the Office of Ocean Coastal Resource Management (OCRM); the Maryland Department of Natural Resources (MD-DNR); and the Virginia Institute of Marine Science, School of Marine Science, College of William and Mary (VIMS). Also, we thank Allied - Signal, Inc. for providing supplemental funding for this work. Additionally, the Virginia Council on the Environment EcoMAPS Program provided ARC/INFO expertise, training, and the use of their SUN Micro Systems Spark Station 2 workstation for converting 1990 SAV digital data to ARC/INFO 5.0.1 format.

Acknowledgement would not be complete without commendation for the groups which provided ground truthing of SAV beds which was used in conjunction with interpretation of the 1990 photography. USFWS conducted a survey and, with the Chesapeake Bay Foundation (CBF), also organized citizens to report locations and species composition of grassbeds around the bay. In addition, members of the Maryland Charterboat Association were funded by the MD-DNR to participate in the ground truthing program and contributed valuable information on location and species composition of SAV beds in Maryland waters. Bill Dennison of the University of Maryland Horn Point Environmental Laboratories (HPEL), Stan Kollar of Harford Community College (HCC), and the Essex Community College SAV Research Group of Baltimore County, Maryland provided ground truth information for certain specific regions of the Maryland portion of the Bay. The Metropolitan Washington Council of Governments (COG) provided ground truth information from the Potomac River. The Maryland-National Capital Parks and Planning Commission provided ground truth data for the Patuxent River Park. Ken Moore, Lori Morris, Sheryl Robertson, Sharon Dewing, Gene Silberhorn, Curtis Harper, Betty Berry, Jill Goodman, Art Schwartzchild, Chris Rowe, Beth Cockey, and Cindi Horton of VIMS provided ground truth information for the lower bay.

The production of this report required the dedication of numerous scientists, technicians, artists, photographers, and others. The following people deserve a note of thanks: Silvia Terziotti (Virginia Council on the Environment) for developing computer software necessary for conversion of digital data to ARC/INFO 5.0.1 format; Rich Batiuk, USEPA-Chesapeake Bay Program Office; Linda Hurley and Kathyrn Reshetiloff, USFWS; David Bleil, MD-DNR; and Christina Pompa (CBF).

We are especially grateful to the dedicated VIMS personnel who contributed greatly to the production of this report: Leah Nagey for her tremendous assistance and perseverance in digitizing most of the maps, editing the digital data files, mapping ground truth information, and for her constant, careful efforts to maintain high quality control; Pat Barthle for computer programming and computer graphics; Diane Bowers, Harold Burrell, Kay Stubblefield, Sylvia Motley, and Billy Jenkins for graphic art work on the SAV maps reproduced in Appendix C, and for figure preparation, photography, and printing; Ruth Hershner for typography; Pat Hall for

computer services; Gary Anderson for statistical analysis of the 1990 digital data in ARC/INFO 5.0.1 format for quality assurance purposes. Michael Upchurch, Virginia Division of Mineral Resources, Randy Karin, Maryland Geological Survey, Claud Summers, USGS, National Cartographic Information Center (NCIC), Mid-Continent Mapping Center, and Craig Breen, Professional Blueprinters, Inc., Newport News, VA, were helpful in the procurement of high quality topo maps and map copies. Architectural and Engineering Supply Company, Richmond, VA, did the high quality photo-reductions of the maps reproduced in Appendix C. Air Photographics, Inc. conducted the aerial photographic missions and was responsible for the high quality aerial photographs.

Aquatic plant illustrations were provided by the Information Office of the University of Florida, Institute of Food and Agricultural Sciences, Center for Aquatic Plants (Gainesville) and were drawn by Laura Line Reep, biological illustrator.

INTRODUCTION

Monitoring programs of living resources are being increasingly recognized as critical to contributing to our understanding fluctuations in abundance of these resources. In the Chesapeake Bay, monitoring submerged aquatic vegetation has been recognized as necessary to assess the success of the bay cleanup efforts. The baywide decline of SAV in the 1960's and 1970's followed by relatively rapid annual changes from 1984 through 1990 (Orth et al., 1985, 1986, 1987, 1989; Orth and Nowak, 1990), supports the suggestion that SAV may be a good barometer of the health of the bay (Orth and Moore, 1988).

The rapid changes observed in the late 1980's supported the need for an annual aerial monitoring program. Indeed, the simultaneously reported annual increases and decreases at different locations in one tributary of the bay, the Potomac River, has allowed scientists to more accurately determine the relative role of different factors controlling SAV abundance in this system (Carter and Rybicki, submitted).

SAV communities in the entire Chesapeake Bay and tributaries have been photographed and mapped, and the areas of the beds have been digitized in 1978, 1984, 1985, 1986, 1987, 1989, and 1990 (Orth et al., 1979; Anderson and Macomber, 1980; Orth et al., 1985, 1986, 1987, and 1989; Orth and Nowak, 1990). Portions of the upper bay were mapped and digitized in 1979, and the lower bay was mapped and digitized in 1980 and 1981. The bay shoreline was photographed in 1988 but was not mapped. Sections of the lower bay were mapped and digitized in 1971 and 1974.

The goal of the 1990 work was to continue the annual monitoring of SAV on a baywide basis using aerial photographic methods. Appropriate ground truth was used to substantiate presence or absence of SAV in particular sections.

SAV SPECIES

The term "submerged aquatic vegetation" for the purpose of this report encompasses 19 taxa from 10 vascular macrophyte families and 3 taxa from 1 freshwater macrophytic algal family, the Characeae, but excludes all other algae, both benthic and planktonic, which occur in the Chesapeake Bay and tributaries (Appendix A; Figs. 30-40). For instance, benthic marine algae, including many macrophytes, sometimes co-occur in the same beds with vascular plants, even as epiphytes on vascular plants (Humm, 1979). Although outside the scope of this study, the algal component does constitute a portion of the SAV biomass in the Chesapeake Bay and tributaries. However, except for the Characeae, this study has not attempted to identify, delineate or discuss the algal component of the vegetation nor its relative importance in the flora.

Ten species of submerged aquatic vegetation exclusive of the algae are commonly found in the Chesapeake Bay and its tributaries. *Zostera marina* (eelgrass) is dominant in the lower reaches of the bay. *Myriophyllum spicatum* (Eurasian watermilfoil), *Potamogeton pectinatus* (sago pondweed), *Potamogeton perfoliatus* (redhead grass), *Zannichellia palustris* (horned pondweed), *Vallisneria americana* (wild celery), *Elodea canadensis* (common elodea), *Ceratophyllum demersum* (coontail) and *Najas guadalupensis* (southern naiad) are less tolerant of high salinities and are found in the middle and upper reaches of the bay (Stevenson and Confer, 1978; Orth et al., 1979; Orth and Moore, 1981, 1983). *Ruppia maritima* (widgeon grass) is tolerant of a wide range of salinities and is found from the bay mouth to the Susquehanna Flats. Approximately twelve other species are only occasionally found and, when present, occur primarily in the middle and upper reaches of the bay and the tidal rivers (Appendix A). *Hydrilla verticillata* (hydrilla), a recently introduced species, presently dominates SAV beds in the tidal freshwater reaches of the Potomac River. It has also been reported again in 1990 in the Susquehanna Flats where its growth has not been as widespread as in the Potomac River (Kollar, pers. comm.).

Zostera marina and *Ruppia maritima* are the dominant species reported from Chincoteague Bay.

METHODS

Introduction

Black and white aerial photography at a scale of 1:24,000 was the principal source of information used to assess the distribution and abundance of SAV in the Chesapeake Bay, its tributaries, and Chincoteague Bay in 1990. SAV beds mapped from photographs onto USGS 7.5 minute topographic quadrangles were then digitized, providing a digital data base for analysis of bed area and location. Ground truth information collected in 1990 was mapped onto the same topographic quadrangles.

Aerial Photography

The 1990 SAV photography was obtained by Air Photographics (Martinsburg, West Virginia) using a Wild RC-20 camera, with a 153 mm (6 inch) focal length Aviogon lens, and Agfa Pan 200 film. The camera was mounted in the bottom fuselage of the Air Photographics' Piper Aztec, a twin engine reconnaissance aircraft. Photography was acquired at approximately 12,000 feet altitude, yielding a 1:24,000 photographic scale.

Flight lines for photography, which were drawn on 1:250,000 scale USGS maps, were predetermined by Air Photographics to include all areas known to have SAV, as well as those areas which could potentially have SAV (i.e. all areas where water depths were less than 2 m at mean low water). Flightlines also included land features that are necessary as control points for accurate mapping (Fig. 4). Sections of the upper Rappahannock, upper York, and most of the James rivers were not flown because of the continued absence of SAV in these areas.

Flight lines were prioritized by major sections. Dates of flight windows for aerial photography were timed to occur at peak standing crop of species known to occur in the sections. In addition, specific areas with significant coverage were given priority. Prior approval by the VIMS staff was required to extend dates of flight windows if necessary. Actual dates of acquisition of photography are noted on each quadrangle map in Appendix C.

General guidelines for mission planning and execution (Table 1) address tidal stage, plant growth, sun elevation, water and atmospheric transparency, turbidity, wind, sensor operation, and plotting. Adherence to these guidelines assured acquisition of photography under nearly optimal conditions for detection of SAV, thus insuring accurate photo interpretation.

Quality assurance and calibration procedures were consistently followed. The altimeter was calibrated by the Federal Aviation Administration annually. Photographic settings were selected with an automatic exposure control. Sun angle was measured with an indicator on the plane. Flight lines were plotted on 1:250,000 scale maps to allow for

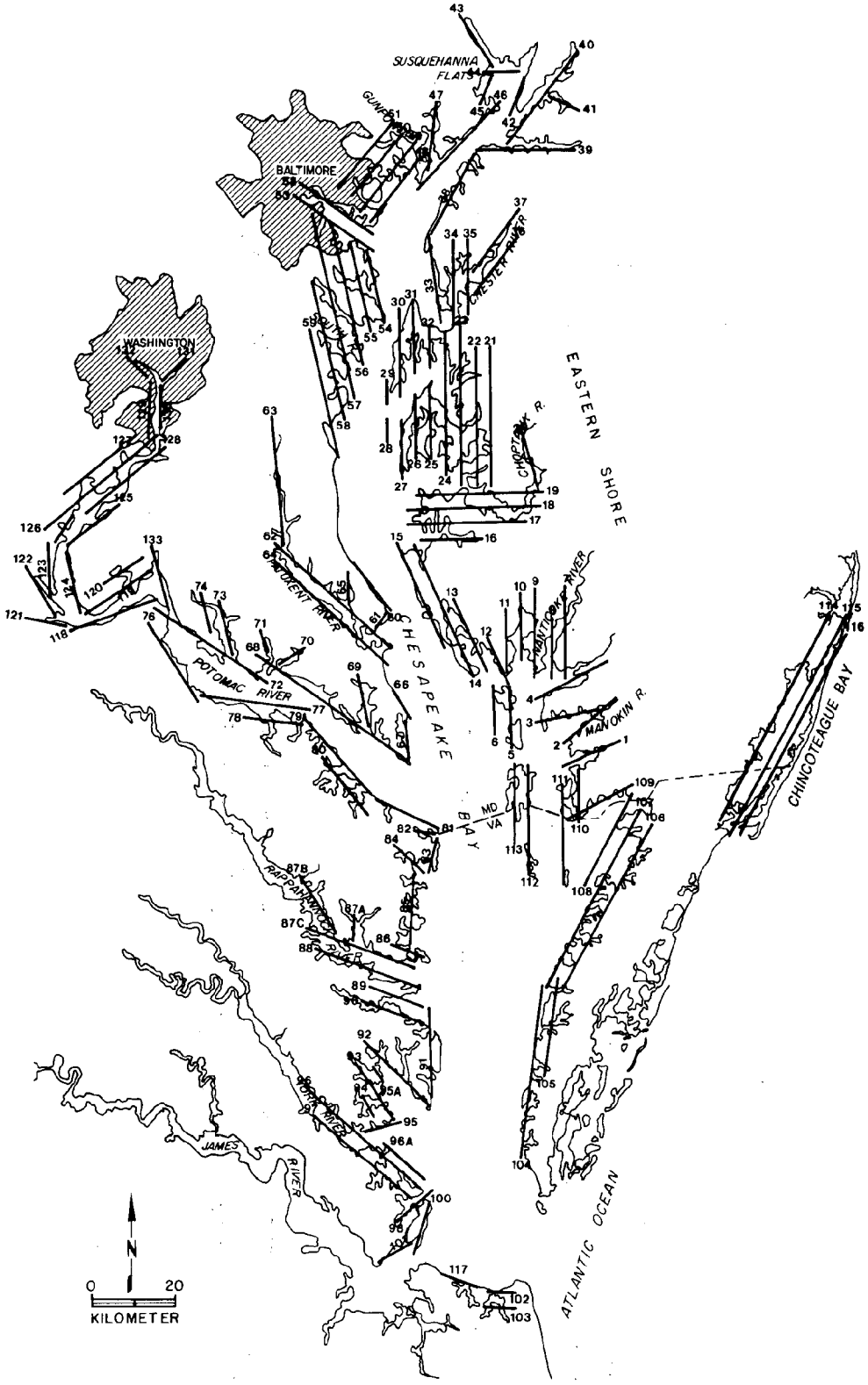

Figure 4. Map of the Chesapeake Bay, its tributaries, and Chincoteague Bay with approximate locations of flight lines for 1990 SAV photography.

Table 1

Guidelines Followed During Acquisition Of Aerial Photographs.

1. Tidal Stage - Photography was acquired at low tide, +/- 0-1.5 ft., as predicted by the National Ocean Survey tables.

2. Plant Growth - Imagery was acquired when growth stages ensured maximum delineation of SAV, and when phenologic stage overlap was greatest.

3. Sun Angle - Photography was acquired when surface reflection from sun glint did not cover more than 30 percent of frame. Sun angle was generally between 20° and 40° to minimize water surface glitter. At least 60 percent line overlap and 20 percent side lap was used to minimize image degradation due to sun glint.

4. Turbidity - Photography was acquired when clarity of water ensured complete delineation of grass beds. This was visually determined from the airplane to insure that SAV could be seen by the observer.

5. Wind - Photography was acquired during periods of no or low wind. Off-shore winds were preferred over on-shore winds when wind conditions could not be avoided.

6. Atmospherics - Photography was acquired during periods of no or low haze and/or clouds below aircraft. There could be no more than scattered or thin broken clouds, or thin overcast above aircraft, to ensure maximum SAV to bottom contrast.

7. Sensor Operation - Photography was acquired in the vertical mode with less than 5 degrees tilt. Scale/altitude/film/focal length combination permitted resolution and identification of one square meter area of SAV (at the surface).

8. Plotting - Each flight line included sufficient identifiable land area to assure accurate plotting of grass beds.

overlap of photography. To minimize image degradation due to sun glint, the camera was equipped with a computer controlled intervalometer which established 60% line overlap and 20% sidelap. An automatic bubble level held the camera to within one degree tilt. The scale/altitude/film/focal length combination was coordinated to produce one square meter resolution. Wind speed was monitored hourly from the flight service available in the region. Under normal operating conditions, flights were usually conducted under wind speeds less than 10 mph. (Above this, wind generated waves stir the bottom sediments which can easily obscure SAV beds in less than one hour.) Pilot experience determined what acceptable level of turbidity would insure complete delineation of SAV beds. At low tide the pilot should have been able to distinguish bottom features such as SAV or algae. When turbid conditions prevailed photography did not commence. Cloud cover did not exceed 5% of the area covered by the camera frame.

Determination of cloud cover was based on pilot experience. Records of this parameter were kept in a flight notebook. Every attempt was made to acquire photographs with no cloud cover below 12,000 feet. A thin haze layer above 12,000 feet was generally acceptable. Experience has shown that the optimal conditions given above generally occur two to three days following passage of a cold front when winds have shifted from north-northwest to south and moderated to less than 10 mph. Where possible, and within the guidelines given for prioritizing and executing the photography, flights were planned to coincide with these atmospheric conditions.

Exposed film was processed by Air Photographics. A contact print was produced for each exposed frame. Each photograph was labeled with date of acquisition as well as flight line number. Film and photographs were stored under appropriate environmental conditions to prevent degradation of the product.

Mapping Process

This study utilized USGS 7.5 minute topographic quadrangle maps as a basis for mapping SAV beds from aerial photography, for digitizing the SAV beds, and for compiling SAV bed area measurements. Figure 5 gives locations of topographic quadrangles in the study area which includes all regions with potential for SAV growth. Most quadrangles are sequentially numbered for efficient access to data. The name corresponding to each quadrangle in Figure 5 is listed in Table 2.

Photo-interpretation to identify and delineate SAV beds utilized all available information including knowledge of aquatic grass signatures on film, distribution of SAV in 1990 from aerial photography, 1990 ground truth information, and aerial site surveys. USGS-published 7.5 minute topographic quadrangle masters (1:24,000 scale) printed by the Mid-Continent Mapping Center of the USGS on stable transparent mylar were used as base maps. Identical copies of these base maps were made at

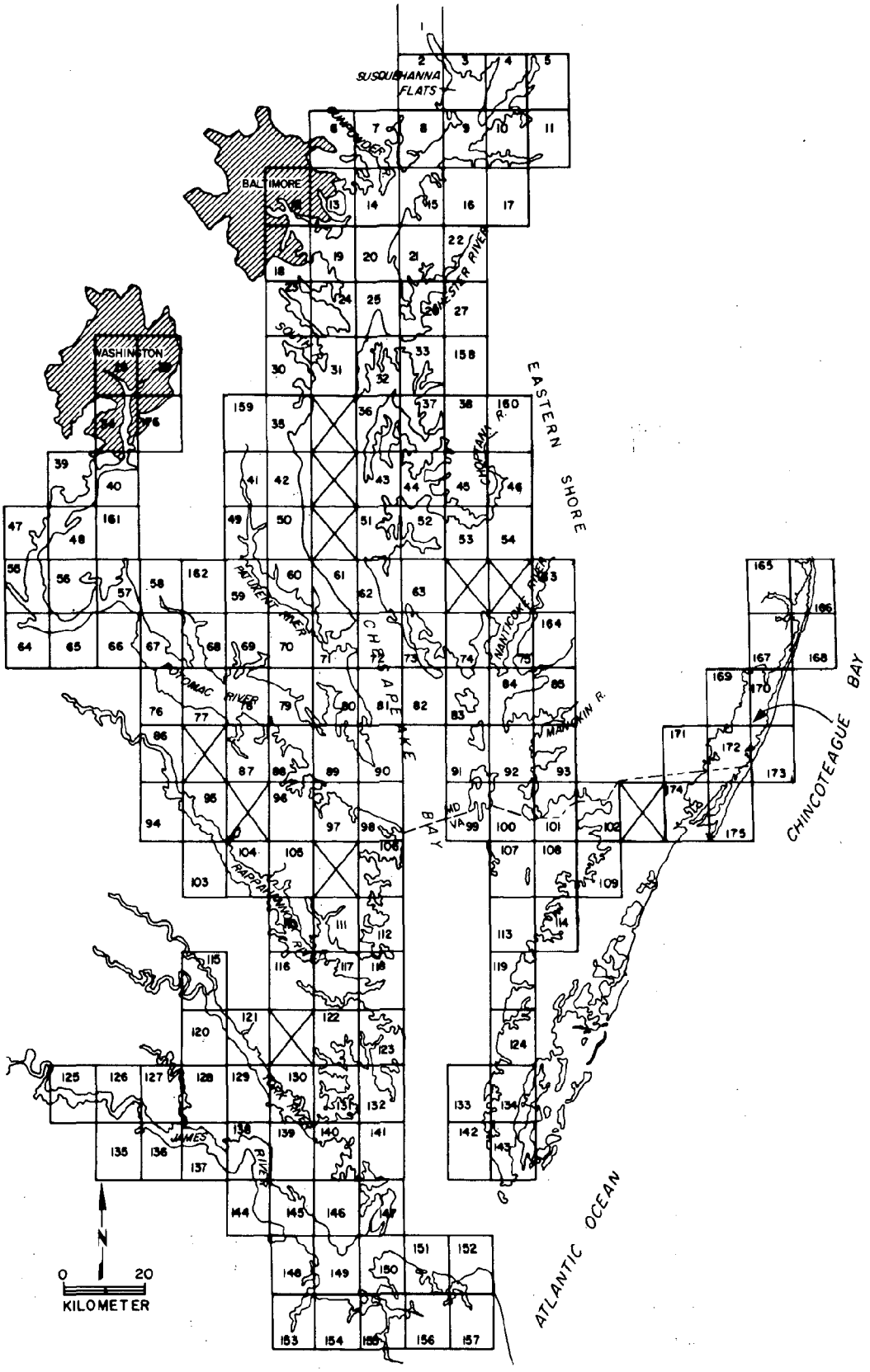

Figure 5. Location of USGS 7.5 minute topographic quadrangles for the Chesapeake Bay, its tributaries, and Chincoteague Bay with corresponding code numbers. (See Table 2 for quad names.)

Table 2

List Of USGS 7.5 Minute Topographic Quadrangles For The Chesapeake Bay And Chincoteague Bay SAV Study Areas With Corresponding Code Numbers. (See Fig. 5 for location of quadrangles. Topographic quadrangles with SAV beds can be found in Appendix C.)

1. Conowingo Dam, Md.-Pa.
2. Aberdeen, Md.
3. Havre de Grace, Md.
4. North East, Md.
5. Elkton, Md.-Del.
6. White Marsh, Md.
7. Edgewood, Md.
8. Perryman, Md.
9. Spesutie, Md.
10. Earleville, Md.
11. Cecilton, Md.
12. Baltimore East, Md.
13. Middle River, Md.
14. Gunpowder Neck, Md.
15. Hanesville, Md.
16. Betterton, Md.
17. Galena, Md.
18. Curtis Bay, Md.
19. Sparrows Point, Md.
20. Swan Point, Md.
21. Rock Hall, Md.
22. Chestertown, Md.
23. Round Bay, Md.
24. Gibson Island, Md.
25. Love Point, Md.
26. Langford Creek, Md.
27. Centreville, Md.
28. Washington West, Md.-D.C.-Va.
29. Washington East, D.C.-Md.
30. South River, Md.
31. Annapolis, Md.
32. Kent Island, Md.
33. Queenstown, Md.
34. Alexandria, Va.-D.C.-Md.
35. Deale, Md.
36. Claiborne, Md.
37. St. Michaels, Md.
38. Easton, Md.
39. Fort Belvoir, Va.-Md.
40. Mt. Vernon, Md.-Va.
41. Lower Marlboro, Md.
42. North Beach, Md.
43. Tilghman, Md.
44. Oxford, Md.
45. Trappe, Md.
46. Preston, Md.
47. Quantico, Va.-Md.
48. Indian Head, Va.-Md.
49. Benedict, Md.
50. Prince Frederick, Md.
51. Hudson, Md.
52. Church Creek, Md.
53. Cambridge, Md.
54. East New Market, Md.
55. Widewater, Va.-Md.
56. Nanjemoy, Md.
57. Mathias Point, Md.-Va.
58. Popes Creek, Md.
59. Mechanicsville, Md.
60. Broomes Island, Md.
61. Cove Point, Md.
62. Taylors Island, Md.
63. Golden Hill, Md.
64. Passapatanzy, Md.-Va.
65. King George, Va.-Md.
66. Dahlgren, Va.-Md.
67. Colonial Beach North, Md.-Va.
68. Rock Point, Md.
69. Leonardtown, Md.
70. Hollywood, Md.
71. Solomons Island, Md.
72. Barren Island, Md.
73. Honga, Md.
74. Wingate, Md.
75. Nanticoke, Md.
76. Colonial Beach South, Va.-Md.
77. Stratford Hall, Va.-Md.
78. St. Clements Island, Va.-Md.
79. Piney Point, Md.-Va.
80. St. Marys City, Md.
81. Point No Point, Md.
82. Richland Point, Md.
83. Bloodsworth Island, Md.
84. Deal Island, Md.
85. Monie, Md.
86. Champlain, Va.
87. Machodoc, Va.
88. Kinsale, Va.-Md.
89. St. George Island, Va.-Md.
90. Point Lookout, Md.

Table 2 (continued)

91. Kedges Straits, Md.
92. Terrapin Sand Point, Md.
93. Marion, Md.
94. Mount Landing, Va.
95. Tappahannock, Va.
96. Lottsburg, Va.
97. Heathsville, Va.-Md.
98. Burgess, Va.-Md.
99. Ewell, Md.-Va.
100. Great Fox Island, Va.-Md.
101. Crisfield, Md.-Va.
102. Saxis, Va.-Md.
103. Dunnsville, Va.
104. Morattico, Va.
105. Lively, Va.
106. Reedville, Va.
107. Tangier Island, Va.
108. Chesconessex, Va.
109. Parksley, Va.
110. Urbanna, Va.
111. Irvington, Va.
112. Fleets Bay, Va.
113. Nandua Creek
114. Pungoteague, Va.
115. West Point, Va.
116. Saluda, Va.
117. Wilton, Va.
118. Deltaville, Va.
119. Jamesville, Va.
120. Toano, Va.
121. Gressitt, Va.
122. Ware Neck, Va.
123. Mathews, Va.
124. Franktown, Va.
125. Westover, Va.
126. Charles City, Va.
127. Brandon, Va.
128. Norge, Va.
129. Williamsburg, Va.
130. Clay Bank, Va.
131. Achilles, Va.
132. New Point Comfort, Va.
133. Cape Charles, Va.
134. Cheriton, Va.
135. Savedge, Va.
136. Claremont, Va.
137. Surry, Va.
138. Hog Island, Va.
139. Yorktown, Va.
140. Poquoson West, Va.
141. Poquoson East, Va.
142. Elliotts Creek, Va.
143. Townsend, Va.
144. Bacons Castle, Va.
145. Mulberry Island, Va.
146. Newport News North, Va.
147. Hampton, Va.
148. Benns Church, Va.
149. Newport News South, Va.
150. Norfolk North, Va.
151. Little Creek, Va.
152. Cape Henry, Va.
153. Chuckatuck, Va.
154. Bowers Hill, Va.
155. Norfolk South, Va.
156. Kempsville, Va.
157. Princess Anne, Va.
158. Wye Mills, Md.
159. Bristol, Md.
160. Fowling Creek, Md.
161. Port Tobacco, Md.
162. Charlotte Hall, Md.
163. Mardela Springs, Md.
164. Wetipquin, Md.
165. Selbyville, Md.
166. Assawoman Bay, Md.
167. Berlin, Md
168. Ocean City, Md.
169. Public Landing, Md.
170. Tingles Island, Md.
171. Girdle Tree, Md.-Va.
172. Boxiron, Md.-Va.
173. Whittington Point, Md.-Va.
174. Chincoteague West, Va.
175. Chincoteague East, Va.
176. Anacostia, D.C.-Md.

the same scale on stable transparent mylar using a contact diazo process. SAV from the 1990 aerial photographs was mapped onto these diazo copies of USGS topographic quadrangles. Delineation of SAV bed boundaries onto the topographic quadrangle maps was facilitated by superimposing the photographic print with the appropriate mylar quadrangle on a light table. SAV boundaries were then traced directly onto the mylar quadrangle with a pencil. Where minor scale differences were evident between a photograph and a quadrangle, or where significant shoreline erosion or accretion had occurred since USGS publication of a map, either a best fit was obtained or shoreline changes were noted on the quadrangle.

In addition to delineating SAV bed boundaries, an estimate of percent cover within each bed was made visually in comparison with an enlarged Crown Density Scale similar to those developed for estimating of forest tree crown cover from aerial photography (Fig. 6). Bed density was classified into one of four categories based on a subjective comparison with the density scale. These were: 1, very sparse (<10% coverage); 2, sparse (10 to 40%); 3, moderate (40 to 70%); or 4, dense (70-100%). Either the entire bed or subsections within the bed were assigned a number (1 to 4) corresponding to the above density categories. Additionally, each distinct SAV unit (bed or bed subsection) was assigned an identifying two letter designation unique to its map. Subsections of beds were further identified as being part of a contiguous bed by the addition of two letters unique to each contiguous bed. These contiguous bed descriptions aid the tracking of a single bed between quad sheets as well as the analysis of those beds that had to be separated due to variation in SAV density.

SAV Perimeter Digitization and Area Calculation

The perimeters of all SAV beds mapped from the aerial photography were digitized in a clockwise direction using a Numonics Model 2400/2200 DigiTablet Graphics Analysis System having a resolution of .001 inches (.00254 cm) and an accuracy of .005 inches (.0127 cm). Coordinates were transmitted to a PRIME 9955 computer for area calculations and data manipulation via software developed at VIMS. The perimeter of each SAV bed was defined by a polygon with a linear data point density of 127 per chart inch (50 per cm, 5 meter ground resolution). The total number of points defining any SAV bed is dependent on overall bed size. The SAV bed perimeter was stored as X and Y coordinates in centimeters from the quadrangle origin (lower left corner).

Any "island" within a polygon (digitized SAV perimeter) was disregarded as long as a line was drawn from the outside of the polygon to the "island" and the resulting polygon was digitized in a clockwise direction. The line connecting the "island" polygon to the larger surrounding polygon was drawn in by the digitizer operator.

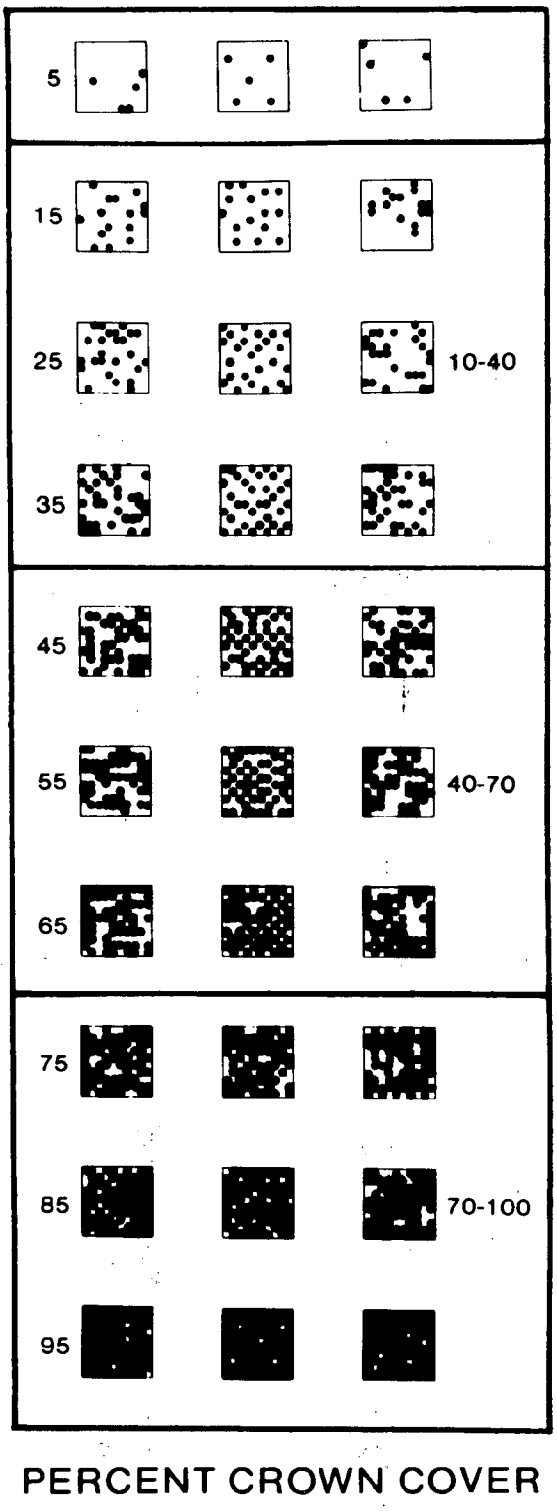

Figure 6. Crown density scale used for determining density of SAV beds: (1) Very sparse, 0-10%; (2) Sparse, 10-40%; (3) Moderate, 40-70%; (4) Dense, 70-100%.

SAV bed area in square centimeters on the chart was calculated via the following equation:

$$A = 1/2 \mid (X_1 * Y_2 - X_2 * Y_1) + (X_2 * Y_3 - X_3 * Y_2) + \ldots + (X_n * Y_1 - X_1 * Y_n) \mid$$

where X_n and Y_n are the nth digitized perimeter points in centimeters. The area is then converted from square centimeters on the chart to square meters on the ground. This is done via the following conversion based on a chart scale of 1:24,000:

$$A_g(m^2 \text{ on ground}) = A_c(cm^2 \text{ on chart}) * 57600 \ (m^2 \text{ on ground} / cm^2 \text{ on chart})$$

where A_g is the area on the ground of each SAV bed and A_c is the area on the chart. The area on the ground is then stored for later use.

Tests of Precision and Accuracy

Prior to each digitization session, the Numonics instrument was checked manually against a digitizing standard. After a map had been secured to the digitizing tablet, the standard was secured to the map and digitized four times. The information from digitizing the standard was transmitted to the beginning of the SAV bed perimeter file on the PRIME computer. This same procedure was followed at the end of each digitizing session. When this file was processed by the computer, the digitized area of each standard was compared to the known area of the standard. If a variation between the known and the mean of the observed areas exceeded 1.0%, a warning was printed advising the operator to check the digitizing system. In addition, checks were made with respect to the absolute location of the digitizing standard as secured to the map. A comparison was made between the location of the standard before and after the digitizing session. If the absolute location differed by more then 0.10 cm another warning to check the system was printed. Any movement in absolute location can be indicative of digitizer instrument drift or chart movement during the digitization session. These checks assure that the final calculated bed locations are as accurate as possible.

Maximum accuracy was maintained by exclusively using mylar topographic quadrangles rather than paper ones which can change scale as a function of changes in air temperature and humidity in the digitizer room.

Calculation of SAV Bed Mean Area and Choice of Representative SAV Bed

Every SAV bed mean area was the result of at least four independent digitizations of the outline of each SAV bed as part of a quality assurance / quality control program designed to isolate and remove anomolous data and produce accurate and representative SAV bed polygons. The computer calculated area for each replication, and the three bed outlines or

perimeters most similar in terms of area were then used for the calculation of a mean area. The areas used in the mean area calculation had to be, by contract, within 5% or less from that of the mean area. All beds whose areal difference were in excess of 5% of the mean bed area were flagged by the VIMS quality assurance quality control computer program for additional error assesment. The VIMS error rate was normally less than 1%. The replicate bed whose area was most similar to the mean area was identified as the "best bed". The best bed area and perimeter coordinate points were then saved by the computer program as the representative area and perimeter for each specific SAV bed.

A complete outline of the digitization procedure can be found in Orth et al., 1988.

Standard Operating Procedures for Quality Assurance/Quality Control

Standard operating procedures (SOPs) were developed to facilitate orderly and efficient processing of the 1990 SAV maps and the SAV bed perimeter computer files produced from them, and to comply with the need for consistency, quality assurance, and quality control. SOPs developed include: a detailed procedure outlining 46 steps for digitization of SAV maps; a 47 step checklist for editing SAV perimeter computer files to insure completeness and accuracy; a digitizer log in which all operations were recorded and dated, and which was used to guide and record editing operations; and a flow chart used to track progress of all operations including all changes in file names. Examples of these SOPs are in Orth et al., 1988.

Conversion of SAV Perimeter Points from X,Y Centimeters to Universal Transverse Mercator (UTM) Coordinates in ARC/INFO 5.0.1 Format

The EPA Chesapeake Bay Program Computer Center manages its geographic data base using Environmental Systems Research Institute (ESRI) ARC/INFO Geographic Information System (GIS) (ESRI, 1989). VIMS, with the assistance of the Virginia Council on the Environment EcoMAPS program, developed procedures to convert/transform the best bed perimeter points from X,Y centimeters to UTM based coordinates in ARC/INFO 5.0.1 format. This involved construction of data transfer files in an ARC/INFO standard format ("generate"). This was done on the VIMS PRIME for each topographic quadrangle with SAV beds present. Four files per quadrangle were produced:

1. Polygon file containing SAV bed coordinates in digitizer-based centimeters.
2. Attribute file containing SAV bed labels, density, species composition, and dates.

3. Tic file containing map corner locations in digitizer-based coordinates (cm).
4. Geo file containing corresponding latitude and longitude positions for map corners.

The generate files were then copied to floppy disk(s) for subsequent transfer and processing at EcoMAPS, using their SUN Microsystems Spark 2 workstation-based ARC/INFO 5.0.1 GIS.

A set of automated ARC/INFO routines were developed by the EcoMAPS staff to input quadrangle-based SAV generate data into ARC/INFO 5.0.1 format, and to assist in interactive editing of SAV polygons. ARC-based SAV polygons were displayed and edited at the Council on the Environment by VIMS staff. SAV polygons appearing on the computer display screen were compared to their counterparts on the mylar quad maps. Discrepancies and artifacts were edited using a suite of ARC/INFO editing "tools". ARC/INFO-based data sets were considered satisfactory for submission to EPA when the shape, location, and label of all SAV beds corresponded to those on the base mylar quad input map. ARC/INFO-based SAV data was transformed to UTM coordinates, Zone 18, and submitted to EPA for final review, analysis, and deposition to archives.

Organizational Provinces for Analysis and Discussion

Discussion of the distribution of SAV in the Chesapeake Bay and tributaries has been organized into three zones as established by Orth and Moore (1982) and modified by Orth et al., 1989 (Fig. 7). The area between the mouth of the bay to a line stretching from the mouth of the Potomac River at Smith Point in Virginia to approximately 3 nautical miles south of Tangier Island then extending to the eastern side of the bay to an area just south of the mouth of the Little Annemessex River is referred to as the Lower Bay zone.

The area between the south shore of the Little Annemessex River and the south shore of the Potomac River to the Chesapeake Bay bridge at Kent Island is referred to as the Middle Bay zone. The area between the Chesapeake Bay bridge and the Susquehanna Flats is referred to as the Upper Bay zone. The salinity within each zone roughly coincides with the major salinity zones of estuaries: polyhaline (18-25°/oo), Lower zone; mesohaline (5-18°/oo), Middle zone; oligohaline (0.5-5 °/oo), Upper zone. Although the major rivers and smaller tributaries of the bay have their own salinity regimes, the distribution of SAV in each river is discussed within the zone where it connects to the bay proper.

In addition, 21 major sections of the bay are identified for more detailed discussion of SAV distribution (Fig. 7, Table 3). These sections, which were first delineated for the 1984 survey (Orth et al., 1985) and had been slightly modified for the 1987 survey (Orth et al., 1989), denote relatively distinct parts of the bay and its tributaries that are readily identifiable from a map. The section boundaries used for analysis and discussion of the 1990 SAV distribution and abundance data are those used for the 1987

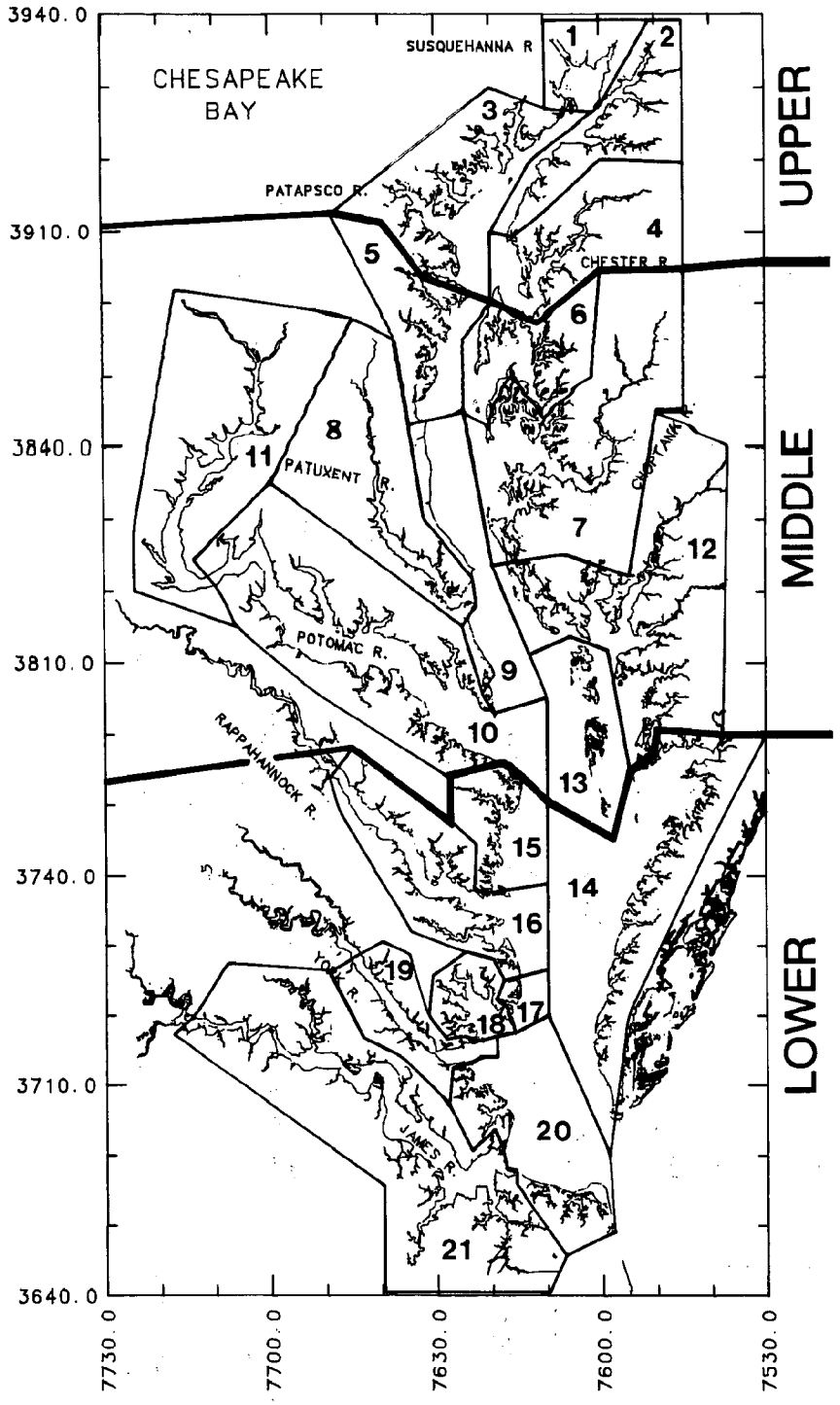

Figure 7. Location of Upper, Middle, and Lower zones of the Chesapeake Bay and the 21 major sections used for delineation of SAV distribution patterns. (Latitude and longitude are in decimal degrees along the vertical and horizontal axes, respectively. See Table 3 and Appendix B for exact boundary positions.)

Table 3

Area Descriptions For Each Of The 21 Major Sections Of The Chesapeake Bay SAV Study Area.

Section 1.	Susquehanna Flats - all areas between and including Spesutie Island and Turkey Point at the mouth of the Elk River to include the Northeast River.
Section 2.	Upper Eastern Shore - all areas in the Elk, Bohemia, and Sassafras Rivers, and SAV in areas on the eastern shore above the Swan Point quadrangle.
Section 3.	Upper Western Shore - all areas south of Spesutie Island and north of the bay bridge to include the Bush, Gunpowder, Middle, Patapsco, and Magothy Rivers.
Section 4.	Chester River - includes all of the Chester River, Eastern Neck, areas north of the bay bridge on Kent Island, and south of Swan Point, and to include SAV on the Swan Point quadrangle.
Section 5.	Central Western Shore - all areas south of the bay bridge and north of Holland Point on Herring Bay to include the Severn, South, and West Rivers and Herring Bay.
Section 6.	Eastern Bay - all areas south of the bay bridge on Kent Island and north of Tilghman Island from Green Marsh Point to include the Wye, East, and Miles Rivers, Crab Alley Bay, Prospect Bay, and Poplar, Jefferson, and Coaches Islands.
Section 7.	Choptank River - all areas south of Tilghman Island from Green Marsh Point and north of Taylor Island to include the Choptank and Little Choptank Rivers.
Section 8.	Patuxent River - all areas in the Patuxent River.
Section 9.	Middle Western Shore - all areas south of Holland Point at Herring Bay and north of Point Lookout on the Potomac River but not the mouth of the Patuxent River.
Section 10.	Lower Potomac River - all areas between the mouth of the Potomac River to a line extending from Maryland Point on the north shore, just above Nanjemoy Creek, to Somersett Beach on the south shore.
Section 11.	Upper Potomac River - all areas from upriver limit of the Lower Potomac River Section to Chain Bridge at Washington D.C.

Table 3 (continued)

Section 12.**Middle Eastern Shore - all areas south of Taylor Island and north of a line bisecting Cedar Island to include the Big and Little Annemessex Rivers, Fishing Bay, and the Honga, Nanticoke, Wicomico, and Manokin Rivers.

Section 13.**Mid-bay Island Complex - all areas in and adjacent to Bloodsworth, South Marsh, Smith, and Tangier Islands.

Section 14.**Lower Eastern Shore - all areas south of a line bisecting Cedar Island and located just above the Maryland-Virginia line to Fisherman's Island.

Section 15. Reedville Region - includes the area between Windmill Point on the Rappahannock River, and Smith Point at the mouth of the Potomac River.

Section 16. Rappahannock River Complex - includes the entire Rappahannock River, Piankatank River, and Milford Haven area.

Section 17. New Point Comfort Region - includes the area fronting the bay from the lighthouse at New Point Comfort north to, but not including, the bay entrance to Milford Haven.

Section 18.**Mobjack Bay Complex - includes the East, North, Ware, and Severn Rivers, the north shore of the Mobjack Bay from New Pt. Comfort lighthouse to the North River, and north of a line bisecting the large shoal area around the Guinea Marsh area.

Section 19.**York River - all areas along the north shore from Clay Bank to the Guinea Marsh area and south of a line bisecting the large shoal area around the Guinea Marsh area, and along the south shore to include the north shore of Goodwin Island.

Section 20.**Lower Western Shore - includes all areas south of Goodwin Island to Broad Bay off Lynnhaven Inlet, excluding the James River.

Section 21. James River - all SAV in the James River including the Chickahominy River.

**- Sections 12, 13, 14, 18, 19, and 20 were given new boundaries for the 1987 report (Orth et al., 1989) which also changed the delineation of the three major zones. These new boundaries were retained for the 1989 report (Orth and Nowak, 1990) and for this report. (Refer to Figure 7 and Appendix B for boundary locations.)

and 1989 report (Orth et al., 1989; Orth and Nowak, 1990). Sections 1 through 4 are located in the Upper Bay zone. Sections 5 through 13 are located in the Middle Bay zone, and sections 14 through 21 are located in the Lower Bay zone. Appendix B gives the latitude and longitude of the boundary points of each Chesapeake Bay section and Chincoteague Bay in decimal degrees. SAV distribution in Chincoteague Bay is presented and discussed separately from the Chesapeake Bay.

Ground Truth and Other Data Bases

Ground truthing was accomplished by cooperative efforts of a number of agencies and individuals. Although not all areas of the bay were groundtruthed this program does provide valuable supplemental information. This program confirmed the existence of some SAV beds mapped from 1990 aerial photography, located a few 1990 SAV beds not visible from the photography, and provided species data for many of these beds. Ground truth survey information supplied to VIMS researchers was included on the SAV distribution and abundance maps reproduced in Appendix C to show positions of the survey stations in relation to the 1990 beds of SAV mapped from the aerial photographs. Each survey was designated by a unique symbol to identify the different methods of sampling. In most cases, the symbols on the SAV maps (Appendix C) have been enlarged and offset from the actual sampling point to avoid confusion with the mapped SAV bed. Where species information was available, it was included on the map. Additionally, all ground truth data supplied to VIMS referenced on copies of 1989 SAV maps was tabulated in Appendix E and cross- referenced at VIMS by 1990 bed locations.

For those areas in Virginia waters where aerial photographic evidence of SAV beds was inconclusive, photo-verification was accomplished by ground truthing. Observations were principally made from small boats and by divers snorkeling over areas indicated from the photographs. In several river systems included in this survey (York, Piankatank and Rappahannock) where VIMS researchers transplanted SAV (principally eelgrass), transplant sites were also examined carefully by divers for any extant SAV. VIMS scientists also surveyed a number of sites in the bay as part of an intensive quantitative SAV study (VIMS, unpublished data). Citizen Field Observation data for Virginia waters (compiled by the USFWS) were also added to the 1990 Virginia SAV maps reproduced in Appendix C. In addition, a great deal of ground truth information could be extrapolated from earlier studies (Orth et al., 1979; Orth and Moore, 1982) since SAV beds in this region contain primarily one or two species and have not undergone drastic fluctuations in distribution and abundance since the first bay-wide survey in 1978.

In Maryland, ground truth data were obtained in 1990 by the Metropolitan Washington Council of Governments (COG) Potomac River survey, the Maryland-National Capital Parks and Planning Commission Patuxent River Park survey, three SAV research projects, a USFWS survey, and the Citizen's and Charterboat Captain's volunteer surveys (both data sets were compiled by the USFWS along with their own survey data). USFWS personnel surveyed selected locations in the upper bay, including the Potomac River, by boat using rakes to collect samples to determine presence or absence of SAV. All plant samples collected by USFWS were identified to species. Citizen groundtruthing identified plants to species when possible. SAV sightings were referenced on USGS 7.5 minute topographic maps. USFWS staff transferred data from these surveys to full-scale copies of 1989 SAV distribution maps (USGS 7.5

minute topographic quads with 1989 SAV beds). These USFWS-prepared survey maps were supplied to VIMS SAV researchers and survey data were transferred by VIMS staff to the 1990 SAV distribution maps reproduced in Appendix C. USFWS survey data was tabulated, locating each SAV siting by listing its associated 1989 bed. This table was supplied to VIMS where additional survey data were added and it became the basis for the much expanded table published in Appendix E. In this latter VIMS version of the USFWS table, all ground truth data were added from the additional surveys, as noted in this report, and all were cross-referenced by 1990 bed locations as well as by 1989 bed locations.

The field study in the Potomac River by the COG, which covered the shoreline areas from the District of Columbia (D.C.) to Aquia Creek used shoreline surveys to document the distribution of SAV in the tidal freshwater and transition zones of the Potomac River and tributaries (Maps 29, 34, 39, 40, 47, 48, and 55) in September. These surveys were done by boat, using rakes to collect samples to determine presence or absence of SAV. Plants were identified by species and the proportion of each was estimated for vegetated areas. Each vegetated area with species proportions was referenced on USGS 7.5 minute topographic maps by the surveyors. Survey maps were supplied to VIMS SAV researchers. The Patuxent River Park survey was carried out in July and August by park employees who provided survey maps (Maps 41, 49, and 159) with tables for each map listing species present and percent cover. These data and maps were supplied to VIMS. The USFWS, Citizen's, and Charterboat Captain's surveys also collected groundtruth data from these rivers. The Potomac and Patuxent River data were transferred by VIMS staff to the 1990 SAV distribution maps (reproduced in Appendix C) and were tabulated in Appendix E.

One 1990 SAV project being conducted on the Susquehanna Flats by Stan Kollar of Harford Community College provided data in the form of species presence by percentage, primarily by visual estimates. A SAV research group headed by William Dennison at the University of Maryland Horn Point Environmental Laboratories (HPEL) also provided 1990 ground truth data in collaboration with the VIMS research team. This was part of the intensive quantitative study mentioned earlier (VIMS, unpublished data). The Essex Community College SAV Research Group of Baltimore County, Maryland, contributed groundtruth data for quads 13 and 14. Maps of these study sites with species data were provided to VIMS researchers. Species locations from these data were added to the 1990 SAV maps reproduced in Appendix C and were tabulated in Appendix E by VIMS staff.

In addition to the scientific surveys, private citizens participated in identifying 1990 SAV beds by checking for presence of SAV at previous years SAV bed locations in certain areas in the bay, and by locating SAV bed locations new in 1990. Two groups were responsible for looking for SAV under the sponsorship of separate organizations. The Maryland Charterboat Association participated in the baywide effort, funded by the Maryland Department of Natural Resources (MD-DNR) Watermen's

Assistance Program. Boat captains were provided with reduced 1989 SAV quadrangle maps to aid in location of 1990 SAV beds and with data sheets on which to record information on each 1990 SAV bed identified. Sampling of SAV sites was undertaken at low tide. Samples were taken by hand, net or rake. Plants were identified as to species onsite or placed in zip-lock plastic bags and sent to the MD-DNR for identification.

Private citizens volunteered to assist in the 1990 SAV ground survey under guidance of the USFWS and the Chesapeake Bay Foundation (CBF). This program entailed identifying and recording the location of SAV in the bay in 1990. Volunteers, who were recruited through press releases, newsletters, and personal letters, were provided with a SAV identification guide, reduced 1989 SAV maps to aid in location of SAV beds, and data sheets for visits to numerous sites around the bay. Each volunteer was asked to identify the location where SAV was sighted, and to identify the species. All information from the Charterboat Captain's and the Citizen's surveys was submitted to Kathryn Reshetiloff (USFWS) for processing. SAV sitings reported by the Citizen's and Charterboat Captain's surveys were mapped on 1989 SAV maps. As previously explained, USFWS personnel also tabulated data from most of the 1990 Citizen's and Charterboat Captain's surveys along with their own survey's data, listing each SAV siting by 1989 bed location. VIMS staff mapped these data on maps reproduced in Appendix C, and data were tabulated in Appendix E.

RESULTS

Data Presentation

SAV distribution data are presented by topographic quadrangle (Table 4), by section and zone (Table 5), and by quadrangles within a section (Table 6). Topographic quadrangle maps annotated with all SAV beds are presented in Appendix C, while individual bed areas for each quadrangle are given in Appendix D. Appendix E tabulates all ground truth data for 1990. The 1990 SAV distribution data and species occurrences are first discussed relative to the Upper, Middle, and Lower Bay zones, respectively. The 21 sections of the Chesapeake Bay, and Chincoteague Bay, are then discussed individually and the data compared to results from the 1989 survey of SAV distribution and abundance (Orth and Nowak, 1990). SAV is plotted for each section and for Chincoteague Bay in Figures 8 through 29. SAV is plotted in red, a starred line represents a section boundary, latitude and longitude are in decimal degrees along the vertical and horizontal axes, respectively, and USGS 7.5 minute topographic quadrangles are represented by a grid of numbered rectangles (refer to Table 2 for quadrangle names listed by map number.)

1990 SUMMARY

In 1990, the Chesapeake Bay had 24,313 hectares of SAV, compared to 24,138 hectares in 1989, with 2,353 hectares (10%), 11,328 hectares (47%), and 10,632 hectares (44%) occurring in the Upper, Middle, and Lower Bay zones, respectively (Figs. 1, 2, and 3).

Upper Bay Zone

In 1990 seventy-five percent (1,774 hectares) of the SAV within the Upper Bay zone was located in the Susquehanna Flats (Section 1). Eight species of SAV were documented by ground truth surveys in this section, with *Myriophyllum spicatum* being dominant. A recently introduced exotic species, *Hydrilla verticillata*, was found in the Flats but occurred in small isolated beds. Overall abundance of SAV declined from 1989 (1,945 hectares) and 1987 (2,219 hectares) levels , but the density of beds increased slightly from 1989. Ninety-two percent of all SAV beds in the Flats were classified as very sparse (0-10% coverage), and 5% of beds were classified as dense (70-100% coverage). This is a slight improvement over 1989 coverage when 95% were very sparse and no beds were classified as dense. In the Upper Eastern Shore (Section 2) there were 421 hectares of SAV (113 hectares more than in 1989) located principally in the Elk and lower Sassafras rivers, and Swan, Stillpond, and Churn creeks, with many of the same species as reported in the Susquehanna Flats section. The Upper Western Shore (Section 3) had 90 hectares of SAV, primarily *M. spicatum* and *Vallisneria americana*, concentrated in Saltpeter and Dundee creeks. This is an increase of 52 hectares over 1989 and approaches the 1987 level of 117 hectares. In the Chester River (Section 4) SAV abundance (67 hectares) was down 100 hectares from 1989 and 448 hectares from 1987. SAV was most abundant

Table 4

Total Area Of SAV In Hectares By USGS 7.5 Minute Topographic Quadrangles For 1989 And 1990.

QUADRANGLE	1989	1990
1. Conowingo Dam, Md.-Pa.	0	-
2. Aberdeen, Md.	0.66	2.12
3. Havre de Grace, Md.	1835.50	1770.03
4. North East, Md.	105.51	146.69
5. Elkton, Md.-Del.	5.70	39.59
6. White Marsh, Md.	0	-
7. Edgewood, Md.	#	0
8. Perryman, Md.	0	0
9. Spesutie, Md.	187.85	50.95
10. Earleville, Md.	97.87	166.92
11. Cecilton, Md.	0	-
12. Baltimore East, Md.	0	-
13. Middle River, Md.	3.61	0.69
14. Gunpowder Neck, Md	34.55	89.75
15. Hanesville, Md.	12.66	6.33
16. Betterton, Md.	1.09	4.23
17. Galena, Md.	2.79	7.94
18. Curtis Bay, Md.	#	#
19. Sparrows Pt., Md.	#	#
20. Swan Point, Md.	5.24	6.47
21. Rock Hall, Md.	19.16	12.00
22. Chestertown, Md.	0	0
23. Round Bay, Md.	#	#
24. Gibson Island, Md.	#	#
25. Love Point, Md.	0	0
26. Langford Creek, Md.	138.92	47.79
27. Centreville, Md.	0	0
28. Washington West, Md.-DC-Va.	0	0
29. Washington East, DC-Md.	0	#
30. South River, Md.	#	#
31. Annapolis, Md.	0	#

Table 4 (Continued)

QUADRANGLE	1989	1990
32. Kent Island, Md.	327.06	132.99
33. Queenstown, Md.	128.33	55.66
34. Alexandria, Va.-DC-Md.	368.44	399.54
35. Deale, Md.	#	#
36. Claiborne, Md	381.68	139.05
37. St. Michaels, Md.	172.44	62.67
38. Easton, Md.	0	#
39. Fort Belvoir, Va.-Md.	63.48	105.06
40. Mt. Vernon, Md.-Va.	334.61	358.25
41. Lower Marlboro, Md.	0	#
42. North Beach, Md.	0	0
43. Tilghman, Md.	231.11	11.81
44. Oxford, Md.	95.94	19.27
45. Trappe, Md.	0	0
46. Preston, Md.	0	0
47. Quantico, Va.-Md.	533.16	694.01
48. Indian Head, Va.-Md.	184.01	303.67
49. Benedict, Md.	#	#
50. Prince Frederick, Md.	0	0
51. Hudson, Md.	331.36	96.78
52. Church Creek, Md.	18.99	6.46
53. Cambridge, Md.	0	0
54. East New Market, Md.	0	0
55. Widewater, Va.-Md.	466.64	614.54
56. Nanjemoy, Md.	149.61	126.73
57. Mathias Pt., Md.-Va.	346.69	285.36
58. Popes Creek, Md.	6.20	4.86
59. Mechanicsville, Md.	0	0
60. Broomes Island, Md.	#	0
61. Cove Pt., Md.	0.48	#
62. Taylors Island, Md.	16.17	58.41

Table 4 (Continued)

QUADRANGLE	1989	1990
63. Golden Hill, Md.	2.49	4.05
64. Passapatanzy, Md.-Va.	0	0
65. King George, Va.-Md.	52.24	53.05
66. Dahlgren, Va.-Md.	65.33	51.65
67. Colonial Beach N., Md.-Va.	28.46	45.89
68. Rock Point, Md.	0	#
69. Leonardtown, Md.	#	#
70. Hollywood, Md.	#	#
71. Solomons Island, Md.	2.96	#
72. Barren Island, Md.	301.43	299.81
73. Honga, Md.	773.43	1006.05
74. Wingate, Md.	369.33	400.16
75. Nanticoke, Md.	5.02	0
76. Colonial Beach S., Va.-Md.	0	0
77. Stratford Hall, Va.-Md.	0	0
78. St. Clements Is., Va.-Md.	0	0
79. Piney Point, Md.-Va.	#	#
80. St. Marys City, Md.	#	0
81. Point No Point, Md.	0	0
82. Richland Point, Md.	24.02	30.83
83. Bloodsworth Island, Md.	686.80	700.35
84. Deal Island, Md.	27.38	39.07
85. Monie, Md.	17.84	18.36
86. Champlain, Va.	-	-
87. Machodoc, Va.	0	0
88. Kinsale, Va.-Md.	0	0
89. St. George Island, Va.-Md.	2.84	0
90. Point Lookout, Md.	0	0
91. Kedges Straits, Md.	781.25	876.49
92. Terrapin Sand Point, Md.	218.21	256.81
93. Marion, Md.	199.80	192.22

Table 4 (Continued)

QUADRANGLE	1989	1990
94. Mount Landing, Va.	-	-
95. Tappahannock, Va.	-	-
96. Lottsburg, Va.	0	0
97. Heathsville, Va.-Md.	0	0
98. Burgess, Va.-Md.	0	0
99. Ewell, Va.-Md.	2423.98	2446.54
100. Great Fox Is., Va.-Md.	1381.77	1371.98
101. Crisfield, Va.-Md.	202.04	226.41
102. Saxis, Va.-Md.	2.08	0.78
103. Dunnsville, Va.	-	-
104. Morattico, Va.	0	0
105. Lively, Va.	0	0
106. Reedville, Va.	157.87	226.98
107. Tangier Island, Va.	699.37	751.90
108. Chesconessex, Va.	972.11	954.06
109. Parksley, Va.	320.18	339.88
110. Urbanna, Va.	200.66	15.89
111. Irvington, Va.	245.45	221.46
112. Fleets Bay, Va.	334.59	381.94
113. Nandua Creek, Va.	406.21	365.87
114. Pungoteague, Va.	795.10	824.70
115. West Point, Va.	-	0
116. Saluda, Va.	19.08	1.97
117. Wilton, Va.	43.07	48.67
118. Deltaville, Va.	81.06	90.48
119. Jamesville, Va.	496.40	509.86
120. Toano, Va.	-	-
121. Gressitt, Va.	-	-
122. Ware Neck, Va.	278.06	303.80
123. Mathews, Va.	110.18	196.38
124. Franktown, Va.	435.88	485.05

Table 4 (Continued)

QUADRANGLE	1989	1990
125. Westover, Va.	-	#
126. Charles City, Va.	-	-
127. Brandon, Va.	#	-
128. Norge, Va.	0**	**
129. Williamsburg, Va.	-	-
130. Clay Bank, Va.	#	1.48
131. Achilles, Va.	957.95	997.18
132. New Point Comfort, Va.	1273.85	1398.85
133. Cape Charles, Va.	271.66	318.97
134. Cheriton, Va.	73.21	70.69
135. Savedge, Va.	-	-
136. Claremont, Va.	-	-
137. Surry, Va.	-	-
138. Hog Island, Va.	-	-
139. Yorktown, Va.	1.58	1.68
140. Poquoson West, Va.	411.99	541.33
141. Poquoson East, Va.	994.84	1007.50
142. Elliotts Creek, Va.	15.90	28.20
143. Townsend, Va.	12.55	1.51
144. Bacons Castle, Va.	-	-
145. Mulberry Island, Va.	-	-
146. Newport News North, Va.	-	-
147. Hampton, Va.	304.06	342.00
148. Benns Church, Va.	-	-
149. Newport News South, Va.	0	0
150. Norfolk North, Va.	0	0
151. Little Creek, Va.	0	0
152. Cape Henry, Va.	36.47	28.33
153. Chuckatuck, Va.	-	-
154. Bowers Hill, Va.	-	-
155. Norfolk South, Va.	-	-

Table 4 (Continued)

QUADRANGLE	1989	1990
156. Kempsville, Va.	-	-
157. Princess Anne, Va.	0	0.73
158. Wye Mills, Md.	0	0
159. Bristol, Md.	#	#
160. Fowling Creek, Md.	0	0
161. Port Tobacco, Md.	12.09	11.90
162. Charlotte Hall, Md.	0	0
163. Mardela Springs, Md.	0	0
164. Wetipquin, Md.	0	0
165. Selbyville, Md	0	0
166. Assawoman Bay, Md.	0	0
167. Berlin, Md.	4.98	6.33
168. Ocean City, Md.	3.45	19.79
169. Public Landing, Md.	0	0
170. Tingles Island, Md.	820.82	993.64
171. Girdle Tree, Md.-Va.	0	0
172. Boxiron, Md.-Va.	653.88	636.13
173. Whittington Point, Md.-Va.	161.79	239.86
174. Chincoteague West, Va.	0	0
175. Chincoteague East, Va.	665.58	598.70
176. Anacostia, D.C.-Md.	0	0
TOTAL SAV - Chesapeake Bay	24,137.63	24,312.55
TOTAL SAV - Chincoteague Bay	2,310.49	2,494.45

NOTES:

- \- Indicates quadrangle not photographed and assumed to have no SAV.
- 0 Indicates quadrangle photographed and no SAV noted.
- ** Area was photographed in 1987 and 1989, and was known to have SAV both years but was not mapped because SAV beds were too narrow and obscured by the shoreline at 1:24,000 scale. Ground truthing in 1987 revealed narrow beds fringing the shoreline of small tributaries of the Chickahominy River. (Area was not photographed in 1990).
- # SAV beds not detected from aerial photography. Ground truth information indicated presence of SAV.

Table 5

Number of Hectares of SAV in 1989 and 1990 For The 21 Major Sections And Three Zones of the Chesapeake Bay And For Chincoteague Bay. (Section boundaries redefined for 1987 (Orth et al., 1989) and retained for 1989 (Orth and Nowak, 1990 and for 1990. See Figure 7, Table 3 and Appendix B for boundary locations.

ZONE	SECTION	AREA (HECTARES) 1989	1990
Upper	1. Susquehanna Flats	1,944.96	1,773.93
	2. Upper Eastern Shore	307.72	421.29
	3. Upper Western Shore	38.17	90.44
	4. Chester River	167.16	67.37
	Zone Total	2,458.01	2,353.03
Middle	5. Central Western Shore	0.00	0.00
	6. Eastern Bay	831.48	388.84
	7. Choptank River	864.70	192.74
	8. Patuxent River	3.44	0.00
	9. Middle Western Shore	0.00	0.00
	10. Lower Potomac River	615.62	532.16
	11. Upper Potomac River	1,998.16	2,522.34
	12. Middle Eastern Shore	1,997.99	2,286.72
	13. Mid-Bay Island Complex	5,199.04	5,405.12
	Zone Total	11,510.43	11,327.92
Lower	14. Lower Eastern Shore	4,718.41	4,828.67
	15. Reedville	492.34	608.93
	16. Rappahannock River Complex	669.22	544.37
	17. New Point Comfort Region	345.78	356.98
	18. Mobjack Bay Complex	1,592.59	1,703.40
	19. York River	676.89	789.95
	20. Lower Western Shore	1,670.08	1,796.57
	21. James River	3.86	2.73
	Zone Total	10,169.17	10,631.60
Total SAV for Chesapeake Bay		24,137.61	24,312.55
Total SAV for Chincoteague Bay		2,310.49	2,494.45

Table 6

Number of Square Meters Of SAV in 1990 For Each Quadrangle of The 21 Sections in the Chesapeake Bay and of Chincoteage Bay. (Map code numbers from Table 2 in parentheses.)

SECTION	QUADRANGLE	AREA
Susquehanna Flats - 1	Conowingo Dam (1)	0
	Aberdeen (2)	21,241
	Havre de Grace (3)	17,700,292
	North East (4)	0
	Elkton (5)	0
	Perryman (8)	0
	Spesutie (9)	17,727
	Earleville (10)	0
		17,739,260 sq. m
		1,773.93 hectares
		4,383.37 acres
Upper Eastern Shore - 2	North East (4)	1,466,894
	Elkton (5)	395,899
	Perryman (8)	0
	Spesutie (9)	491,747
	Earleville (10)	1,669,177
	Cecilton (11)	0
	Gunpowder Neck (14)	0
	Hanesville (15)	63,326
	Betterton (16)	42,303
	Galena (17)	79,353
	Swan Point (20)	0
	Rock Hall (21)	4,197
	Chestertown (22)	0
		4,212,896 sq. m
		421.29 hectares
		1,041.01 acres
Upper Western Shore - 3	White Marsh (6)	0
	Edgewood (7)	0
	Perryman (8)	0
	Spesutie (9)	0
	Baltimore East (12)	0
	Middle River (13)	6,933
	Gunpowder Neck (14)	897,489

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Upper Western Shore - 3 (continued)		
	Hanesville (15)	0
	Curtis Bay (18)	0
	Sparrows Point (19)	0
	Swan Point (20)	0
	Round Bay (23)	0
	Gibson Island (24)	0
	Love Point (25)	0
		904,422 sq. m
		90.44 hectares
		223.48 acres
Chester River - 4	Betterton (16)	0
	Galena (17)	0
	Swan Point (20)	64,658
	Rock Hall (21)	115,806
	Chestertown (22)	0
	Love Point (25)	0
	Langford Creek (26)	477,893
	Centreville (27)	0
	Kent Island (32)	0
	Queenstown (33)	15,321
		673,678 sq. m
		67.37 hectares
		166.47 acres
Central Western Shore - 5	Curtis Bay (18)	0
	Round Bay (23)	0
	Gibson Island (24)	0
	Love Point (25)	0
	South River (30)	0
	Annapolis (31)	0
	Kent Island (32)	0
	Deale (35)	0
	North Beach (42)	0
		0.00 sq. m
		0.00 hectares
		0.00 acres

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Eastern Bay - 6	Centreville (27)	0
	Annapolis (31)	0
	Kent Island (32)	1,329,908
	Queenstown (33)	541,305
	Claiborne (36)	1,390,455
	St. Michaels (37)	626,741
	Easton (38)	0
	Tilghman (43)	0
	Oxford (44)	0
	Wye Mills (158)	0
		3,888,409 sq. m
		388.84 hectares
		960.83 acres
Choptank River - 7	Centreville (27)	0
	Claiborne (36)	0
	St. Michaels (37)	0
	Easton (38)	0
	Tilghman (43)	118,127
	Oxford (44)	192,706
	Trappe (45)	0
	Preston (46)	0
	Hudson (51)	967,841
	Church Creek (52)	64,556
	Cambridge (53)	0
	East New Market (54)	0
	Taylors Island (62)	584,126
	Golden Hill (63)	0
	Nanticoke (75)	0
	Wye Mills (158)	0
	Fowling Creek (160)	0
		1,927,356 sq. m
		192.74 hectares
		476.25 acres
Patuxent River - 8	Deale (35)	0
	Lower Marlboro (41)	0
	North Beach (42)	0

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Eastern Bay - 6	Centreville (27)	0
	Annapolis (31)	0
	Kent Island (32)	1,329,908
	Queenstown (33)	541,305
	Claiborne (36)	1,390,455
	St. Michaels (37)	626,741
	Easton (38)	0
	Tilghman (43)	0
	Oxford (44)	0
	Wye Mills (158)	0
		3,888,409 sq. m
		388.84 hectares
		960.83 acres
Choptank River - 7	Centreville (27)	0
	Claiborne (36)	0
	St. Michaels (37)	0
	Easton (38)	0
	Tilghman (43)	118,127
	Oxford (44)	192,706
	Trappe (45)	0
	Preston (46)	0
	Hudson (51)	967,841
	Church Creek (52)	64,556
	Cambridge (53)	0
	East New Market (54)	0
	Taylors Island (62)	584,126
	Golden Hill (63)	0
	Nanticoke (75)	0
	Wye Mills (158)	0
	Fowling Creek (160)	0
		1,927,356 sq. m
		192.74 hectares
		476.25 acres
Patuxent River - 8	Deale (35)	0
	Lower Marlboro (41)	0
	North Beach (42)	0

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Patuxent River - 8 (continued)		
	Benedict (49)	0
	Prince Frederick (50)	0
	Mechanicsville (59)	0
	Broomes Island (60)	0
	Cove Point (61)	0
	Leonardtown (69)	0
	Hollywood (70)	0
	Solomons Island (71)	0
	Bristol (159)	0
	Charlotte Hall (162)	0
		0.00 sq. m
		0.00 hectares
		0.00 acres
Middle Western Shore - 9	North Beach (42)	0
	Prince Frederick (50)	0
	Hudson (51)	0
	Broomes Island (60)	0
	Cove Point (61)	0
	Taylors Island (62)	0
	Solomons Island (71)	0
	Barren Island (72)	0
	St. Mary's City (80)	0
	Point No Point (81)	0
	Richland Point (82)	0
	Point Lookout (90)	0
		0.00 sq. m
		0.00 hectares
		0.00 acres
Lower Potomac River - 10	Nanjemoy (56)	1,267,306
	Mathias Point (57)	2,853,555
	Popes Creek (58)	48,644
	Mechanicsville (59)	0
	King George (65)	176,643

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Lower Potomac River - 10 (continued)		
	Dahlgren (66)	516,549
	Colonial Beach North (67)	458,857
	Rock Point (68)	0
	Leonardtown (69)	0
	Hollywood (70)	0
	Solomons Island (71)	0
	Colonial Beach South (76)	0
	Stratford Hall (77)	0
	St. Clements Island (78)	0
	Piney Point (79)	0
	St. Mary's City (80)	0
	Champlain (86)	0
	Machodoc (87)	0
	Kinsale (88)	0
	St. George Island (89)	0
	Point Lookout (90)	0
	Lottsburg (96)	0
	Heathsville (97)	0
	Burgess (98)	0
	Port Tobacco (161)	0
	Charlotte Hall (162)	0
		5,321,554 sq. m
		532.16 hectares
		1,314.96 acres
Upper Potomac River - 11	Washington West (28)	0
	Washington East (29)	0
	Alexandria (34)	3,995,384
	Fort Belvoir (39)	1,050,578
	Mt. Vernon (40)	3,582,541
	Quantico (47)	6,940,103
	Indian Head (48)	3,036,701
	Widewater (55)	6,145,398
	Nanjemoy (56)	0
	Mathias Point (57)	0
	Passapatanzy (64)	0

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Upper Potomac River - 11 (continued)		
	King George (65)	353,695
	Dahlgren (66)	0
	Port Tobacco (161)	118,994
		25,223,394 sq. m
		2,522.34 hectares
		6,232.70 acres
Middle Eastern Shore - 12	Taylors Island (62)	0
	Golden Hill (63)	40,528
	Barren Island (72)	2,998,076
	Honga (73)	10,060,454
	Wingate (74)	4,001,599
	Nanticoke (75)	0
	Point No Point (81)	0
	Richland Point (82)	308,287
	Bloodsworth Island (83)	964,794
	Deal Island (84)	390,746
	Monie (85)	183,570
	Terrapin Sand Point (92)	205,568
	Marion (93)	1,922,186
	Great Fox Island (100)	1,169,760
	Crisfield (101)	621,594
	Mardela Springs (163)	0
	Wetipquin (164)	0
		22,867,162 sq. m
		2,286.72 hectares
		5,650.48 acres
Mid-Bay Island Complex - 13	Richland Point (82)	0
	Bloodsworth Island (83)	6,038,677
	Deal Island (84)	0
	Kedges Straits (91)	8,764,894
	Terrapin Sand Point (92)	2,362,497
	Ewell (99)	24,465,408
	Great Fox Island (100)	5,381,238

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Mid-Bay Island Complex - 13 (continued)		
	Tangier Island (107)	7,038,465
		54,051,179 sq. m
		5,405.12 hectares
		13,356.05 acres
Lower Eastern Shore - 14		
	Marion (93)	0
	Great Fox Island (100)	7,168,122
	Crisfield (101)	1,642,408
	Saxis (102)	7,772
	Tangier Island (107)	480,540
	Chesconessex (108)	9,540,552
	Parksley (109)	3,398,758
	Nandua Creek (113)	3,658,735
	Pungoteague (114)	8,247,049
	Jamesville (119)	5,098,593
	Franktown (124)	4,850,463
	Cape Charles (133)	3,189,686
	Cheriton (134)	706,939
	Elliotts Creek (142)	281,996
	Townsend (143)	15,115
		48,286,728 sq. m
		4,828.67 hectares
		11,931.65 acres
Reedville - 15		
	Heathsville (97)	0
	Burgess (98)	0
	Reedville (106)	2,269,830
	Irvington (111)	0
	Fleets Bay (112)	3,819,443
		6,089,273 sq. m
		608.93 hectares
		1,504.66 acres

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
Rappahannock River Complex - 16	Tappahannock (95)	0
	Lottsburg (96)	0
	Dunnsville (103)	0
	Morattico (104)	0
	Lively (105)	0
	Urbanna (110)	158,934
	Irvington (111)	2,214,585
	Fleets Bay (112)	0
	Saluda (116)	19,731
	Wilton (117)	486,692
	Deltaville (118)	904,796
	Ware Neck (122)	0
	Mathews (123)	1,658,974
		5,443,712 sq. m
		544.37 hectares
		1,345.14 acres
New Point Comfort Region - 17	Mathews (123)	0
	New Point Comfort (132)	3,569,822
		3,569,822 sq. m
		356.98 hectares
		882.10 acres
Mobjack Bay Complex - 18	Ware Neck (122)	3,038,030
	Mathews (123)	304,789
	Clay Bank (130)	0
	Achilles (131)	6,889,709
	New Point Comfort (132)	6,801,460
		17,033,988 sq. m
		1,703.40 hectares
		4,209.10 acres
York River - 19		
	Toano (120)	0
	Gressitt (121)	0
	Norge (128)	0
	Williamsburg (129)	0
	Clay Bank (130)	14,832
	Achilles (131)	3,081,945

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
York River - 19 (continued)		
	New Point Comfort (132)	3,581,465
	Hog Island (138)	0
	Yorktown (139)	16,805
	Poquoson West (140)	1,204,477
	Poquoson East (141)	0
		7,899,524 sq. m
		789.95 hectares
		1,951.97 acres
Lower Western Shore - 20	New Point Comfort (132)	0
	Poquoson West (140)	4,207,382
	Poquoson East (141)	10,075,026
	Elliotts Creek (142)	0
	Newport News North (146)	0
	Hampton (147)	3,392,666
	Norfolk North (150)	0
	Little Creek (151)	0
	Cape Henry (152)	283,343
	Kempsville (156)	0
	Princess Anne (157)	7,257
		17,965,674 sq. m
		1,796.57 hectares
		4,439.32 acres
James River - 21	Toano (120)	0
	Westover (125)	0
	Charles City (126)	0
	Brandon (127)	0
	Norge (128)	0
	Williamsburg (129)	0
	Savedge (135)	0
	Claremont (136)	0
	Surry (137)	0
	Hog Island (138)	0
	Yorktown (139)	0
	Poquoson West (140)	0
	Bacons Castle (144)	0
	Mulberry Island (145)	0

Table 6 (Continued)

SECTION	QUADRANGLE	AREA
James River - 21 (continued)		
	Newport News North (146)	0
	Hampton (147)	27,328
	Benns Church (148)	0
	Newport News South (149)	0
	Norfolk North (150)	0
	Little Creek (151)	0
	Chuckatuck (153)	0
	Bowers Hill (154)	0
	Norfolk South (155)	0
	Kempsville (156)	0
	Princess Anne (157)	0
		27,328 sq. m
		2.73 hectares
		6.75 acres
Chincoteague Bay	Selbyville (165)	0
	Assawoman Bay (166)	0
	Berlin (167)	63,349
	Ocean City (168)	197,897
	Public Landing (169)	0
	Tingles Island (170)	9,936,407
	Girdle Tree (171)	0
	Boxiron (172)	6,361,266
	Whittington Point (173)	2,398,610
	Chincoteague West (174)	0
	Chincoteague East (175)	5,987,004
		24,944,533 sq. m
		2,494.45 hectares
		6,163.79 acres

adjacent to Eastern Neck, Eastern Neck Island, and in the lower Chester River. In this region *Ruppia maritima* was the most abundant of seven species reported.

Middle Bay Zone

In 1990 forty-eight percent (5,405 hectares) of the SAV in the Middle Bay zone was found in the Mid-Bay Island Complex (Section 13) which includes the broad shoal area between Smith and Tangier Islands. This is an increase of 206 hectares over 1989. The two dominant species were *R. maritima* and *Zostera marina*. Twenty percent (2,287 hectares) of the SAV in this zone was present in the Middle Eastern Shore (Section 12), primarily in the Barren Island-Honga River area, the Big and Little Annemessex rivers, and the lower section of the Manokin River, with *R. maritima* being the dominant species reported. Little or no SAV was mapped or reported from the Central Western Shore (Section 5), Middle Western Shore (Section 9), and Patuxent River (Section 8).

The Middle Bay zone also includes the entire Potomac River, where 3,054 hectares of SAV were present in 1990. SAV was concentrated in two distinct regions: 1. the Upper Potomac River (Section 11) with 2,522 hectares, where *Hydrilla verticillata* remained the numerically dominant species (eight other species were reported by the COG, VIMS, USFWS, and Citizen's surveys); and 2. the upper portion of the Lower Potomac River (Section 10) with 532 hectares, including Nanjemoy Creek and Port Tobacco River, with *V. americana* and *M. spicatum* being the most frequently reported species. Although the total abundance of SAV in the Upper Potomac section increased from 1989 by 524 hectares, it decreased in the Lower Potomac section by 83 hectares. SAV in the Eastern Bay (Section 6) decreased 443 hectares from 1989 to a total of 389 hectares in 1990, while in the Choptank River (Section 7) it declined 672 hectares from 1989 to a total of 193 hectares in 1990.

Lower Bay Zone

Distribution and abundance in 1990 in the Lower Bay zone were similar to 1989. Forty-five percent (4,829 hectares) of SAV in this zone was found in the Lower Eastern Shore (Section 14) around the Fox Islands and the mouths of major creeks (i.e. Cherrystone Inlet and Hungars, Mattawoman, Occahannock, Craddock, Pungoteague, and Onancock creeks). Along the western shore of the Chesapeake Bay, SAV was abundant in Mobjack Bay (Section 18) (16% of SAV in the Lower Bay zone), in the lower York River (Section 19) (7% of SAV in the Lower Bay zone), and in the Lower Western Shore (Section 20), specifically Back River and Drum Island Flats area adjacent to Plum Tree Island (17% of SAV in the Lower Bay zone). There were 609 hectares of SAV mapped in the Reedville Region (Section 15) in 1990, a 24% increase over 1989. There were 357 hectares of SAV identified in 1990 in the New Point Comfort Region (Section 17) compared to 346 hectares in 1989. Both *R. maritima* and *Z. marina* were abundant throughout this zone. SAV abundance was down slightly from 1989 in both the Piankatank and Rappahannock rivers (Section 16). *Ruppia maritima* was the dominant species in those rivers, with *Zostera marina* also present as a result of previously successful transplant efforts. The James River (Section 21) had less than 3 hectares of SAV in 1990, which is one hectare less than in 1989.

Chincoteague Bay

SAV in Chincoteague Bay increased slightly in distribution from 1989, with 2,494 hectares mapped in 1990. All of the SAV consisted of *R. maritima* and *Z. marina*, and was located along the eastern side of the bay behind Assateague Island.

DISCUSSION OF SECTIONS ARRANGED WITHIN ZONES

Upper Bay Zone

1. SUSQUEHANNA FLATS

There were 1,774 hectares of SAV in the Susquehanna Flats section in 1990 (Tables 4-6; Fig. 8; Appendix C, Maps 2, 3, and 9) compared to 1,945 hectares mapped in 1989. The majority (92%) of the total SAV area is categorized as very sparse and one large bed in the Havre de Grace quadrangle comprises most of this area (1,496 hectares). Beds in the Susquehanna River are denser than what was reported in 1989. SAV beds were located principally in two main areas: 1. sparse to dense fringing beds in the Susquehanna River consisting primarily of *M. spicatum*, with *P. pectinatus*, *C. demersum*, *V. americana*, *Heteranthera dubia*, *H. verticillata*, and *Najas* spp. in lesser amounts from Spencer Island to the river mouth at Havre de Grace on the west side, and to Stump Point at the mouth of Mill Creek on the north side; and 2. a large area of very sparse SAV located in the broad shoal area at the river mouth. This broad shoal consisted primarily of small patches of *M. spicatum*.

A total of eight species (*M. spicatum*, *H. dubia*, *V. americana*, *H. verticillata*, *C. demersum*, *P. pectinatus*, *P. perfoliatus*, and *Najas* spp.) have been reported either by Stan Kollar of Harford Community College, the University of Maryland's HPEL, or the Citizen's and the Charterboat Captain's surveys. SAV beds consisted of up to six species, with *M. spicatum* being dominant in most beds while *V. americana* was dominant in three beds. *Heteranthera dubia*, *H. verticillata*, *C. demersum*, and *Najas* spp. also occurred in significant amounts. SAV remains virtually absent from the Northeast River, Swan Creek, Spesutie Island, and the western side of Elk Neck.

2. UPPER EASTERN SHORE

There were 421 hectares of SAV mapped for the Upper Eastern Shore section in 1990 (Tables 4-6; Fig. 9; Appendix C, Maps 4, 5, 9, 10, 15, 16, 17, and 21) compared to 308 hectares mapped for 1989, consisting of very sparse and sparse beds (10% and 90% respectively, of the total coverage within section 2). Principal locations of beds were in the Elk River, mouth of Bohemia River, Swan Creek, lower Sassafras River, Still Pond and the mouth of Churn Creek. Very little SAV was mapped in the Bohemia River and along the mainstem of the bay from Still Pond to Swan Point. This section has contained relatively little SAV since the first baywide SAV survey in 1978, although historically this section has contained abundant SAV (Stevenson and Confer, 1978).

Myriophyllum spicatum and *V. americana* were the two most commonly reported species, with seven other species (*H. verticillata*, *Najas* spp., *P. pectinatus*, *H. dubia*,

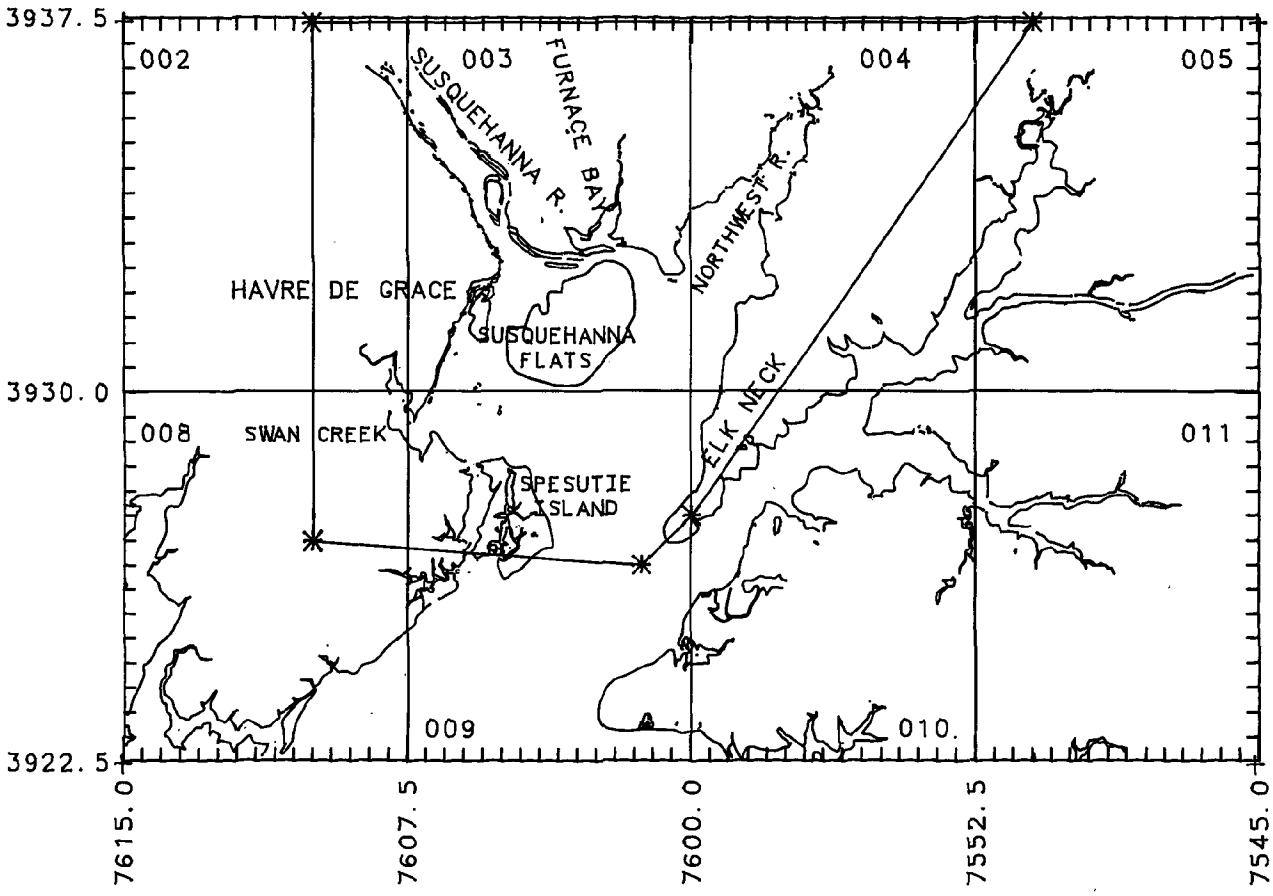

Figure 8. Distribution of SAV in the Susquehanna Flats (Section 1).

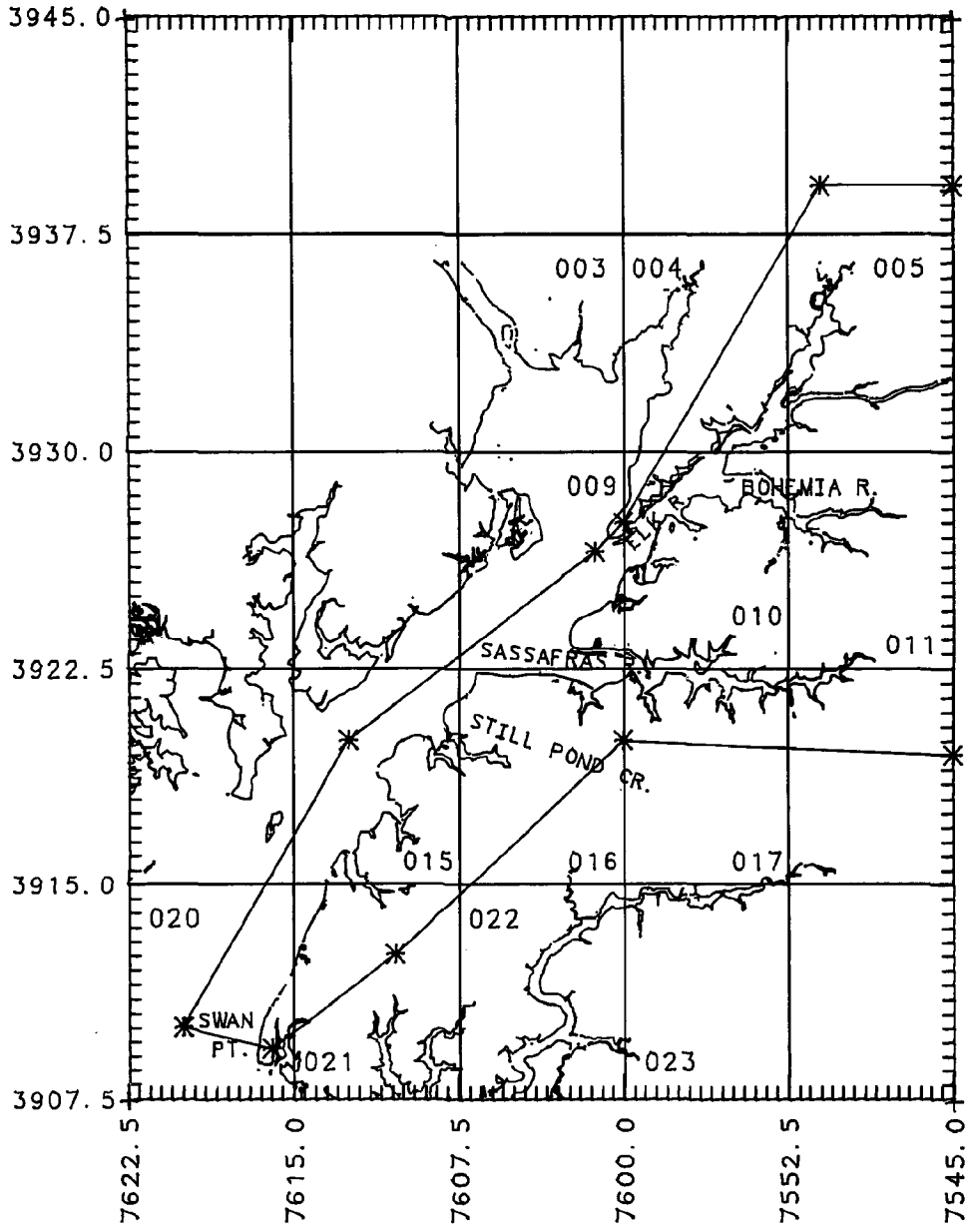

Figure 9. Distribution of SAV in the Upper Eastern Shore (Section 2).

and *Potamogeton crispus*) reported in lesser amounts as determined by Stan Kollar of Harford Community College and the Citizen's and Charterboat Captain's surveys.

3. UPPER WESTERN SHORE

There were 90 hectares of SAV mapped from the aerial photographs in 1990 for the Upper Western Shore section (Tables 4-6; Fig. 10; Appendix C, Maps 13 and 14) compared to 38 hectares in 1989. SAV beds were concentrated in Saltpeter and Dundee creeks. Very little or no SAV was reported in the Back, Patapsco, Bush, Gunpowder, Middle, and Magothy rivers.

Myriophyllum spicatum, E. canadensis, Z. palustris, P. pectinatus, P. crispus, Chara spp., *R. maritima, N. quadalupensis,* and *V. americana* were reported by the Citizen's and Charterboat Captain's surveys (Maps 13, 14, 18, 19, and 24).

4. CHESTER RIVER

There were 67 hectares of SAV in the Chester River section in 1990 (Tables 4-6; Fig. 11; Appendix C, Maps 20, 21, 26, and 33) compared to 167 hectares in 1989. SAV was located adjacent to Eastern Neck and Eastern Neck Island, especially near Eastern Neck Narrows, and in Robins Cove in the Chester River. Additional beds are found in Rock Hall Harbor, The Haven, Swan, and Huntingfield creeks, located above Eastern Neck on the Chesapeake Bay.

Five species of SAV were reported from this section in 1990 by the Citizen's, Charterboat Captain's, Univ. of Maryland's HPEL, and USFWS surveys. *Ruppia maritima* and *P. perfoliatus* were by far the most commonly reported species in this section with *P. pectinatus, M. spicatum, E. canadensis,* and *Z. palustris* being reported less frequently.

The large, dense beds of *R. maritima* present in previous surveys in the Chester River are no longer present, or are in very reduced abundance.

Middle Bay Zone

5. CENTRAL WESTERN SHORE

There was no SAV observed from the aerial photography in the Central Western Shore section in 1990 (Tables 4-6; Fig. 12) which was similar to 1989. Although not evident in the aerial photography, the USFWS and the Citizen's survey reported SAV from a few sites in this section, primarily the Severn River, Blackwalnut Creek, Lake Ogleton, South Creek of the West River, Duvall, Beards, and Almshouse Creeks and Selby Bay of the South River, and Burley Creek (Maps 23, 24, 30, 31, and 35). Species reported from this section include *Z. palustris* and *R. maritima.*

6. EASTERN BAY

There were 389 hectares of SAV identified from the Eastern Bay section in 1990 (Tables 4-6; Fig. 13; Appendix C, Maps 32, 33, 36, and 37) compared to 831 hectares reported in 1989. SAV occurred as very sparse to sparse beds throughout this section

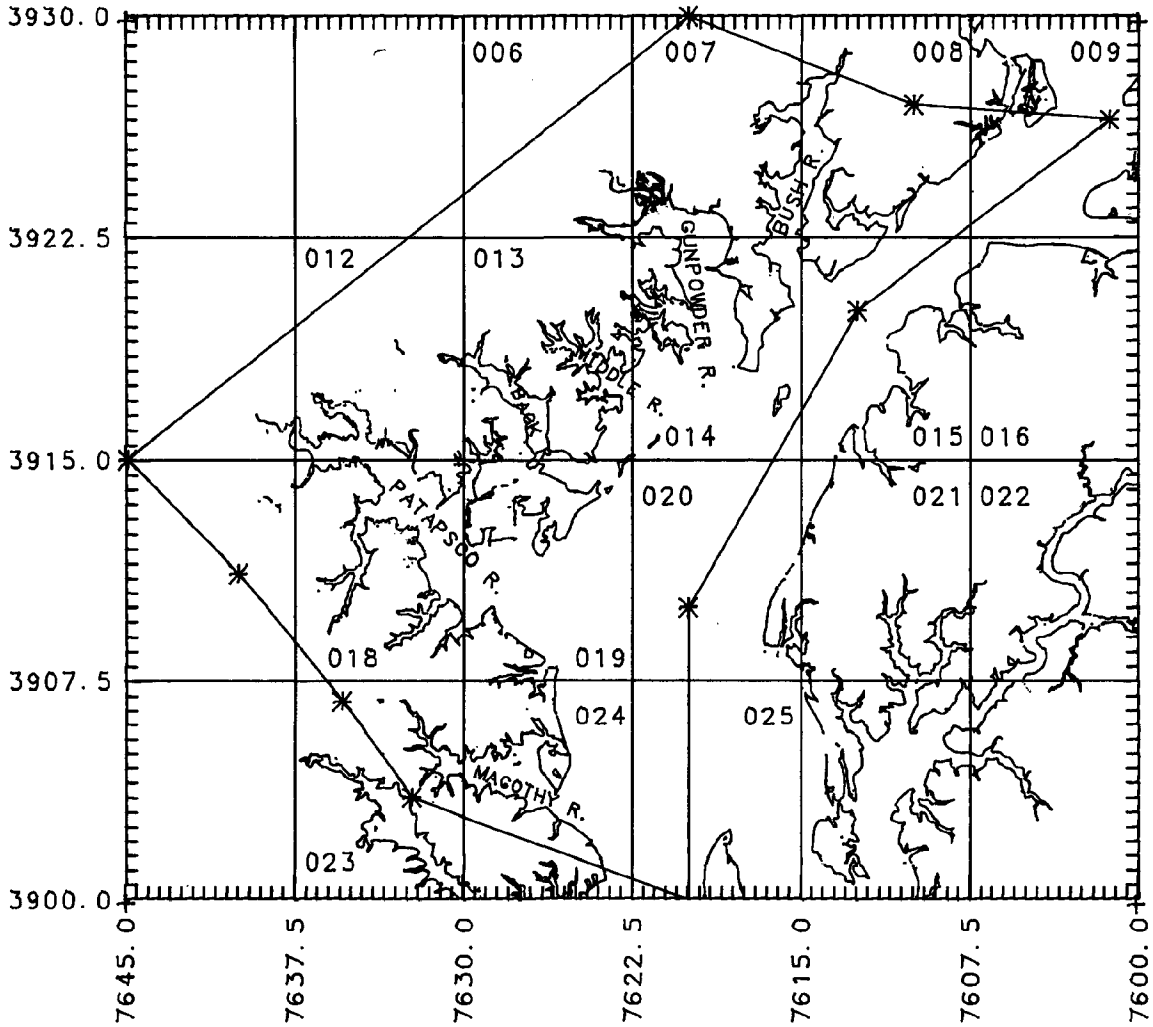

Figure 10. Distribution of SAV in the Upper Western Shore (Section 3).

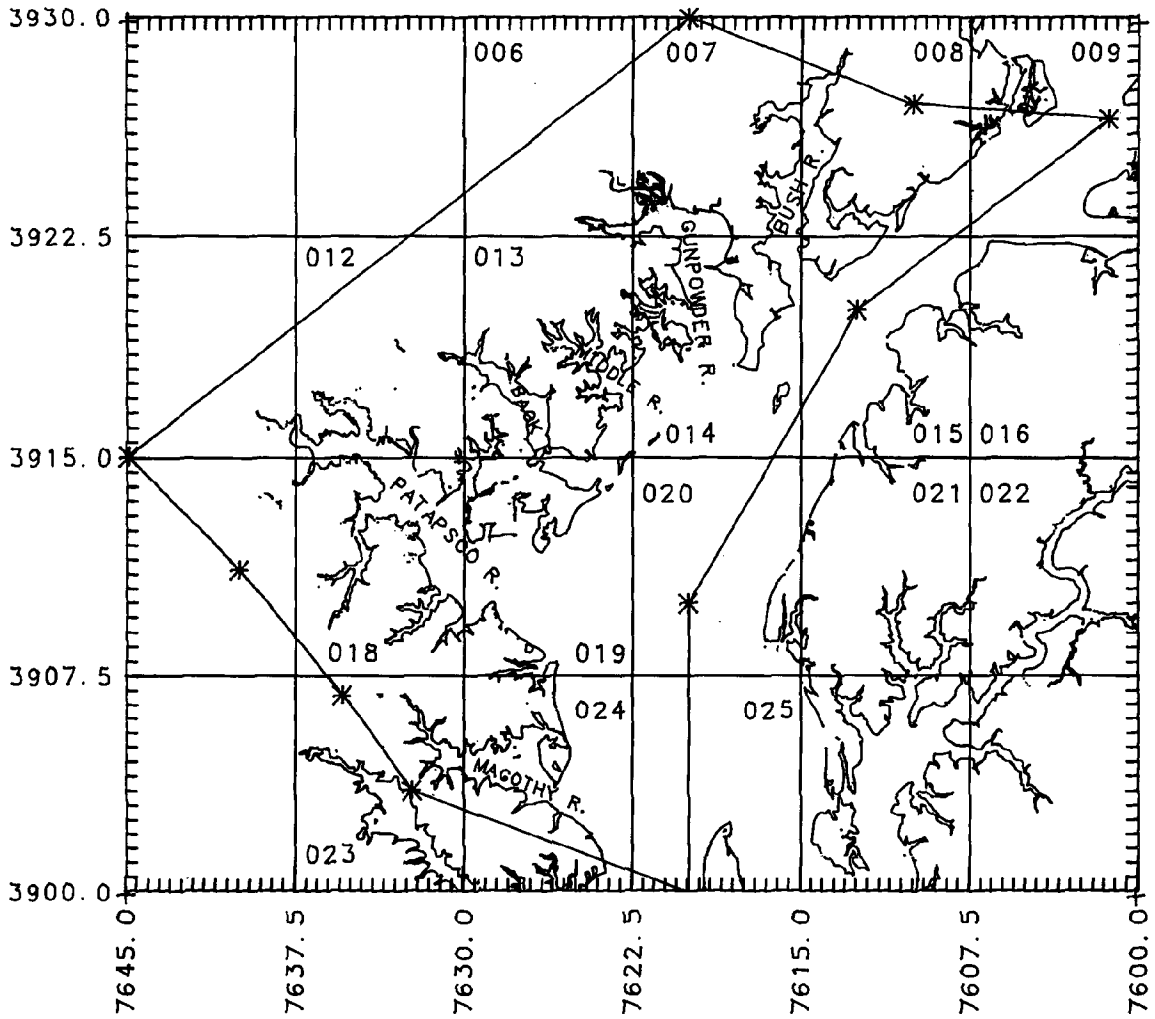

Figure 10. Distribution of SAV in the Upper Western Shore (Section 3).

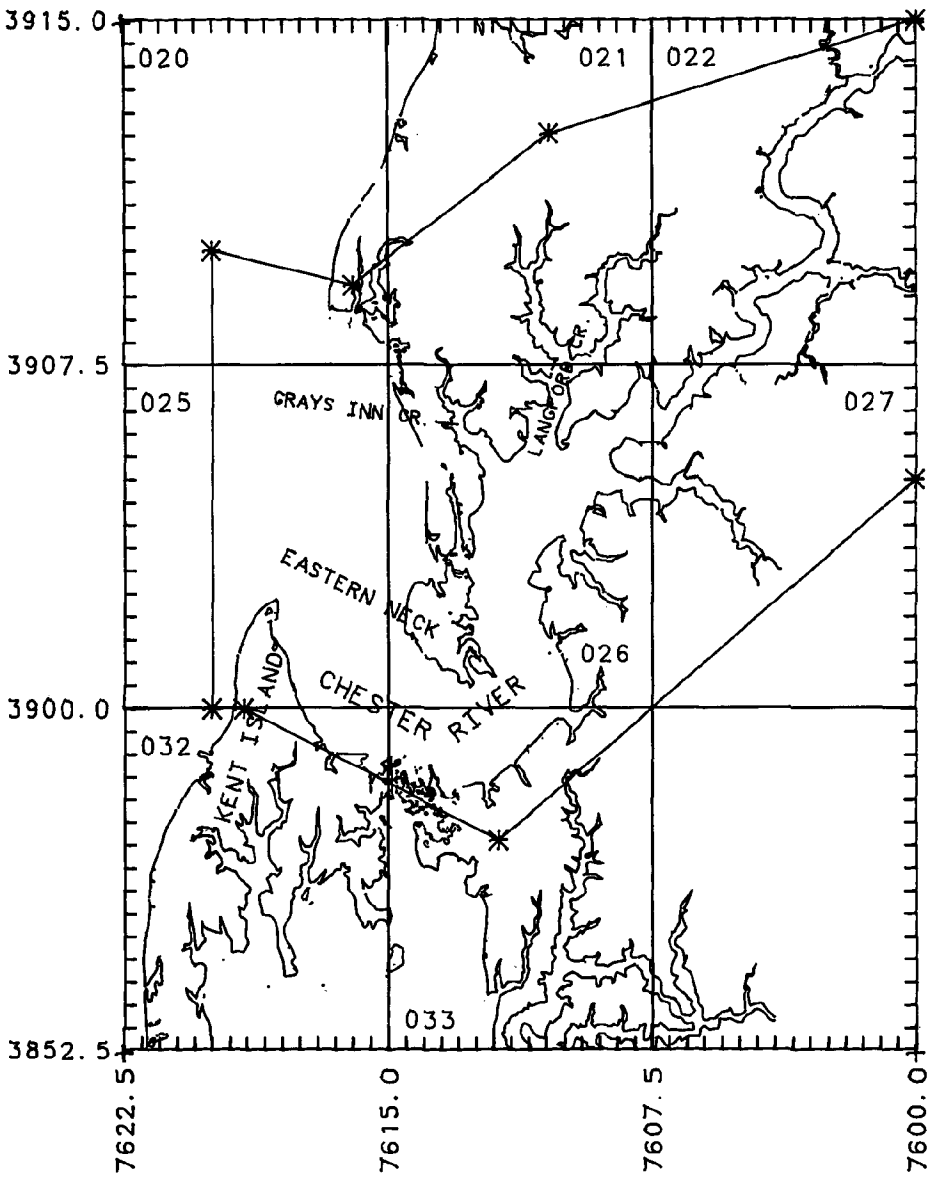

Figure 11. Distribution of SAV in the Chester River (Section 4).

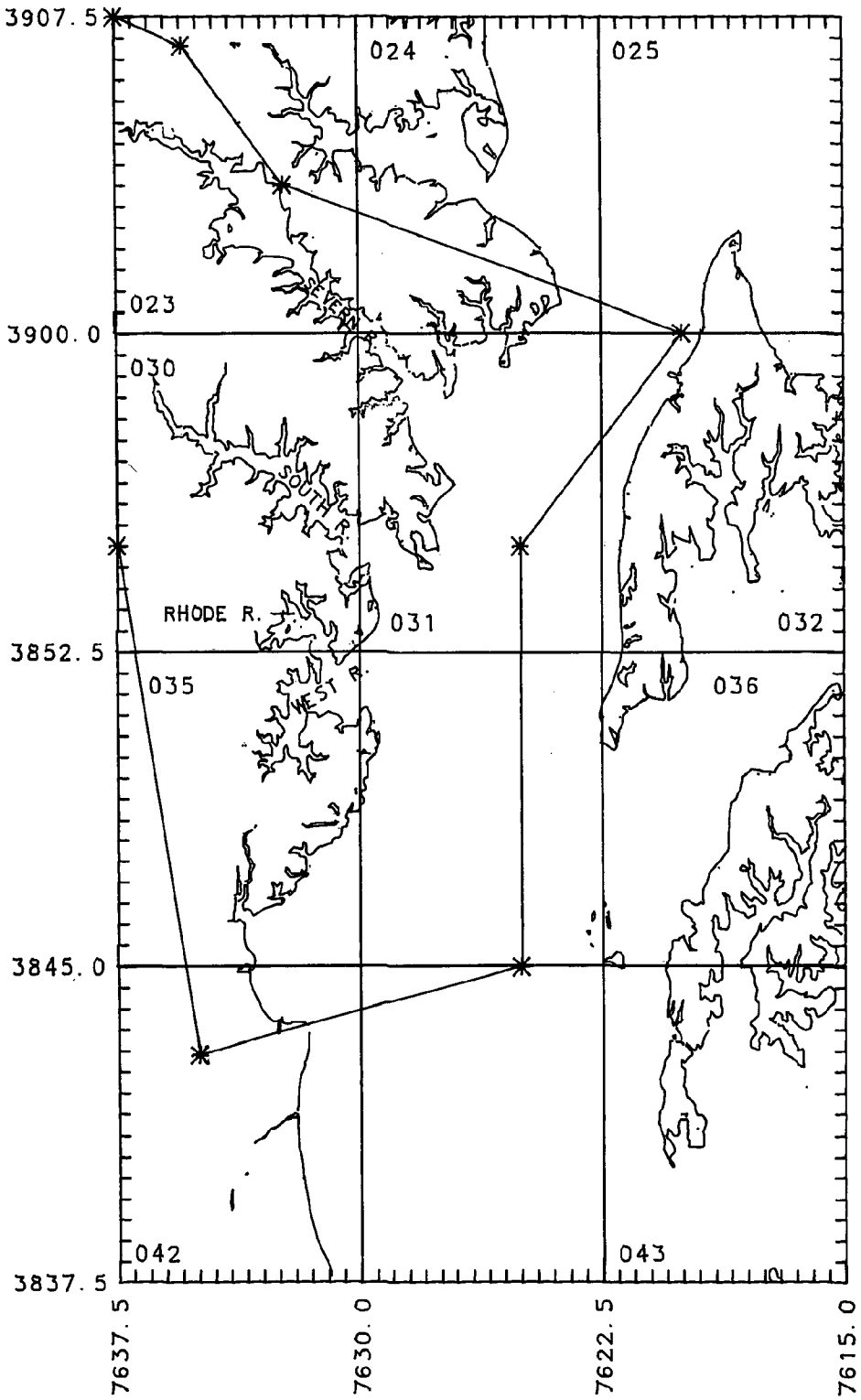

Figure 12. Distribution of SAV in the Central Western Shore (Section 5).

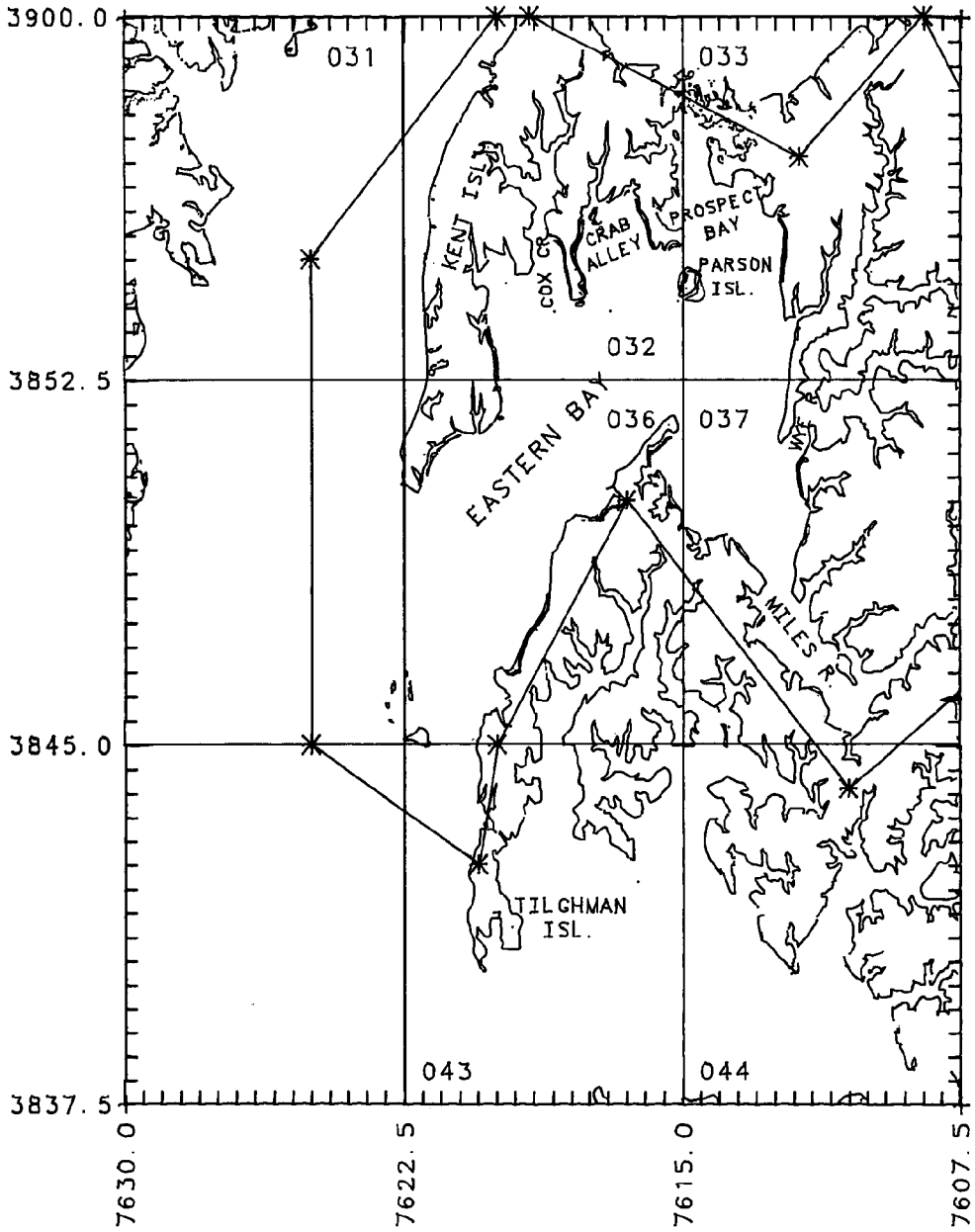

Figure 13. Distribution of SAV in the Eastern Bay (Section 6).

(22% and 54% of the total SAV coverage within section 6, respectively). In 1990 SAV was identified as being particularly abundant along both shorelines in Cox Creek, Crab Alley Bay, the eastern shore of lower Kent Island, Parson Island, Piney Neck, and the lower portion of the Miles River. Little SAV was present from Punch Point on the Western shore of Eastern Bay to Pawpaw Cove on Tilghman Island, as well as in the Miles and Wye River. *Ruppia maritima*, *P. pectinatus*, *Z. palustris*, and *P. perfoliatus* were reported by the FWS, University of Maryland HPEL, the Charterboat Captain's, and the Citizen's surveys (Maps 32, 33, 36, 37, and 38).

7. CHOPTANK RIVER

There were 193 hectares of SAV observed in the Choptank River section in 1990 (Tables 4-6; Fig. 14; Appendix C, Maps 43, 44, 51, 52, and 62) compared to 865 hectares in 1989. Most of the SAV occurred in sparse (27%) to moderate (53%) beds in only a few areas. SAV was found at the mouth of Harris Creek, Leadenham Creek off Broad Creek, Brannock Bay, the mouth of Chapel Creek, Cook Point Cove, Covey Creek, and Cators Cove. There is little or no SAV in Broad Creek, Tred Avon River, and much of the Little Choptank River. Vegetation above Chapel Creek in the Choptank River is sparse but not completely absent.

Ground surveys by Citizens and Charterboat Captains, as well as scientists from the University of Maryland's HPEL, located three species of SAV in this section (Maps 36, 43, 44, 51, 52, and 62) with *R. maritima* being the most prevalent. *Potamogeton pectinatus* and *Z. palustris* were observed in scattered locations.

8. PATUXENT RIVER

There was no SAV observed from the aerial photography in the Patuxent River section in 1990 (Tables 4-6; Fig. 15) compared to 3 hectares reported in 1989. There were sporadic sightings of four SAV species in the Patuxent River by the the Maryland Capital Parks and Planning Commission and Citizen's surveys (Maps 41, 49, 61, 70, 71, and 159). Those species reported from the lower sections of the river were *P. pectinatus*, *Z. palustris*, and *R. maritima*. Species found from the upper sections of the river were *V. americana*, *C. demersum*, *P. epihydrus*, *Najas guadalupensis*, *Najas gracillima*, *Najas minor*, *Z. palustris*, *E. canadensis*, *P. crispus*, *P. pusillus*, *and Najas* spp.

9. MIDDLE WESTERN SHORE

There were no SAV beds identified in the Middle Western Shore section in 1990 (Tables 4-6; Fig. 16) which was similar to 1989. There were three observations from Citizen's ground surveys in 1990 with reports of *R. maritima* at two sites and an unidentified species at the third (Map 71).

10. LOWER POTOMAC RIVER

There were 532 hectares of SAV identified in the Lower Potomac River section from the 1990 aerial photography (Tables 4-6; Fig. 17; Appendix C, Maps 56, 57, 58, 65, 66, and 67) compared to 616 hectares reported in 1989. Most of the SAV occurred

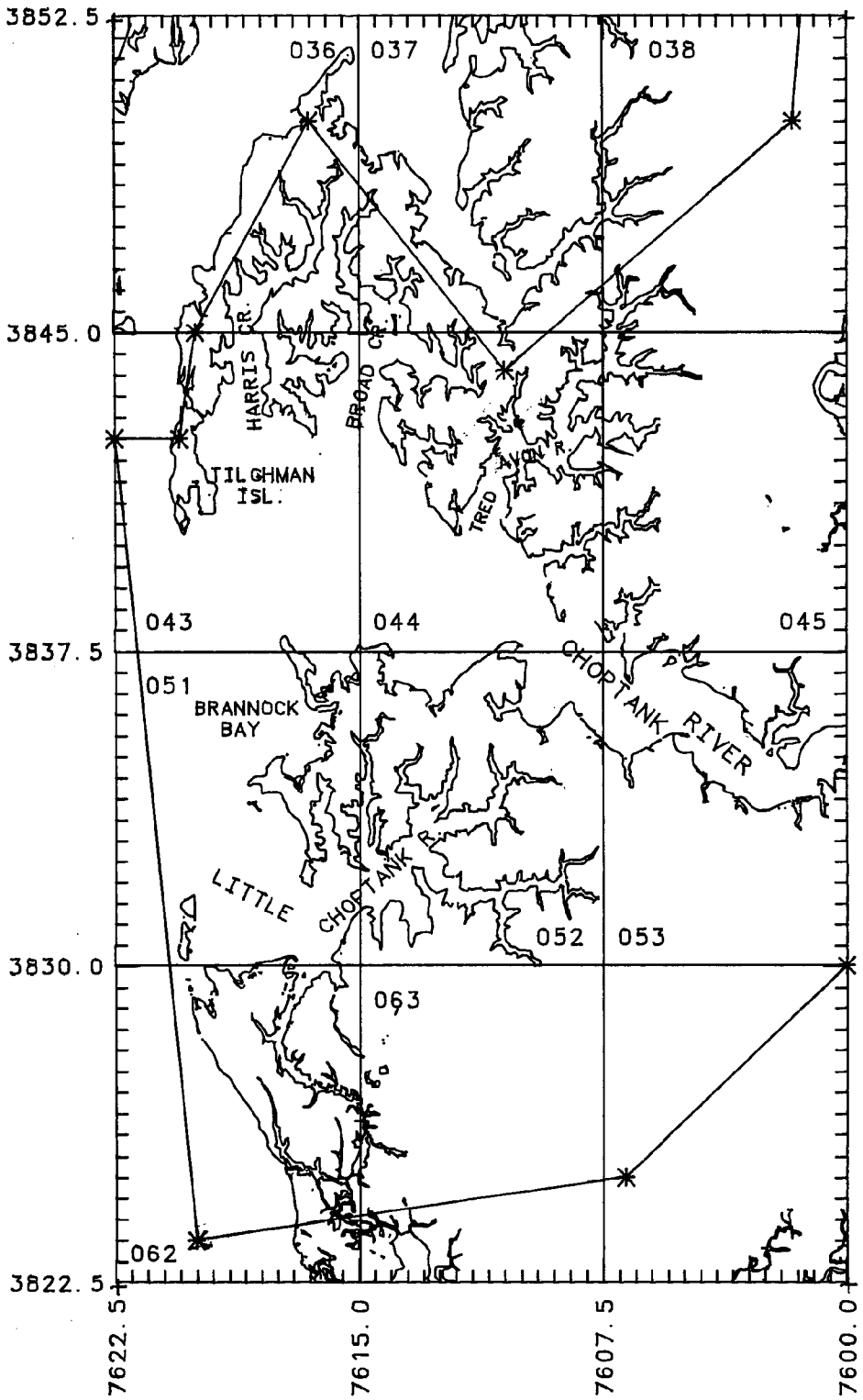

Figure 14. Distribution of SAV in the Choptank River (Section 7).

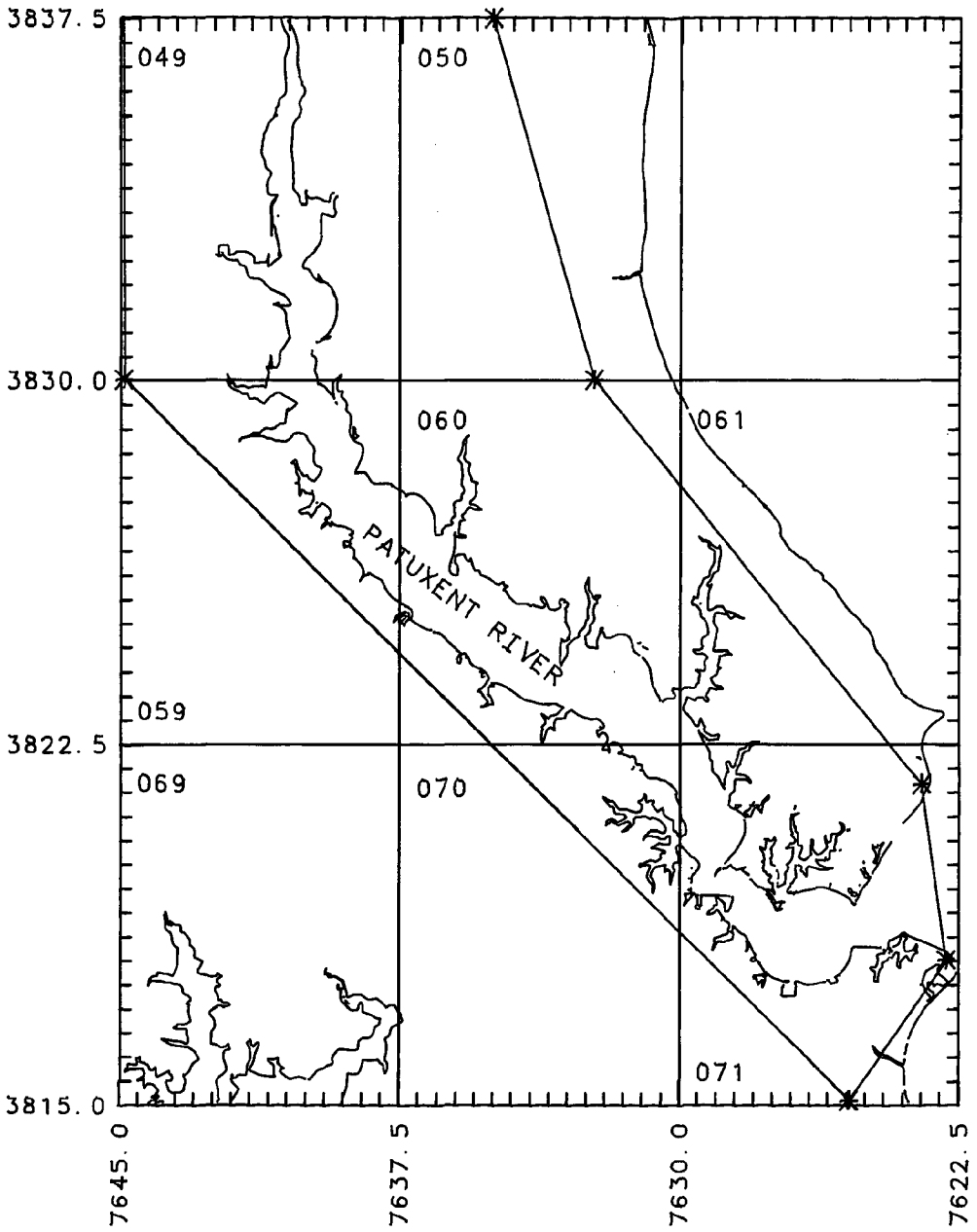

Figure 15. Distribution of SAV in the Patuxent River (Section 8).

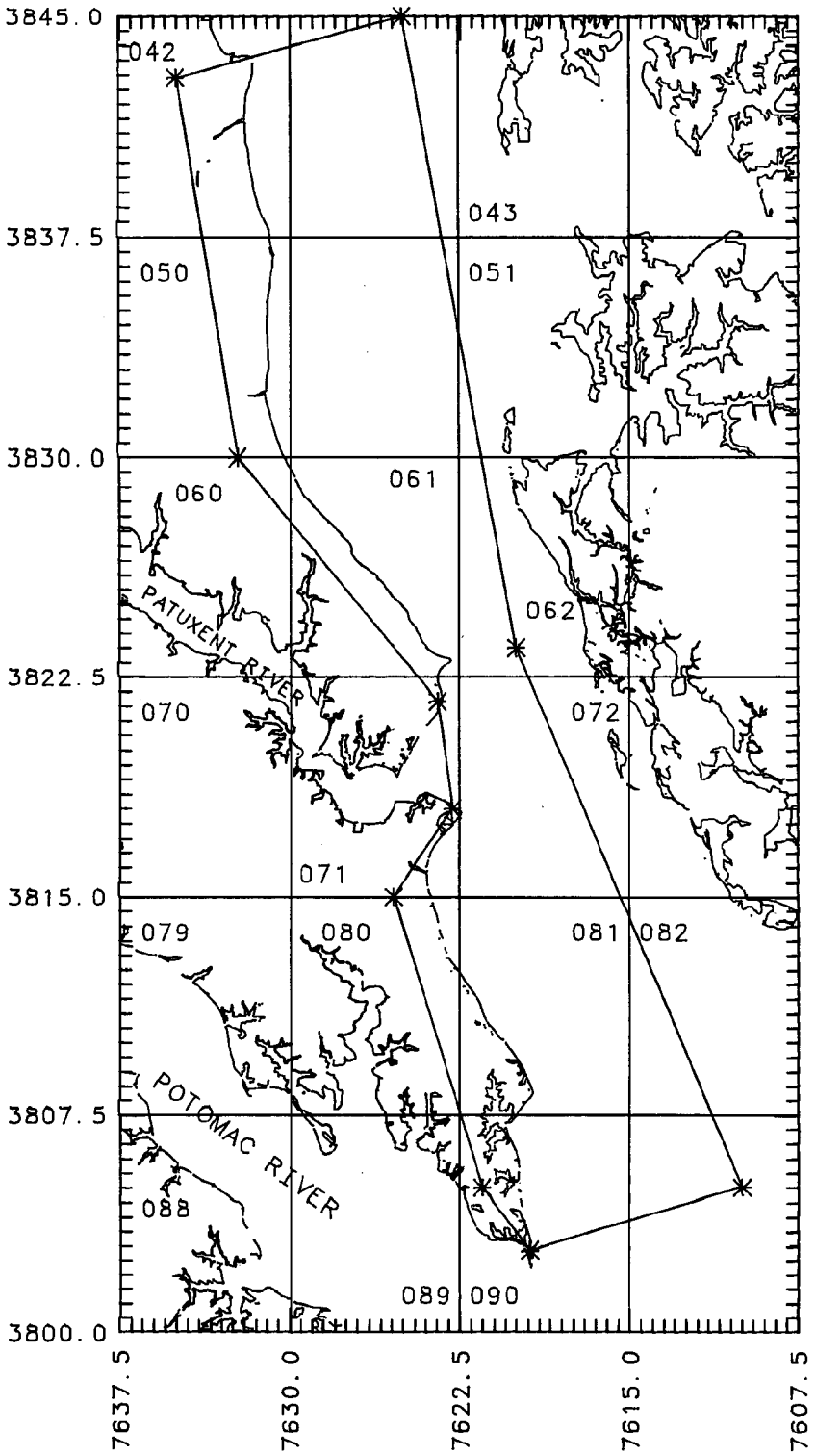

Figure 16. Distribution of SAV in the Middle Western Shore (Section 9).

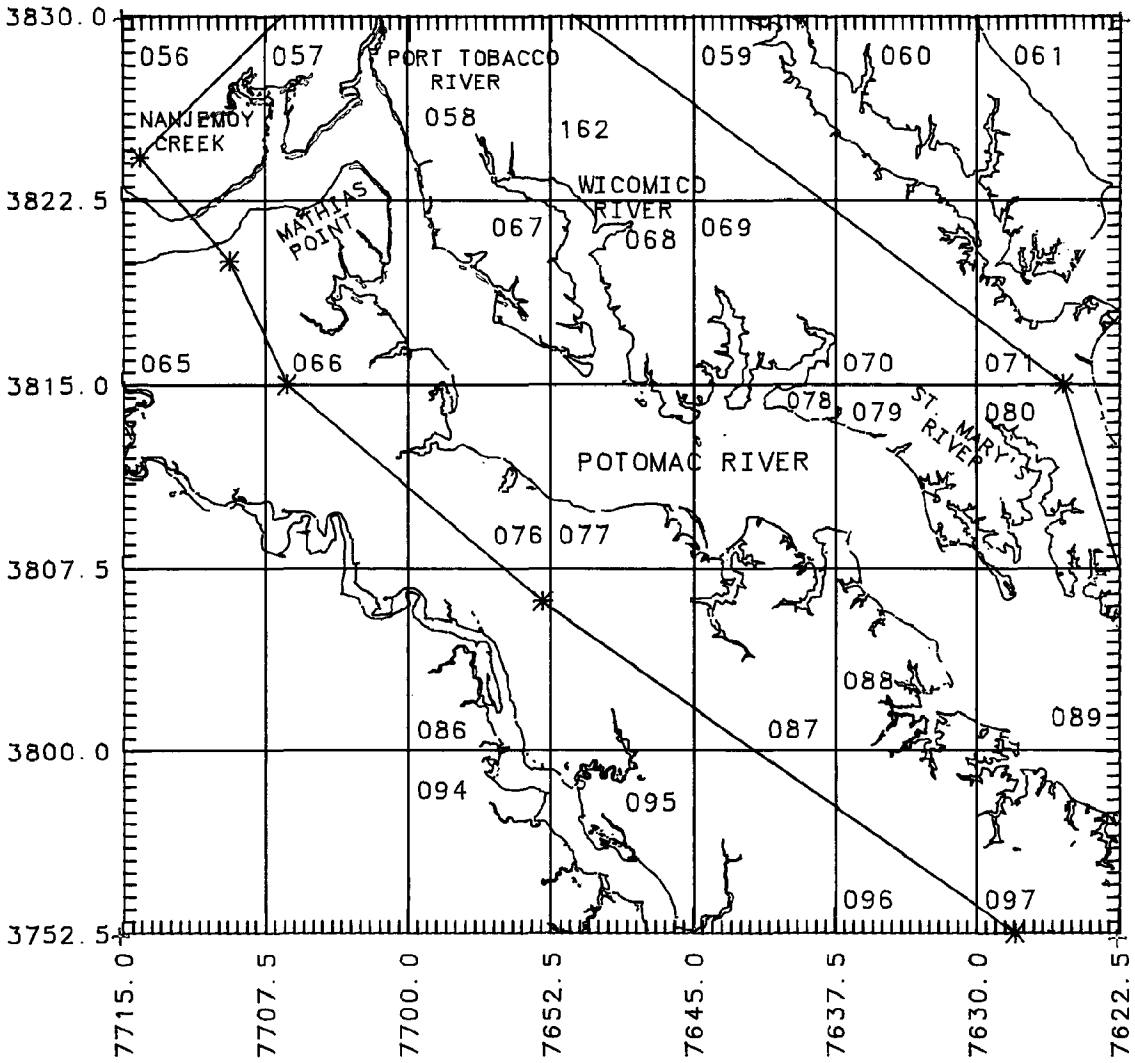

Figure 17. Distribution of SAV in the Lower Potomac River (Section 10).

in the region near the Route 301 bridge, in Nanjemoy Creek and Port Tobacco River, and in the shoreline adjacent to these two creeks. SAV beds were fringing along the eastern side of Mathias Point Neck to just below the Route 301 bridge. Several small beds were observed in Machodoc, Rosier, and Cuckhold Creeks.

VIMS surveys reported *V. americana*, *P. pectinatus*, and *P. perfoliatus* at Windmill Point on the Port Tobacco River, and *V. americana* at Upper Cedar Point, Mathias Point (Map 57), and below the Route 301 bridge on the mainstem Potomac River (Map 66). Citizen's survey observations reported *Z. palustris* at the mouth of the Wicomico River (Map 68), Breton Bay (Map 69), and Herring Creek (Map 79). The USFWS reported *V. americana, M. spicatum, P. perfoliatus, C. demersum, P. pectinatus, P. crispus, E. canadensis, and H. verticillata* in the Port Tobacco River. The Charterboat Captain's survey reported unidentified SAV from the Potomac River and tributary creeks (Maps 56, 66, and 67).

11. UPPER POTOMAC RIVER

There were 2,522 hectares of SAV mapped in the Upper Potomac River section (Tables 4-6; Fig. 18; Appendix C, Maps 34, 39, 40, 47, 48, 55, 65, and 161) in 1990 compared to 1,998 hectares reported in 1989. A total of 72% of the SAV beds were densely vegetated (density class 4). SAV beds from the Woodrow Wilson Bridge (except those in the middle of the river - Map 34, beds BB4, HB4, and GB3) to just below Piscataway Creek remain reduced in coverage from 1987 as in 1989. SAV distribution in the Alexandria and Mount Vernon quadrangles increased 8% and 7% repectively from 1989 but was still less than that in 1987 (15% and 66%, respectively). In the portion from Quantico to Aquia Creek in 1990 SAV continued to increase from 1987 abundances , with large increases from 1989 in the Indian Head (184.01 to 303.67 hectares), Widewater (466.64 to 614.54 hectares), and Fort Belvoir (63.48 to 105.06 hectares) quadrangles. King George quad had similar SAV abundance (35.37 hectares) to that in 1989. SAV is still absent from Occoquan Bay and Belmont Bay.

Extensive groundtruth surverys were conducted by the Council of Governments (Maps 29, 34, 39, 40, 47, 48, and 55) while the Citizen's survey reported SAV from Maps 34, 40, and 47. There were nine species identified from this section in 1990. *Hydrilla verticillata* was reported from Aquia, Chopawamsic, Quantico, Mattawoman, Chicamuxen, Dogue, Pomonkey, Piscataway, Swan, and Broad Creeks, Gunston Cove, the Anacostia River, and both sides of the mainstem Potomac River from Washington D.C. to Aquia Creek. Other species reported from this section included *M. spicatum, C. demersum, H. dubia, N. minor, V. americana, N. guadalupensis, E. canadensis, N. gracillima*, and *Najas* spp.

12. MIDDLE EASTERN SHORE

There were 2287 hectares of SAV identified in the Middle Eastern Shore section (Tables 4-6; Fig. 19; Appendix C, Maps 63, 72, 73, 74, 82, 83, 84, 85, 92, 93, 100, and 101) in 1990 compared to 1,998 hectares reported in 1989. SAV beds, of which 39% were dense (class 4), 27% moderate (class 3), 25% sparse (class 2), and 8% very sparse (class 1) were very abundant in: 1. the Honga River, 2. between Barren Island and Meekins Neck-Upper Hooper Island, and 3. the lower Manokin and the Big and

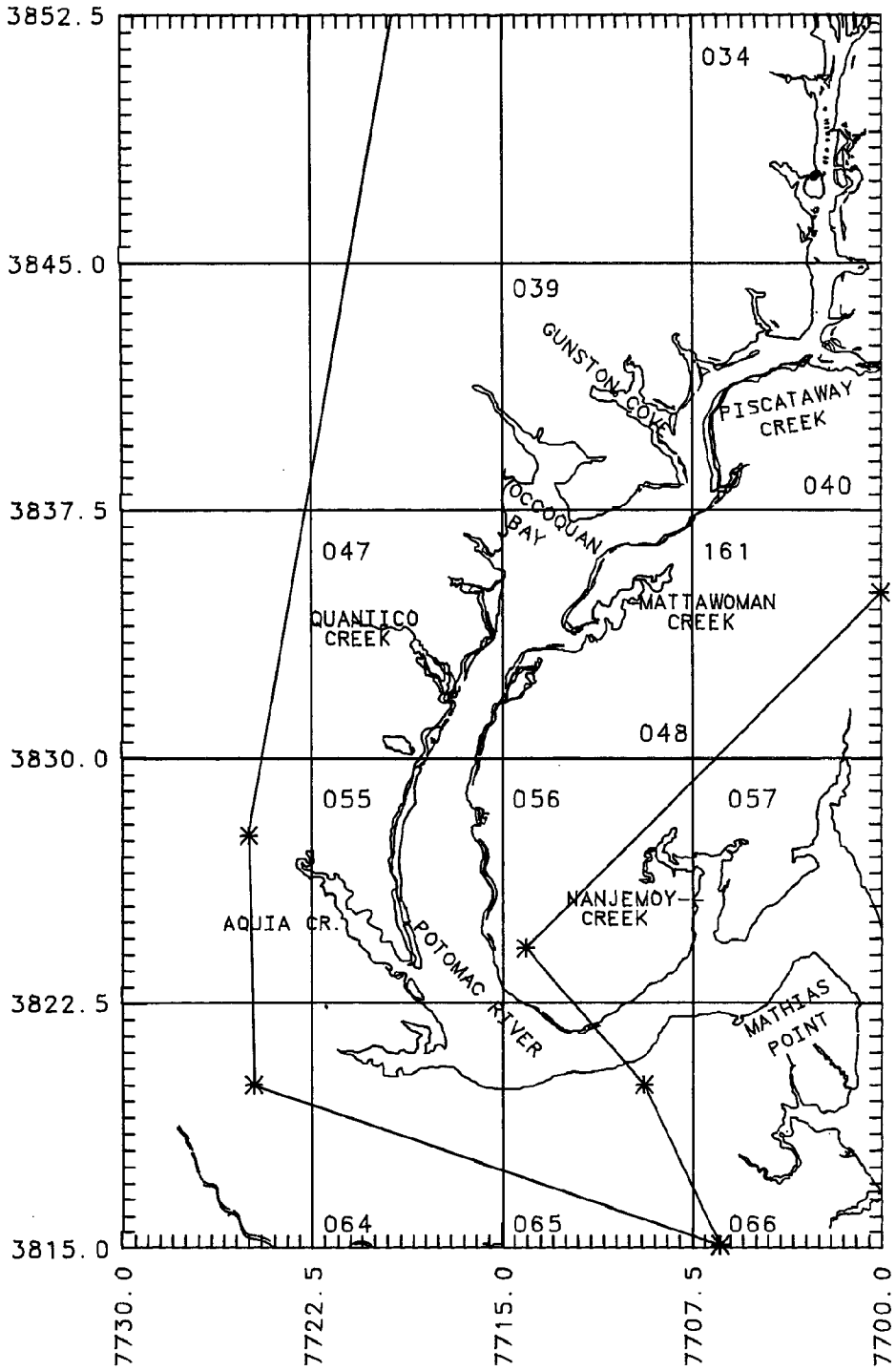

Figure 18. Distribution of SAV in the Upper Potomac River (Section 11).

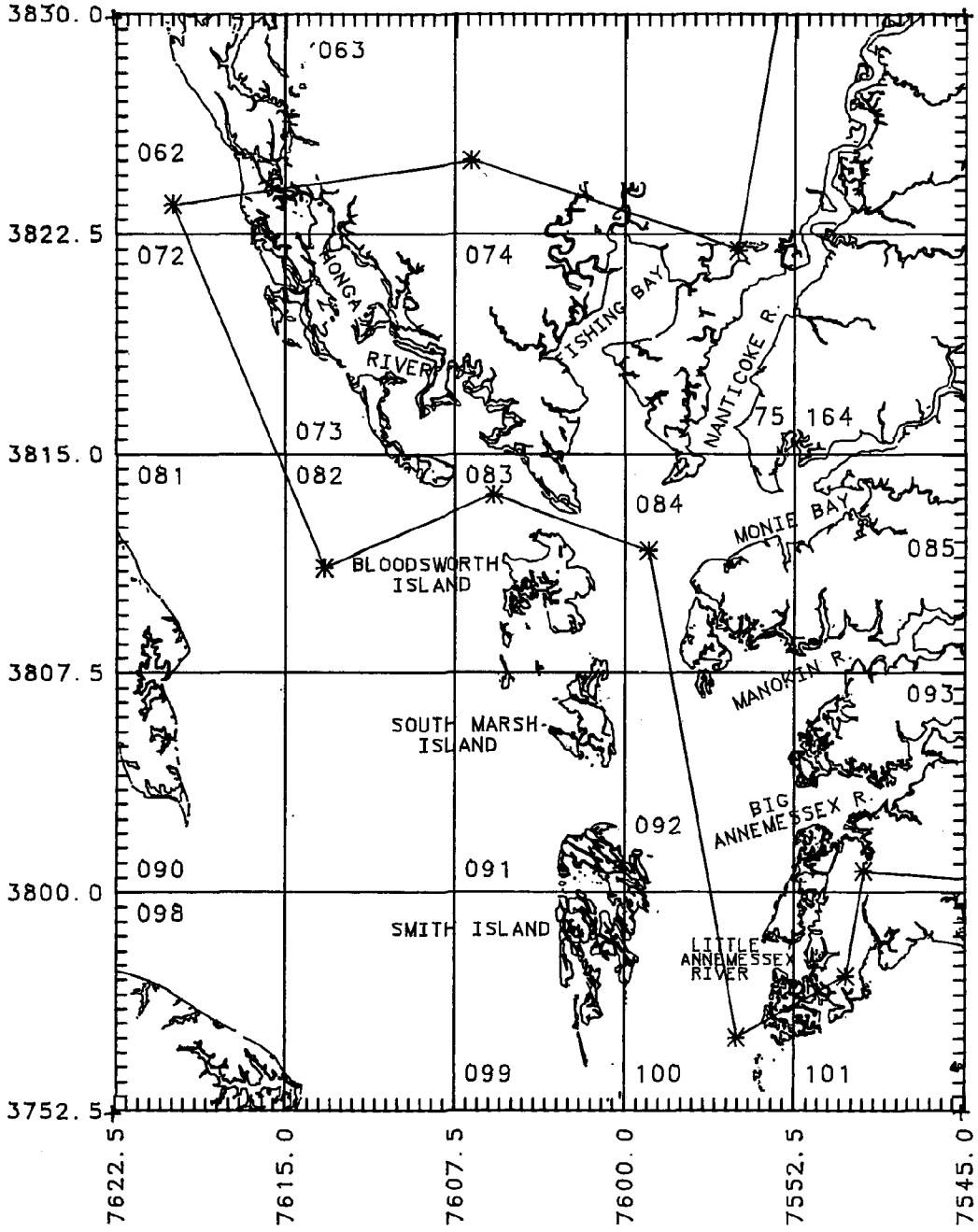

Figure 19. Distribution of SAV in the Middle Eastern Shore (Section 12).

Little Annemessex Rivers. Few SAV beds were observed in Fishing Bay and in the Nanticoke and Wicomico Rivers.

Ruppia maritima was the predominant species found by the HPEL, Citizen's, and Charterboat Captain's surveys (Maps 63, 72, 73, 74, 82, 83, 84, 85, 92, 93, 100, and 101). *Zostera marina* was reported from several locations on the Marion (Map 93), Great Fox Island (Map 100), and Crisfield (Map 101) quadrangles. *Zannichellia palustris* was reported from Crisfield quad (Map 101) and Marion quad (Map 93).

13. MID-BAY ISLAND COMPLEX

There were 5,405 hectares of SAV mapped in the Mid-Bay Island Complex in 1990 (Tables 4-6; Fig. 20; Appendix C, Maps 83, 91, 92, 99, 100, and 107) compared to 5,199 hectares reported in 1989. This section contains 22.1% of the SAV in the entire Chesapeake Bay, an increase of 0.6% over 1990. However, the density of SAV has decreased since 1989. Forty-five percent of the SAV within this section was in density class 4 compared to 80% in 1989. Twenty-four percent of SAV within this section in 1990 was moderate in density (class 3), 19% was sparse (class 2), and 12% was very sparse (class 1).

Groundtruth surveys were conducted by VIMS, HPEL, Citizens, and Charterboat Captains. The broad, expansive shoal area between Tangier Island and Smith Island continued to be densely vegetated by both *R. maritima* and *Z. marina*, and was by far the largest bed in the Chesapeake Bay. *Ruppia maritima* was the species most often reported by the surveys around these islands.

Lower Bay Zone

14. LOWER EASTERN SHORE

There were 4,829 hectares of SAV observed in the Lower Eastern Shore section in 1990 (Tables 4-6; Fig. 21; Appendix C, Maps 100, 101, 102, 107, 108, 109, 113, 114, 119, 124, 133, 134, 142, and 143) compared to 4,718 hectares reported in 1989. Fifty-four percent of the total SAV is in density class 4; 11% is in class 1; and 9% is in class 3. Species reported were primarily *Z. marina* and *R. maritima* with *Z. palustris* reported at a few sites. There were groundtruth observations from VIMS, Citizen's and Charterboat Captain's surveys (Maps 100, 101, 108, 113, 114, and 124). Large, dense beds continue to persist at the mouth of Cherrystone Inlet near Cape Charles, at the mouths of Hungars, Mattawoman, Occohannock, Craddock, Pungoteague, Onancock, and Chesconessex creeks, at the Big Marsh area near Chesconessex Creek, at Webb Island off the mouth of Deep Creek, and on the large shoal area on the eastern side of the Fox and Cedar Islands. The only SAV in the Pocomoke Sound area was on the eastern side of Watts Island. There was no SAV south of Old Plantation Creek just below Cape Charles.

15. REEDVILLE REGION

There were 609 hectares of SAV identified in the Reedville Region in 1990 (Tables 4-6; Fig. 22; Appendix C, Maps 106 and 112) compared to 492 hectares reported in 1989. SAV beds were classified as 16% very sparse (class 1), 24% sparse

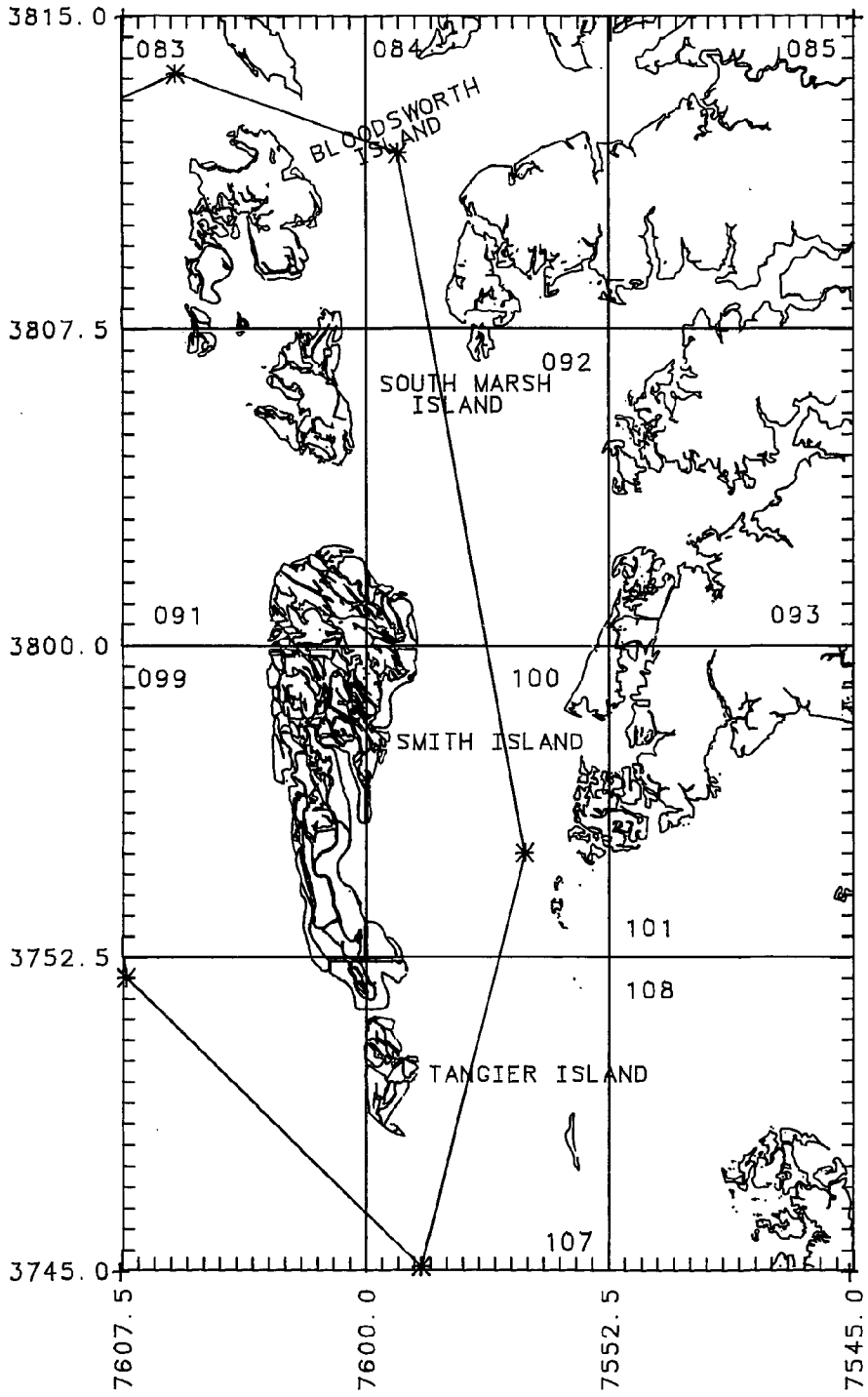

Figure 20. Distribution of SAV in the Mid-Bay Island Complex (Section 13).

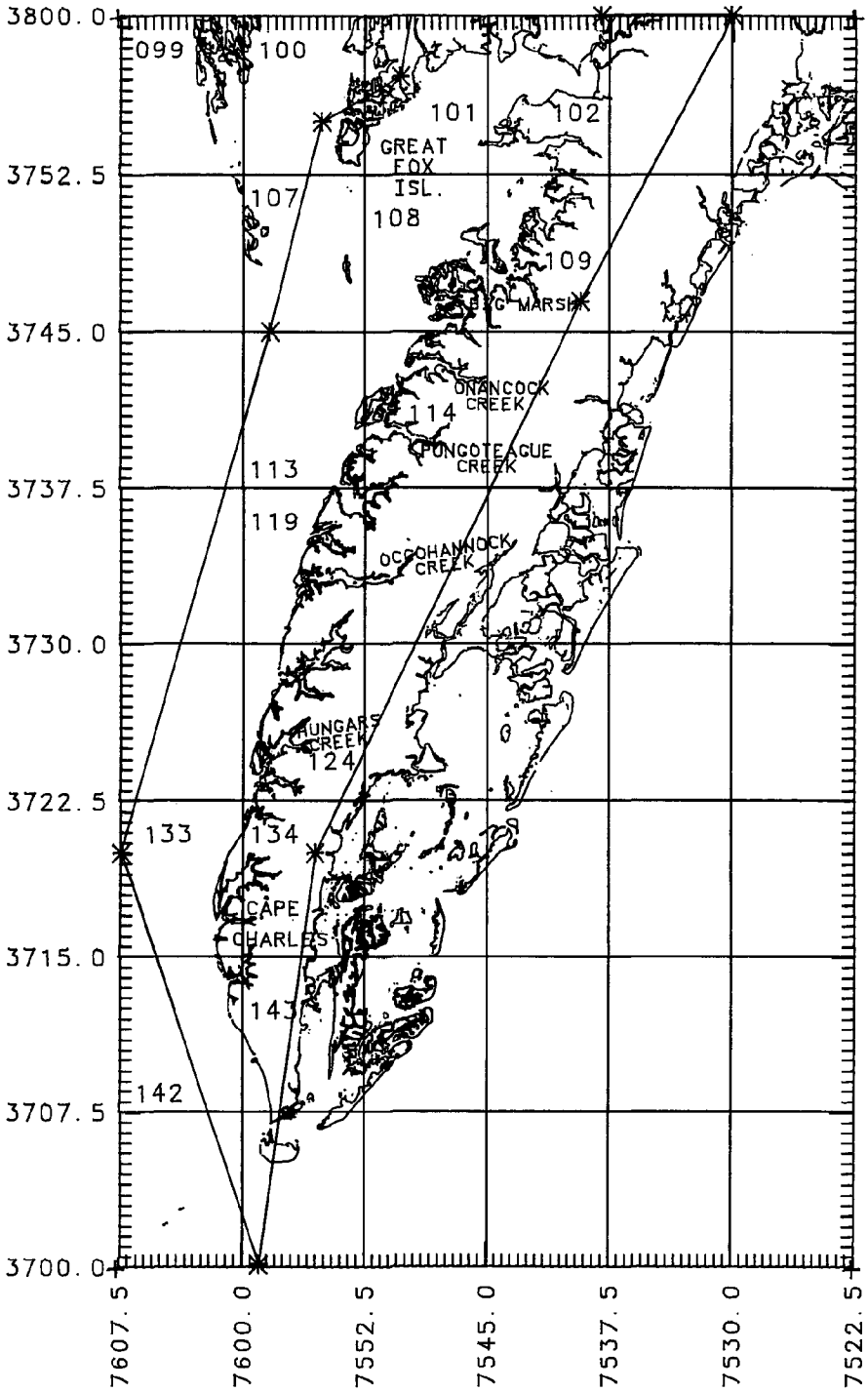

Figure 21. Distribution of SAV in the Lower Eastern Shore (Section 14).

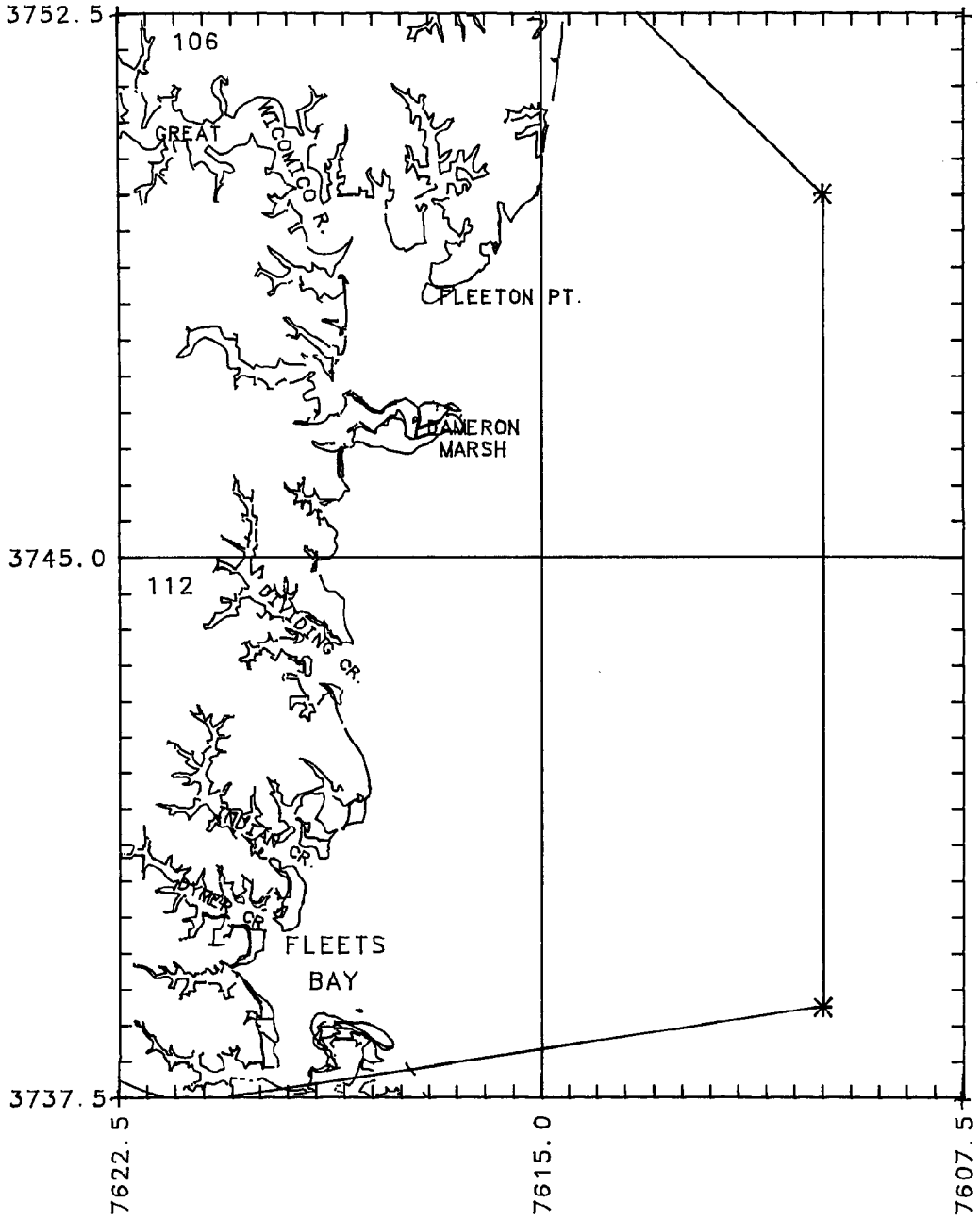

Figure 22. Distribution of SAV in the Reedville Region (Section 15).

(class 2), 41% moderate (class 3), and 19% dense (class 4). *Ruppia maritima* and *Z. marina* were the two species identified by VIMS and Citizen's surveys in 1990 (Maps 106 and 112). Most beds were found in Little Bay, Fleets Bay, Dymer Creek, Indian Creek, Dividing Creek, Ball Creek, Cloverdale Creek, Dameron Marsh, Ingram Bay, and Fleeton Point.

16. RAPPAHANNOCK RIVER COMPLEX

There were 544 hectares of SAV observed in the Rappahannock River Complex in 1990 (Tables 4-6; Fig. 23; Appendix C, Maps 110, 111, 116, 117, 118, and 123) compared to 669 hectares reported in 1989. Although this was an 18.7% drop in abundance, it still is a considerable increase from the 208 hecatares mapped in 1987, or the 18 hectares mapped in 1986. SAV beds consisted mostly of sparse to moderate beds (35% in density classe 2; 44% in class 3), and 20% was dense (class 4).

Ruppia maritima continues to be the dominant species in both the Rappahannock and Piankatank Rivers. In particular, dense beds of *R. maritima* were again present in the Corrotoman River (includes obervations from the Citizen's and VIMS surveys; Maps 110, 111, 117, 118, and 123). *Ruppia maritima* is now present in small scattered patches along the north shore of the Rappahannock River above Towles Point. *Zostera marina*, once a dominant species in this section (similar to the other sections in the lower bay) but rare since 1971, is now present in small patches in both rivers. This is a result of successful transplant efforts using both seeds and whole plants in a number of different areas since 1984 (VIMS, unpublished data) and as a result of natural propagation from nearby beds, especially in the Piankatank River. In the Rappahannock River transplanted *Z. marina* is present adjacent to Parrott Island, off Sanders Cove just above the bridge, at the mouth of Carters Creek, at Ball Point, off Wharton Grove, and adjacent to Towles Point. Also reported by the VIMS survey at Parrot Island was *Z. palustris*. In the Piankatank River and Milford Haven area transplanted *Z. marina* is present off Burton Point, along the northeast side of Gwynn Island and at the mouth of Healy and Hills Creek. Naturally occurring *Z. marina* is present on the west side of Gwynn Island off The Hole in the Wall and off the northeast tip of the island, and in the Willis Wharf area.

17. NEW POINT COMFORT REGION

There were 357 hectares of SAV identified in the New Point Comfort Region in 1990 (Tables 4-6; Fig. 24; Appendix C, Map 132) compared to 346 hectares reported in 1989. As in 1989, SAV consisted of dense beds (68% in density class 4) of *Z. marina* and *R. maritima* between New Point Comfort and just north of Horn Harbor. Twenty-nine percent of the SAV was in density class 2 and the remainder was in density class 3. Groundtruth data was collected by the VIMS survey.

18. MOBJACK BAY COMPLEX

The Mobjack Bay Complex contained 1,703 hectares of SAV in 1990 (Tables 4-6; Fig. 25; Appendix C, Maps 122, 123, 131, and 132) compared to 1,593 hectares reported in 1989. SAV beds consisting of *Z. marina* and *R. maritima* were most abundant along the entire shoreline of Mobjack Bay as well as in the four tributaries:

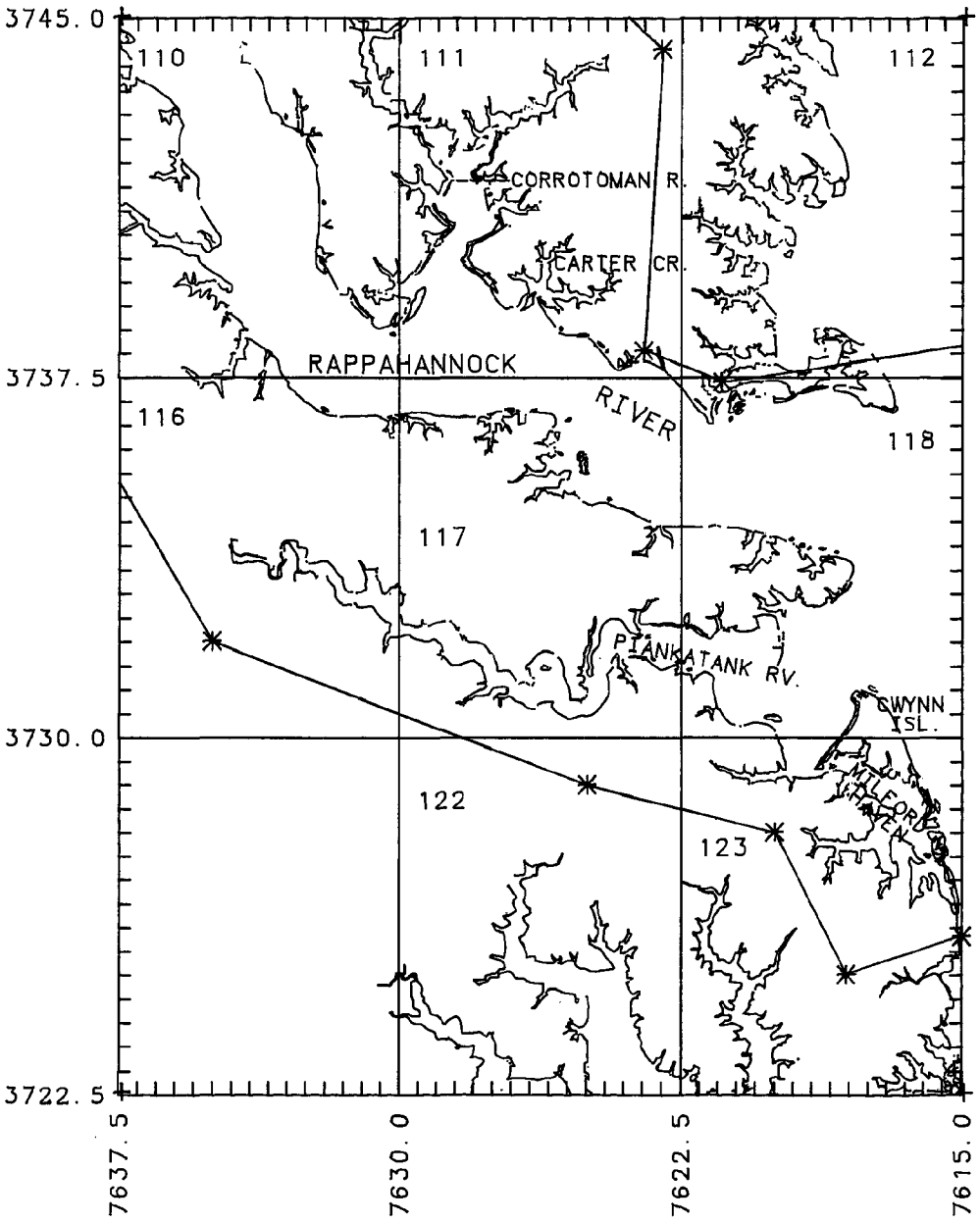

Figure 23. Distribution of SAV in the Rappahannock River Complex (Section 16).

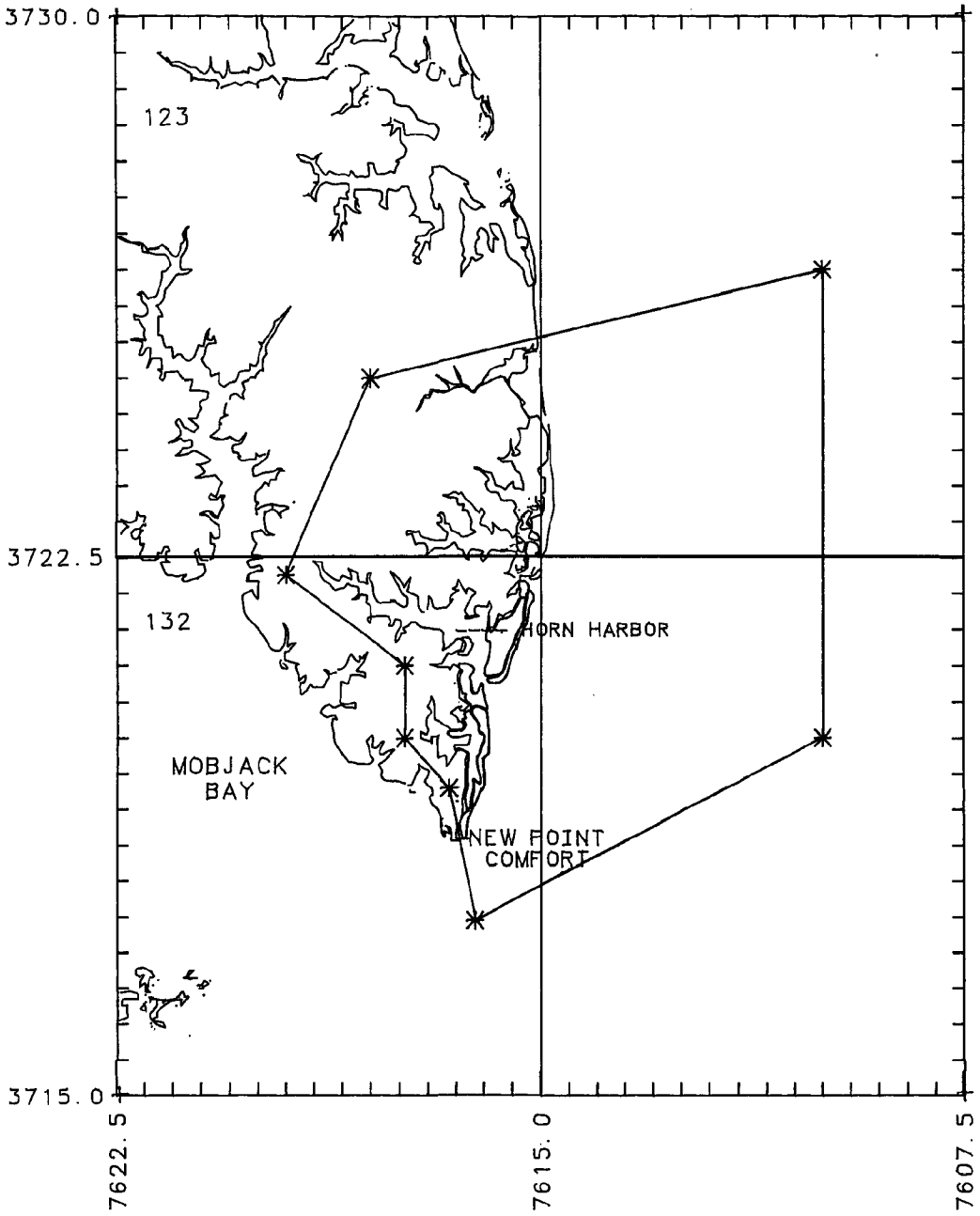

Figure 24. Distribution of SAV in the New Point Comfort Region (Section 17).

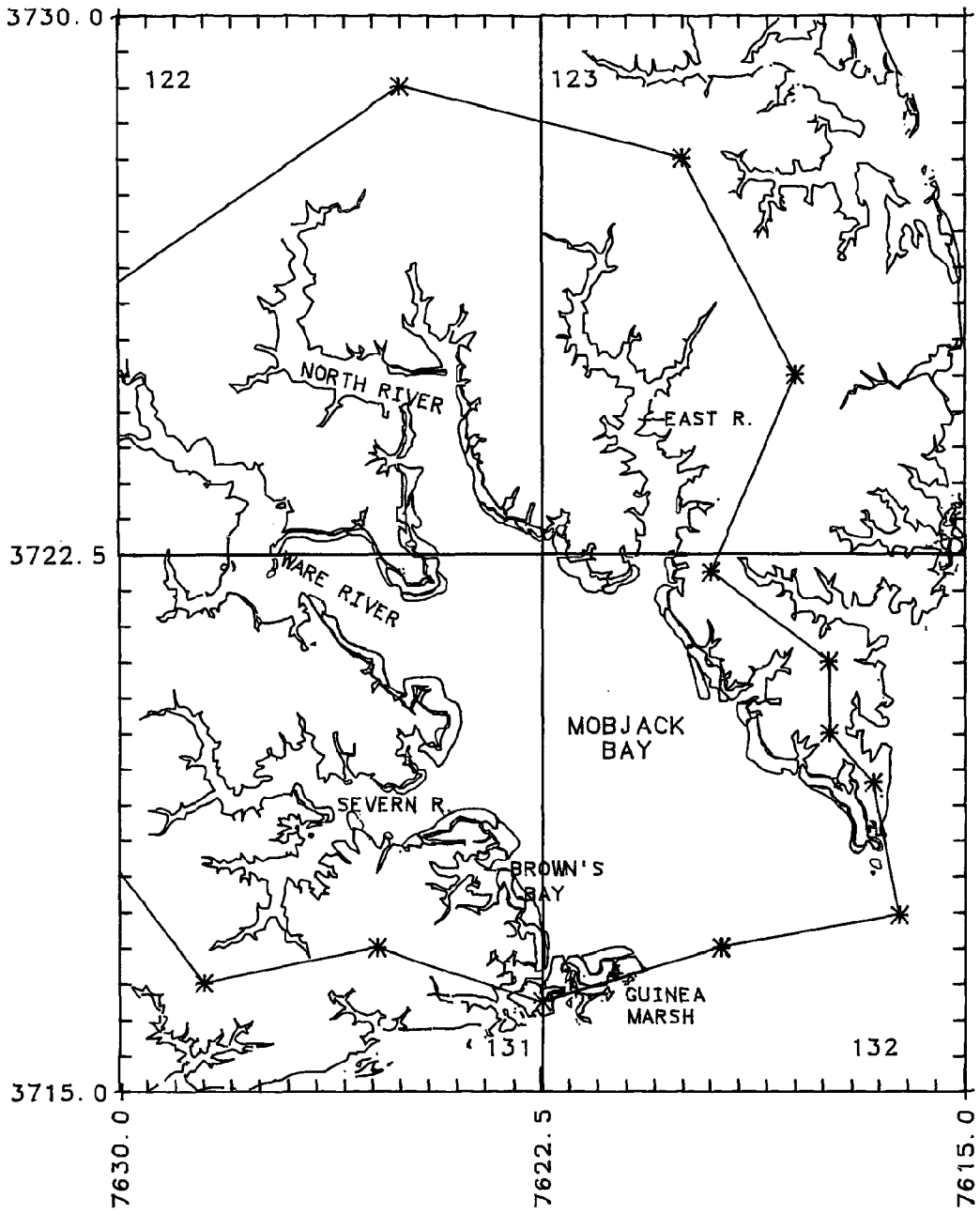

Figure 25. Distribution of SAV in the Mobjack Bay Complex (Section 18).

Severn, Ware, North, and East Rivers. The Mobjack Bay area continued to harbor some of the more extensive SAV beds on the western shore of the lower Chesapeake Bay. Sixty percent of the total coverage of SAV in this section is in density class 4, similar to 1989. The next largest density class was 26% sparse (class 2), while 10% was moderate (class 3) and 4% was very sparse (class 1). Groundtruth observations include those from the Citizen's and VIMS surveys (Maps 122, 131, and 132).

19. YORK RIVER

There were 790 hectares of SAV observed in the York River section in 1990 (Tables 4-6; Fig. 26; Appendix C, Maps 130, 131, 132, 139, and 140) compared to 677 hectares reported in 1989. Seventy-three percent of the total coverage in this section is classified as dense (class 4) compared to 80% in 1989. Twenty-three percent of the SAV was in density class 2, 3% was in class 1, and the remainder was in class 3. Groundtruth observations were made by VIMS surveys (Maps 130, 131, 132, 139, and 140). Dense SAV beds consisting of both *Z. marina* and *R. maritima* were located principally along the north shore from Gloucester Point to the mouth of the river. Three small SAV beds, and one large bed located on the north side of Goodwin Islands, were present along the south shore downstream from the Naval Weapons Station. SAV beds were absent upstream of Gloucester Point on the north shore except for one small bed of *Z. marina* near Gloucester Point and two small beds of *Z. marina* (less than 1.5 hectares) adjacent to Big Mumfort Island, a result of VIMS transplanting efforts using seeds in 1989. The SAV beds planted at Gloucester Point in 1982 and 1983, as well as the smaller areas planted immediately adjacent to these larger areas from 1984 through 1988, continue to thrive in 1990 similar to many naturally expanding beds along the north shore.

20. LOWER WESTERN SHORE

There were 1,797 hectares of SAV mapped in the lower Western Shore section in 1990 (Tables 4-6; Fig. 27; Appendix C, Maps 140, 141, 147, 152, and 157) compared to 1,670 hectares reported in 1989. Groundtruth surveys by Citizen's and VIMS (Maps 141 and 152) reported *Z. marina* and *R. maritima*. As in 1989, 60% percent of the total coverage in this section remained in density class 4. SAV was mapped in Broad Bay, Linkhorn Bay, Back River, the mouth of the Poquoson River off Pasture and Hunts Neck, Drum Island Flats, Poquoson Flats, adjacent to Crab Neck just south of Goodwin Island, and on the south side of Goodwin Island. No SAV was present in the southwest and northwest branches of Back River, or in the Poquoson River, Chisman Creek, and Back Creek.

21. JAMES RIVER

There were not quite 3 hectares of SAV in the mainstem James River in 1990 (Tables 4-6; Fig. 28; Appendix C, Map 147), compared to 4 hectares in 1989. This small (2.7 hectare), dense bed located at the mouth of Hampton Creek adjacent to the Veteran's Hospital was not groundtruthed in 1990 but was reported to consist predominantly of *Z. marina* in 1989. A Citizen survey reported *C. demersum* and

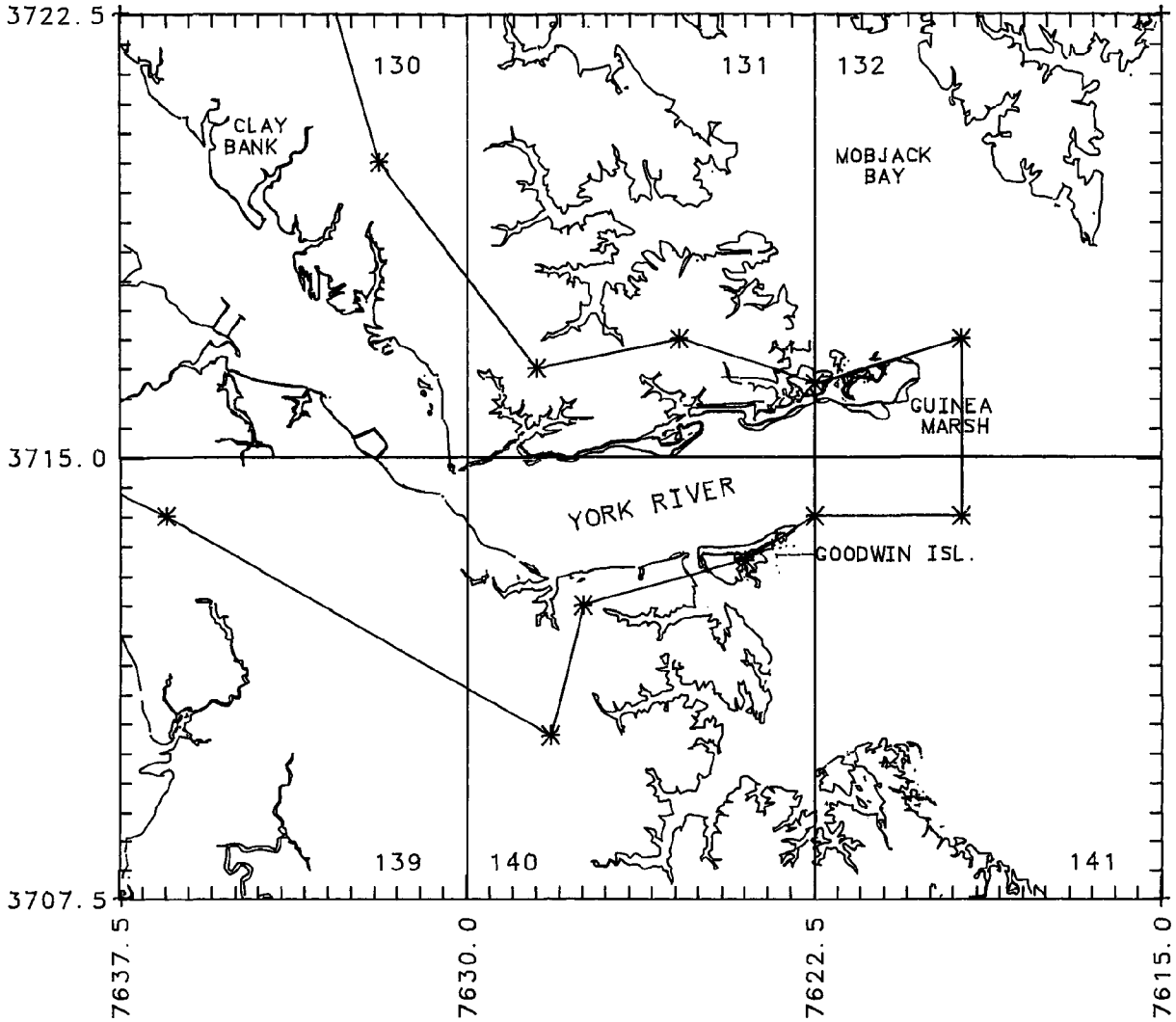

Figure 26. Distribution of SAV in the York River (Section 19).

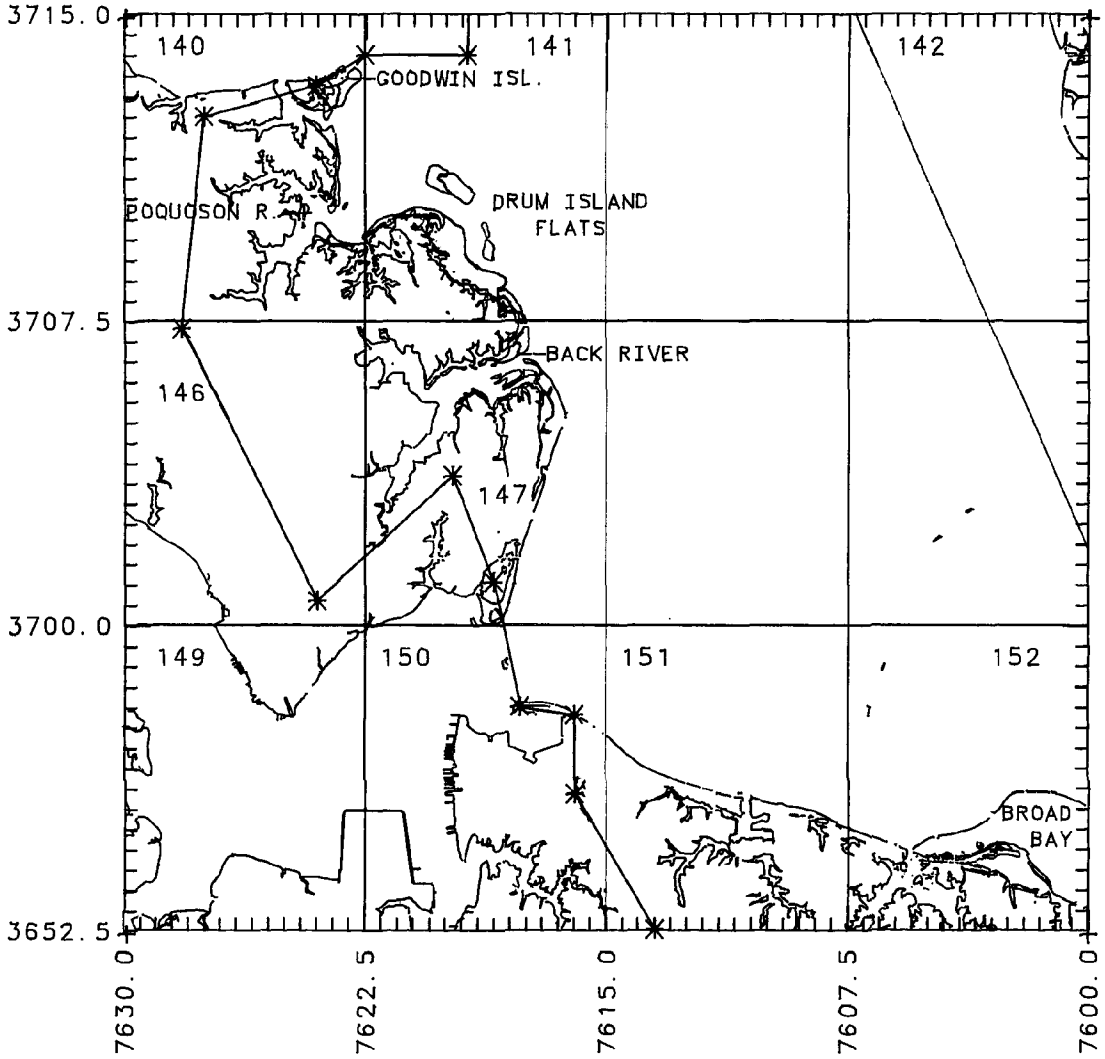

Figure 27. Distribution of SAV in the Lower Western Shore (Section 20).

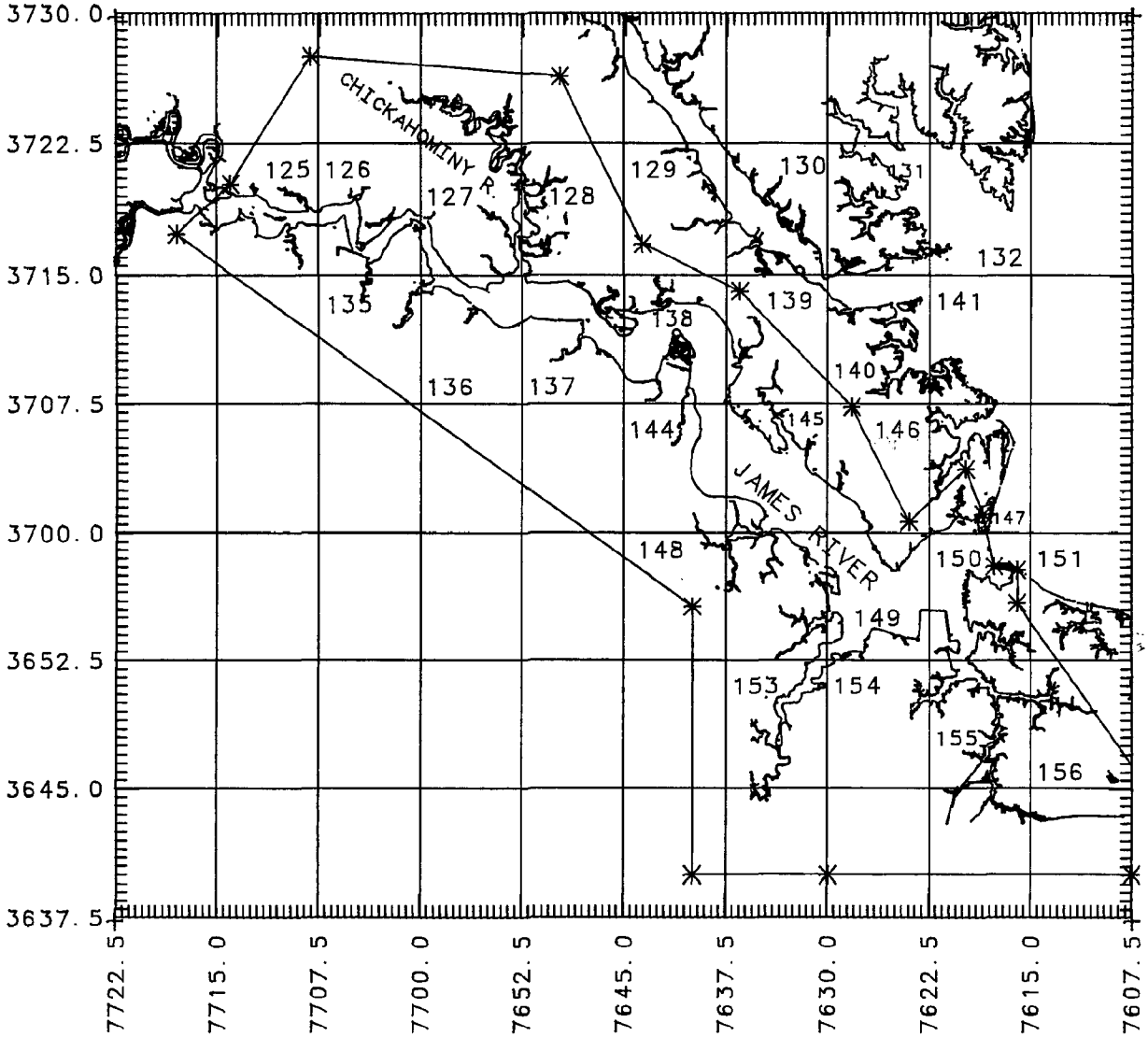

Figure 28. Distribution of SAV in the James River (Section 21).

Chara spp. further upstream in Herring Creek (Map 125), but no SAV was mapped from aerial photography for that quadrangle.

CHINCOTEAGUE BAY

There were 2,494 hectares of SAV identified in Chincoteague Bay in 1990 (Tables 4-6; Fig. 29; Appendix C, Maps 167, 168, 170, 172, 173, and 175) compared to 2,310 hectares reported in 1989. Eighty-four percent of the beds were moderate coverage (density class 3) and 9.8% were dense coverage (class 4). The Citizen's and MD-DNR surveys found both *Z. marina* and *R. maritima* throughout Chincoteague and Sinapuxent Bays (Maps 167, 168, 170, 172, 173, and 175). Only *R. maritima* was reported from Assawoman Bay (Map 166). All of the SAV continues to be present on the eastern side of the bay adjacent to Assateague Island in water depths of less than 1 meter (MLW). The vegetation was concentrated in four relatively distinct areas identical to that reported in the 1986, 1987, and 1989 surveys. They were located west of the northern end of Chincoteague Island, and west of West Bay, Green Run Bay, and the Tingles Island area. Eight percent of the total bottom of this region (32,536 hectares) supported SAV in 1990 compared to 7% in 1989.

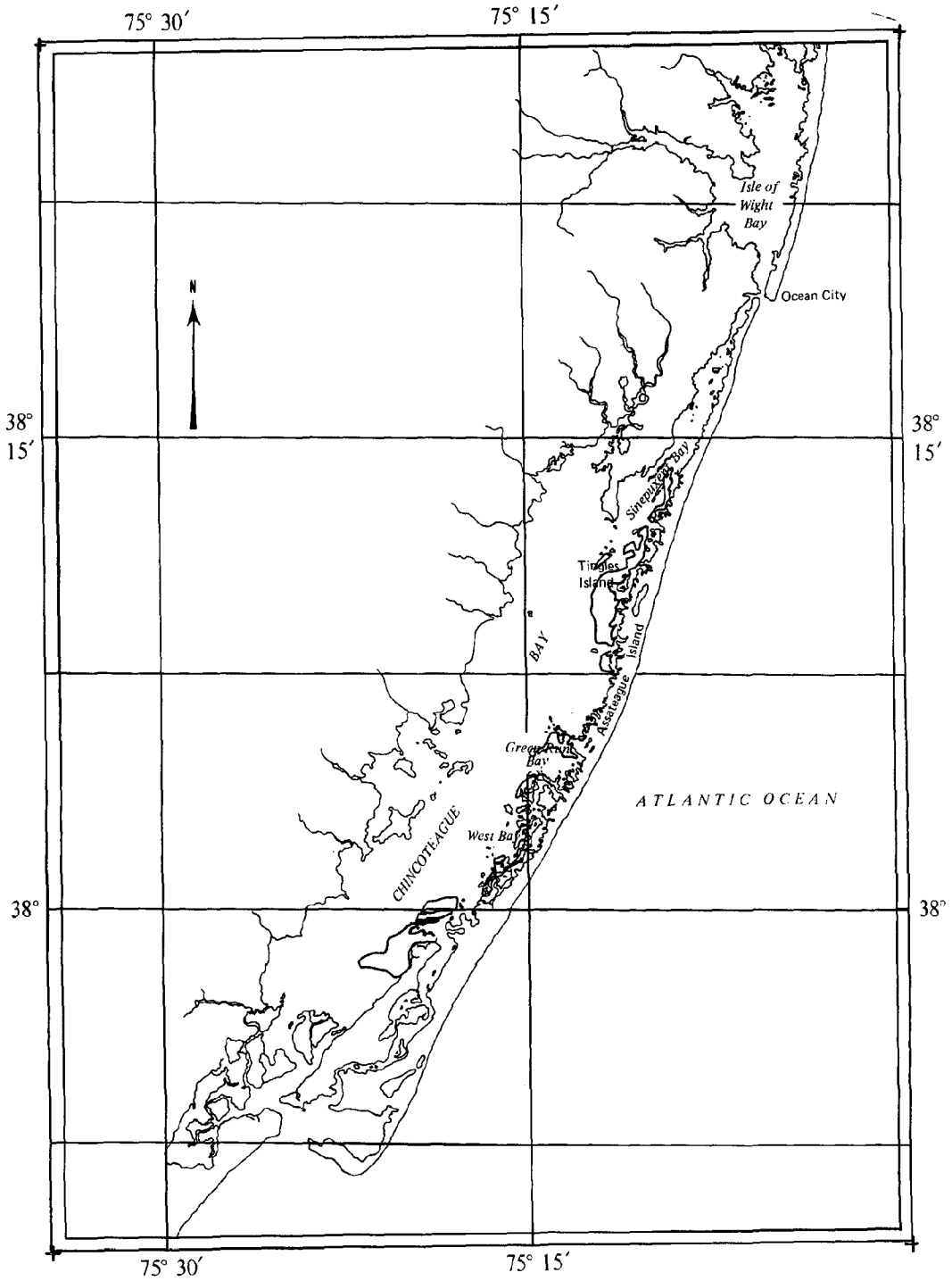

Figure 29. Distribution of SAV in Chincoteague Bay.

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APPENDICES

APPENDIX A

Species Of Submerged Aquatic Plants Found In The Chesapeake Bay And Tributaries Exclusive of the Marine Algae (Classification And Nomenclature Derived From: Godfrey And Wooten, 1979, 1981; Harvill et al., 1977, 1981; Kartesz And Kartesz, 1980; Radford et al., 1968; Wood And Imahori, 1965, 1965)

Family	Species	Common name
Characeae (muskgrass)	*Chara braunii* Gm.	Muskgrass
	Chara zeylanica Klein. ex Willd., em.	
	Nitella flexilis (L). Ag., em.	Stonewort
Potamogetonaceae (pondweed)	*Potamogeton perfoliatus* L. var. *bupleuroides* (Fernald) Farwell	Redhead grass
	Potamogeton epihydrus	Leafy pondweed
	Potamogeton pectinatus L.	Sago pondweed
	Potamogeton crispus L.	Curly pondweed
	Potamogeton pusillus L.	Slender pondweed
Ruppiaceae	*Ruppia maritima* L.	Widgeon grass
Zannichelliaceae	*Zannichellia palustris* L.	Horned pondweed
Najadaceae	*Najas guadalupensis* (Sprengel) Magnus	Southern naiad
	Najas gracillima (A. Braun) Magnus	Naiad
	Najas minor Allioni	
Hydrocharitaceae (frogbit)	*Vallisneria americana* Michaux	Wild celery, tapegrass
	Elodea canadensis (Michaux)	Common elodea
	Egeria densa Planchon	Water-weed
	Hydrilla verticillata (L.f.) Boyle	Hydrilla
Pontedariaceae (pickerelweed)	*Heteranthera dubia* (Jacquin) MacMillian	Water stargrass
Ceratophyllaceae (coontail)	*Ceratophyllum demersum* L.	Coontail
Trapaceae	*Trapa natans* L.	Water chestnut
Haloragaceae (watermilfoil)	*Myriophyllum spicatum* L.	Eurasian watermilfoil
Zosteraceae	*Zostera marina* (L.)	Eelgrass

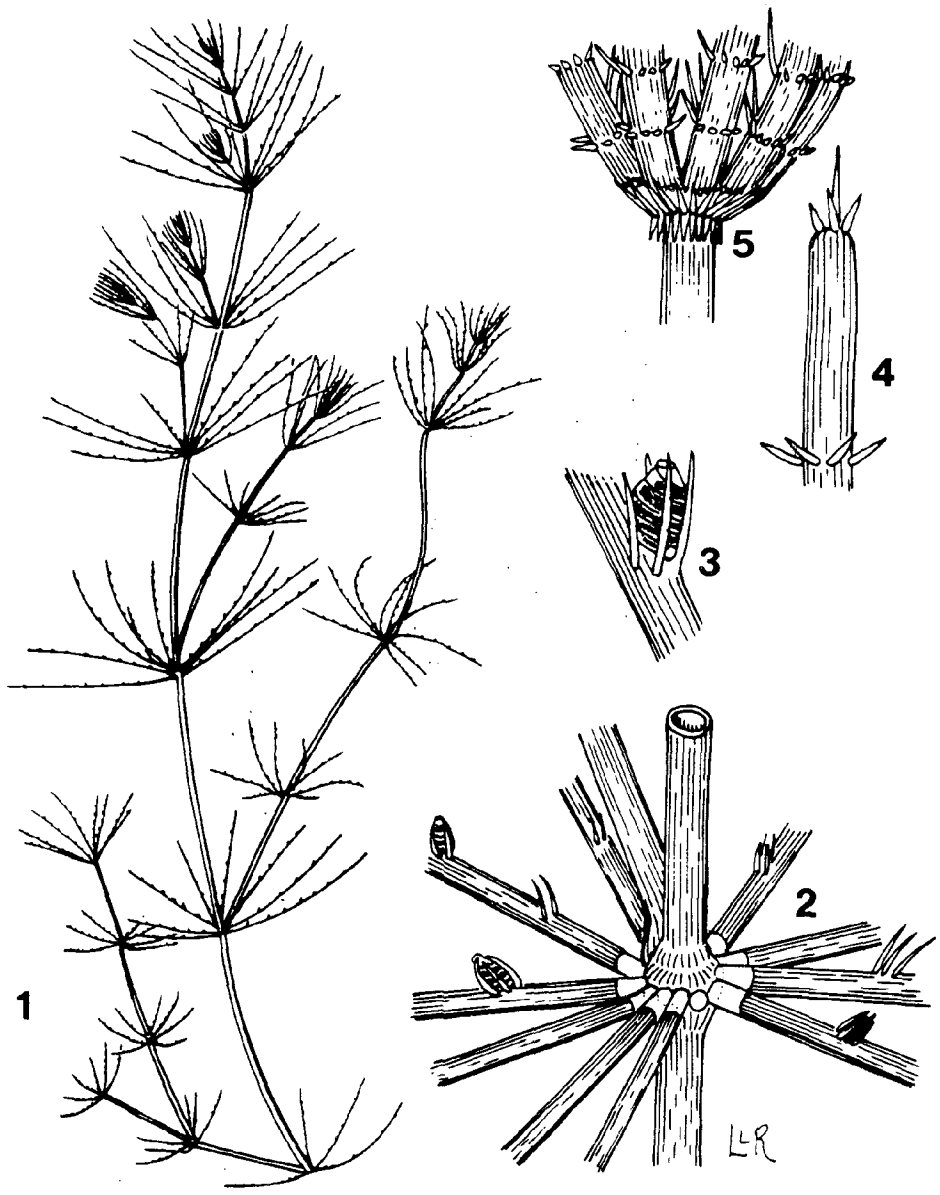


Figure 30. Illustration of *Chara* spp. (Muskgrass): 1. habit, upper portion of plant with branchlet whorls; 2. axial node and fertile branchlets with oogonia; 3. oogonium; 4. branchlet end segment; 5. axial node with 2 tier stipulodes.

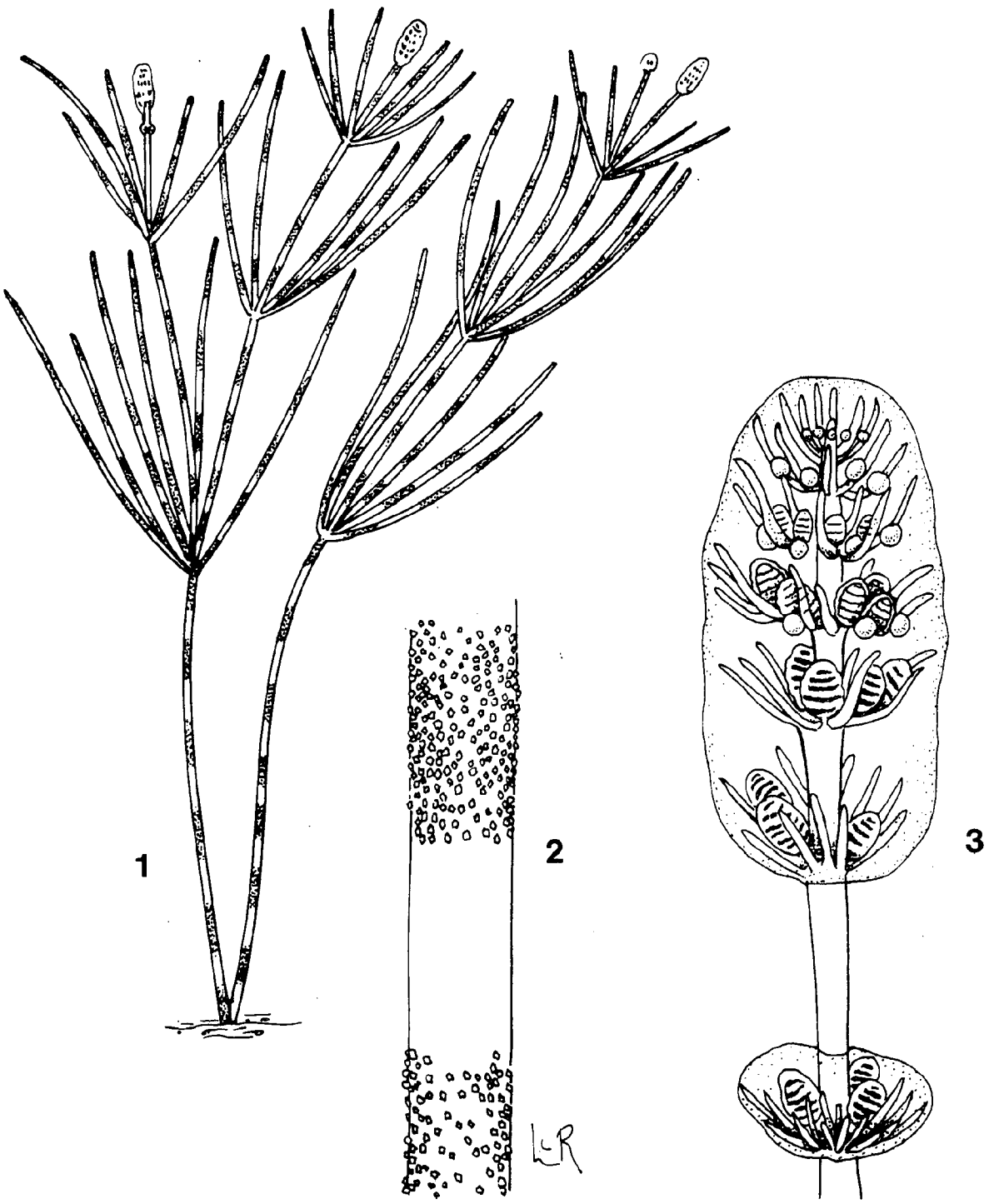


Figure 31. Illustration of *Nitella* spp. (Stonewort): 1. habit, entire plant; 2. portion of ecorticate branchlet; 3. mucus cloud surrounding compacted upper whorls with gametangia.

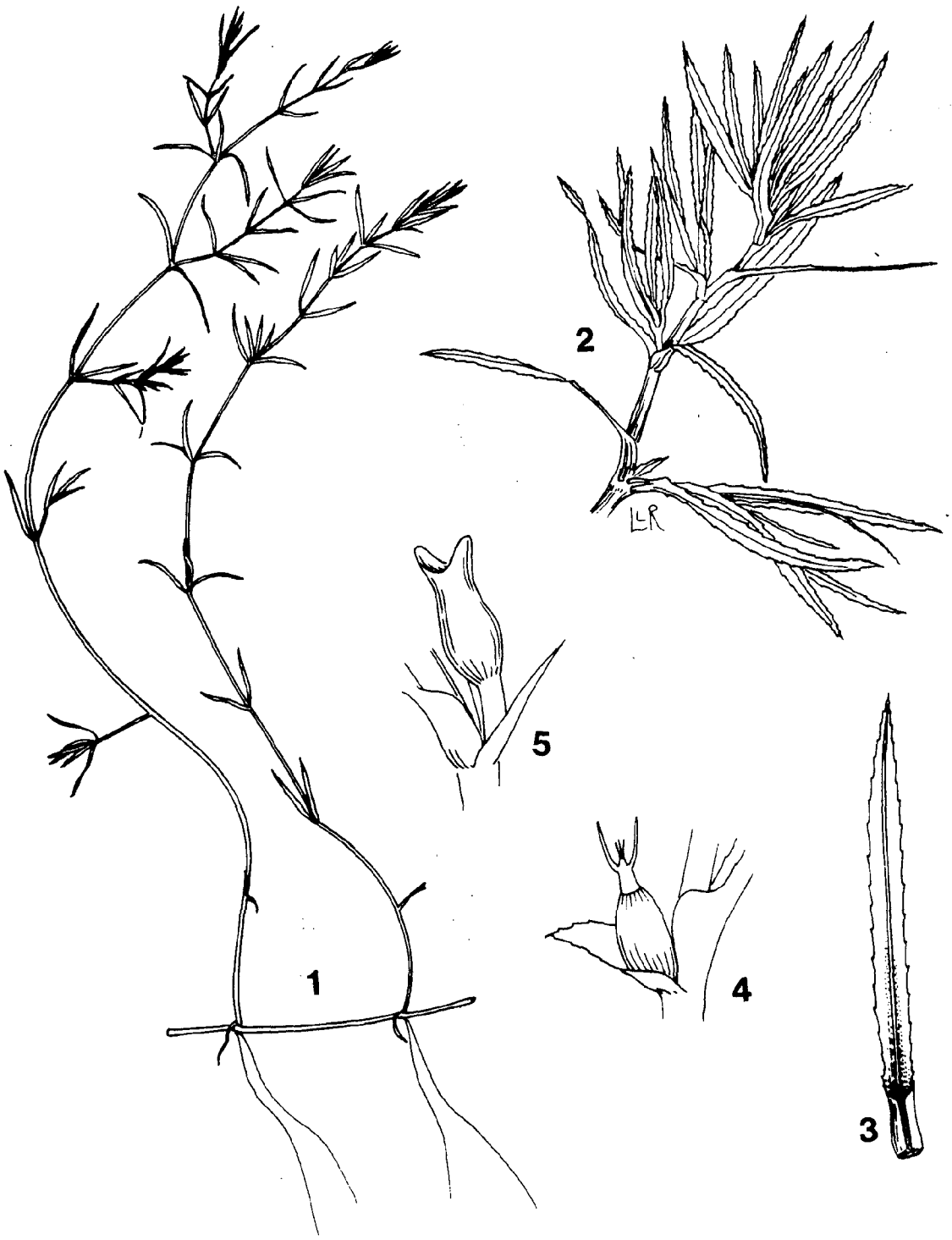


Figure 32. Illustration of *Najas guadalupensis* (Southern naiad): 1. habit, portion of plant; 2. branches; 3. leaf; 4. female flower; 5. male flower.

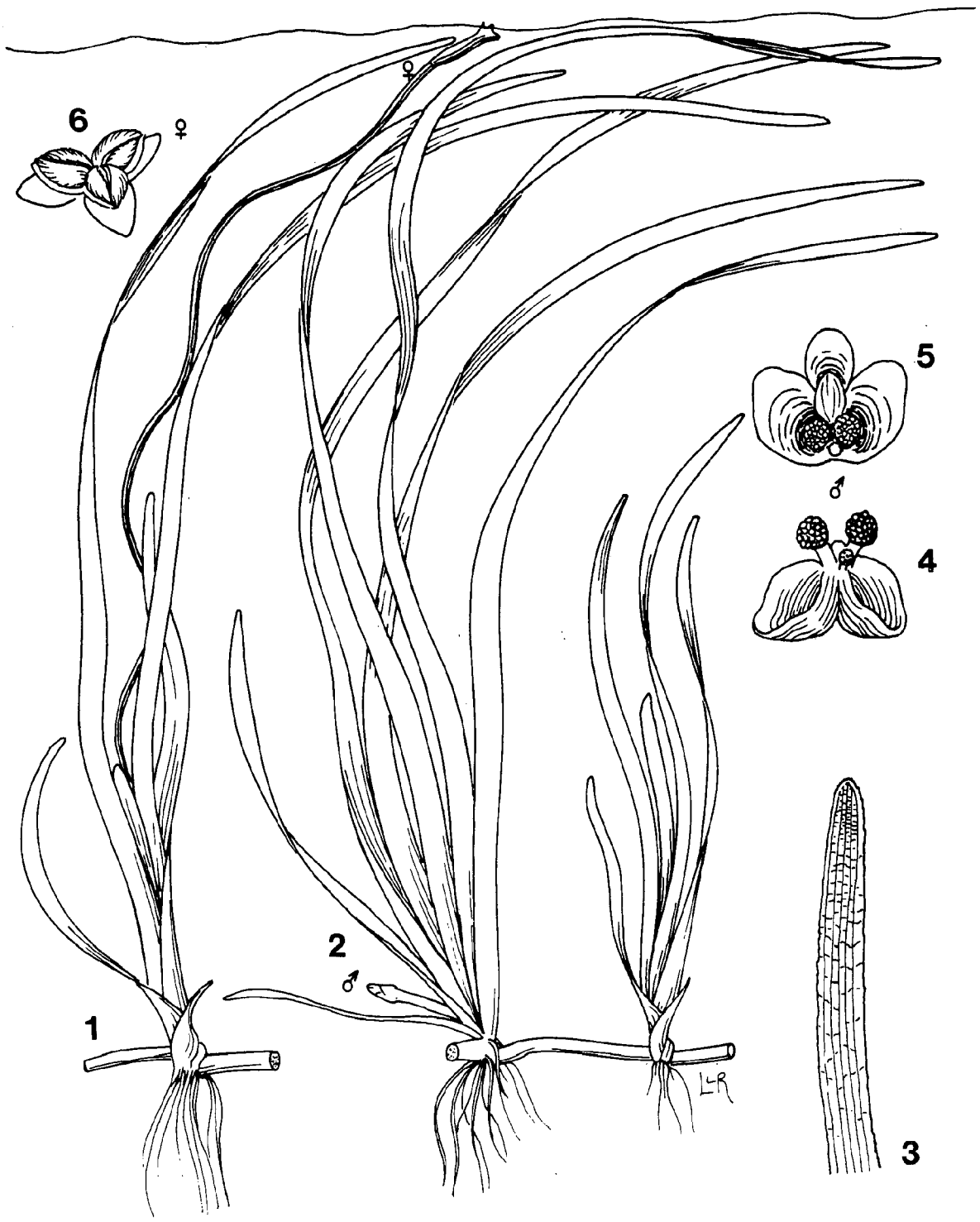


Figure 33. Illustration of *Vallisneria americana* (Tapegrass): 1. female plant; 2. male plant; 3. leaf tip with longitudinal air channels; 4-5. male flower (two views); 6. female flower.

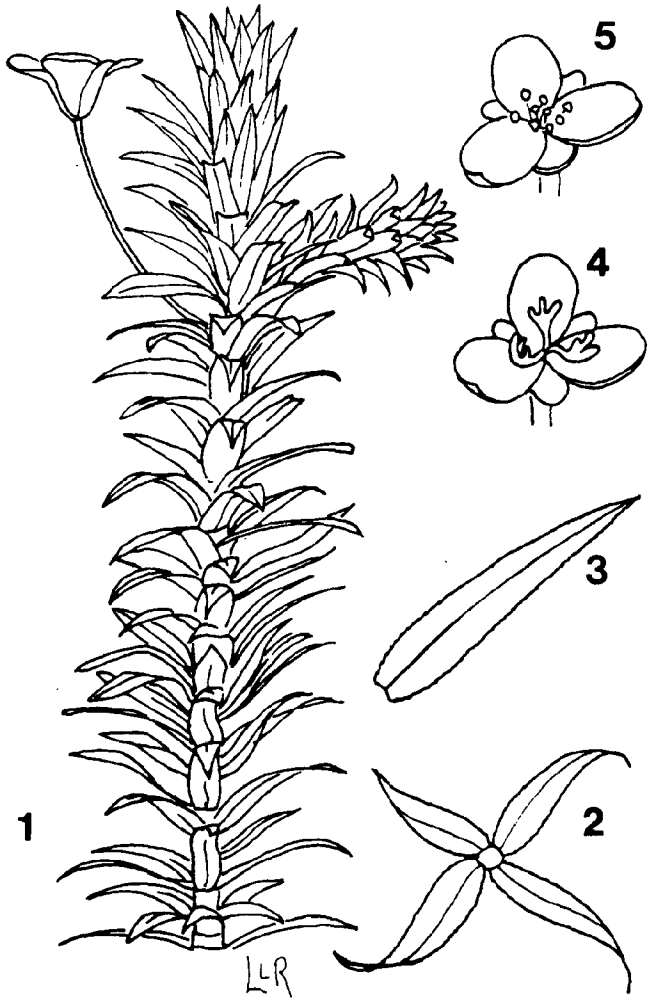


Figure 34. Illustration of *Egeria* spp. (Water-weed): 1. habit, end of branched stem with flower; 2. leaf whorl; 3. leaf; 4. female flower; 5. male flower.

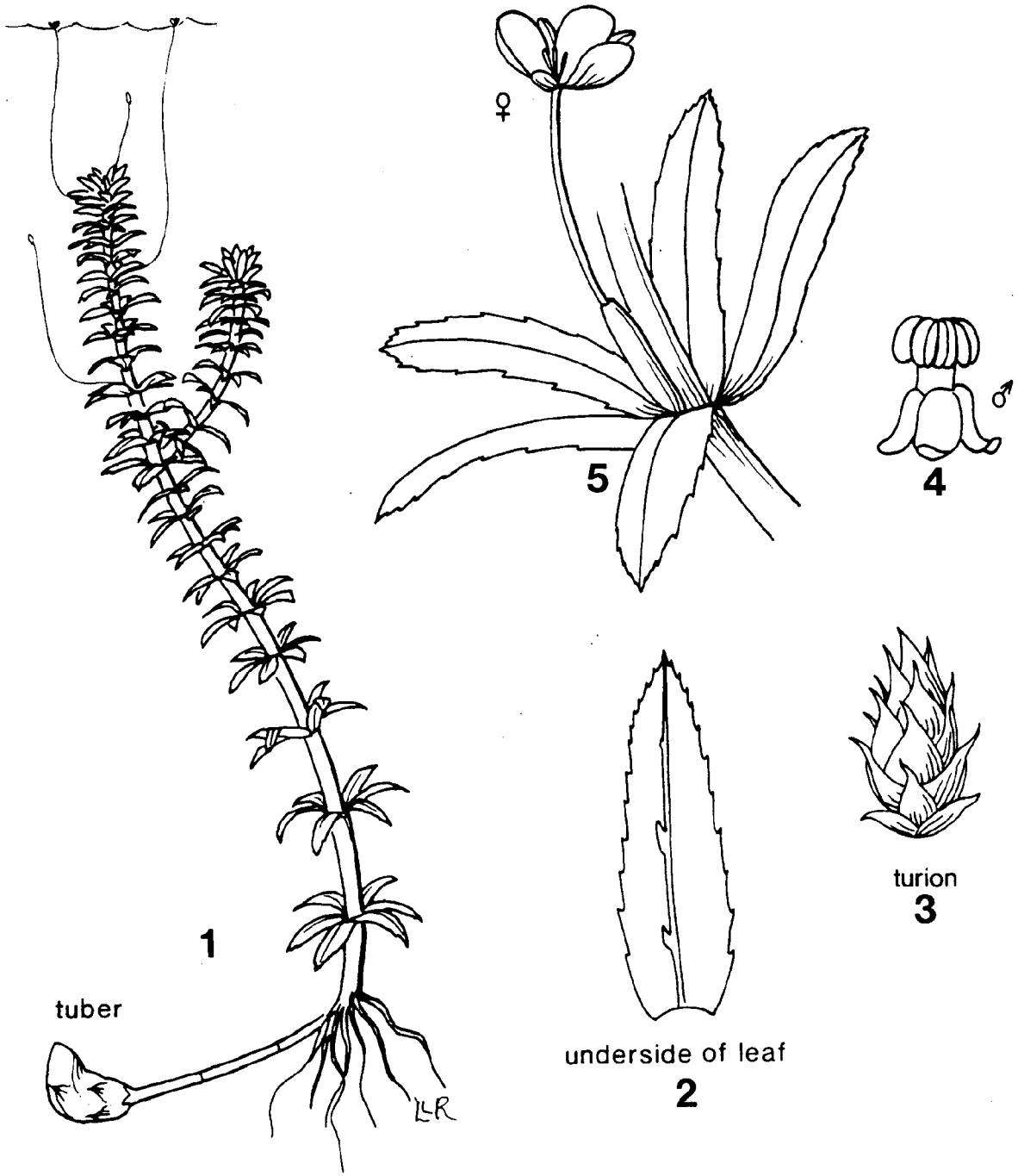


Figure 35. Illustration of *Hydrilla verticillata* (Hydrilla): 1. habit, entire plant; 2. leaf; 3. turion; 4. male flower; 5. female flower and leaf whorl.

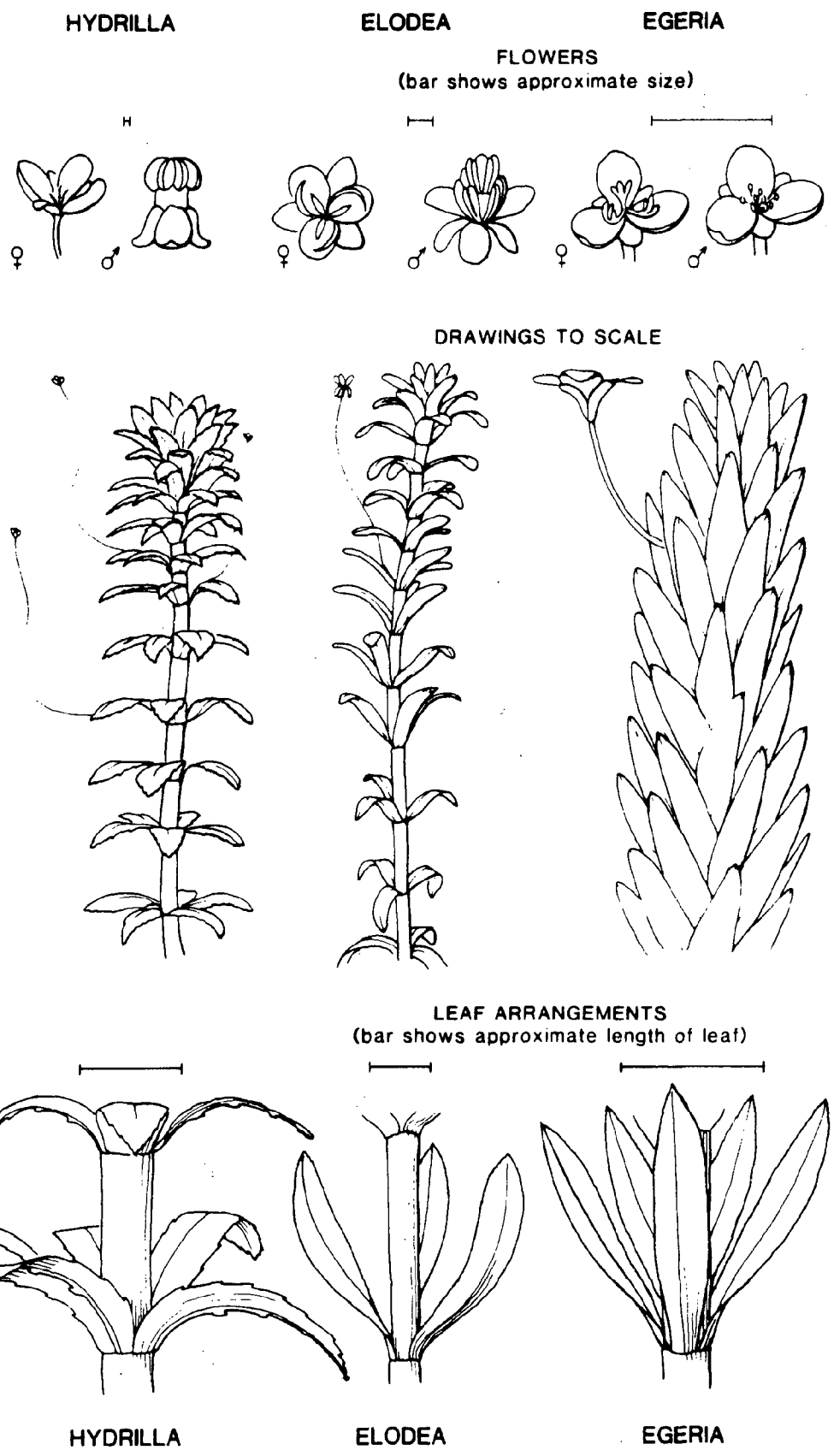


Figure 36. A comparison: illustrations of *Hydrilla verticillata*, *Elodea canadensis*, and *Egeria* spp.

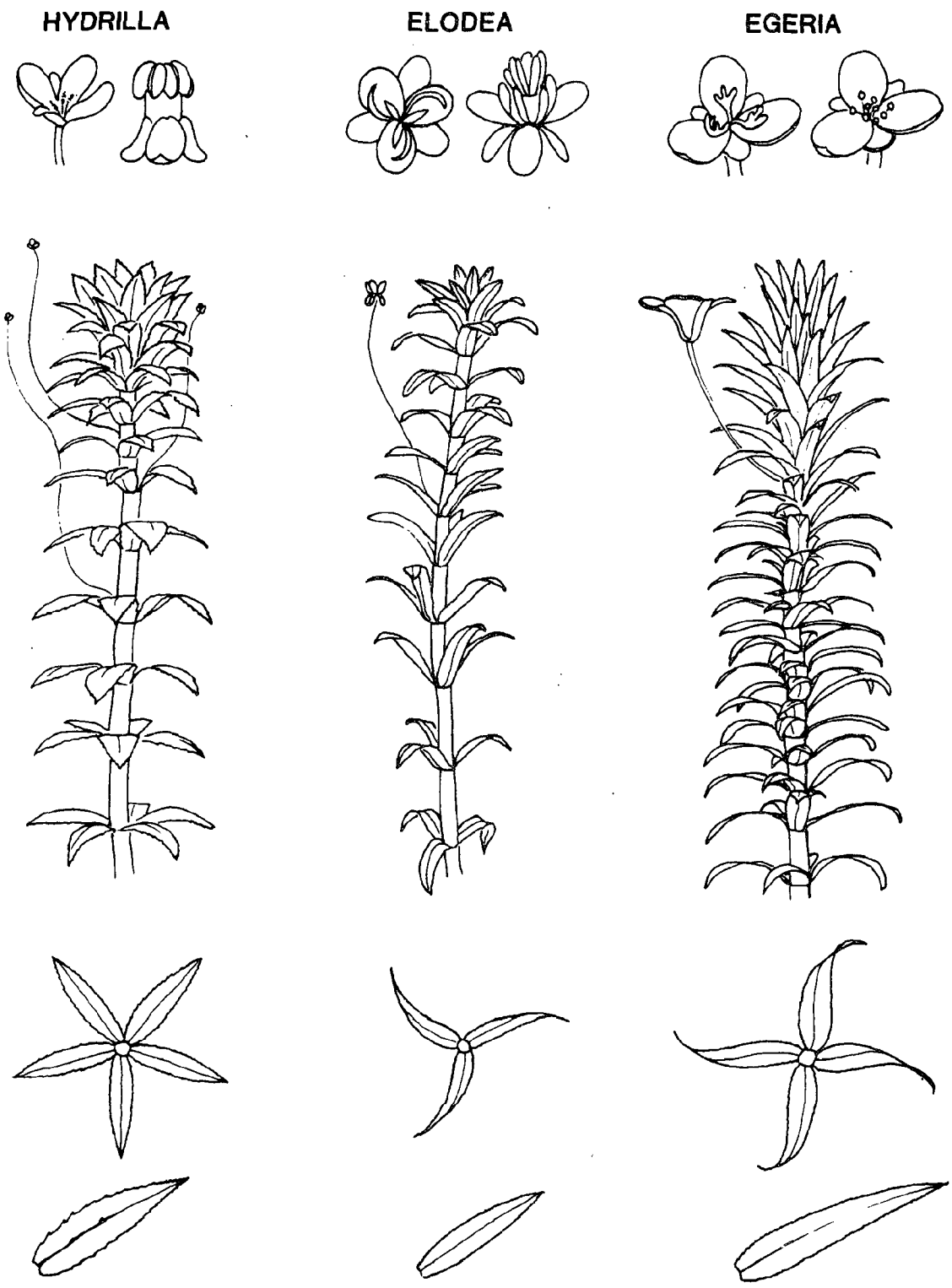


Figure 37. A comparison: illustrations of *Hydrilla verticillata*, *Elodea canadensis*, and *Egeria* spp. showing ends of stems with flowers; leaf whorls; single leaves.

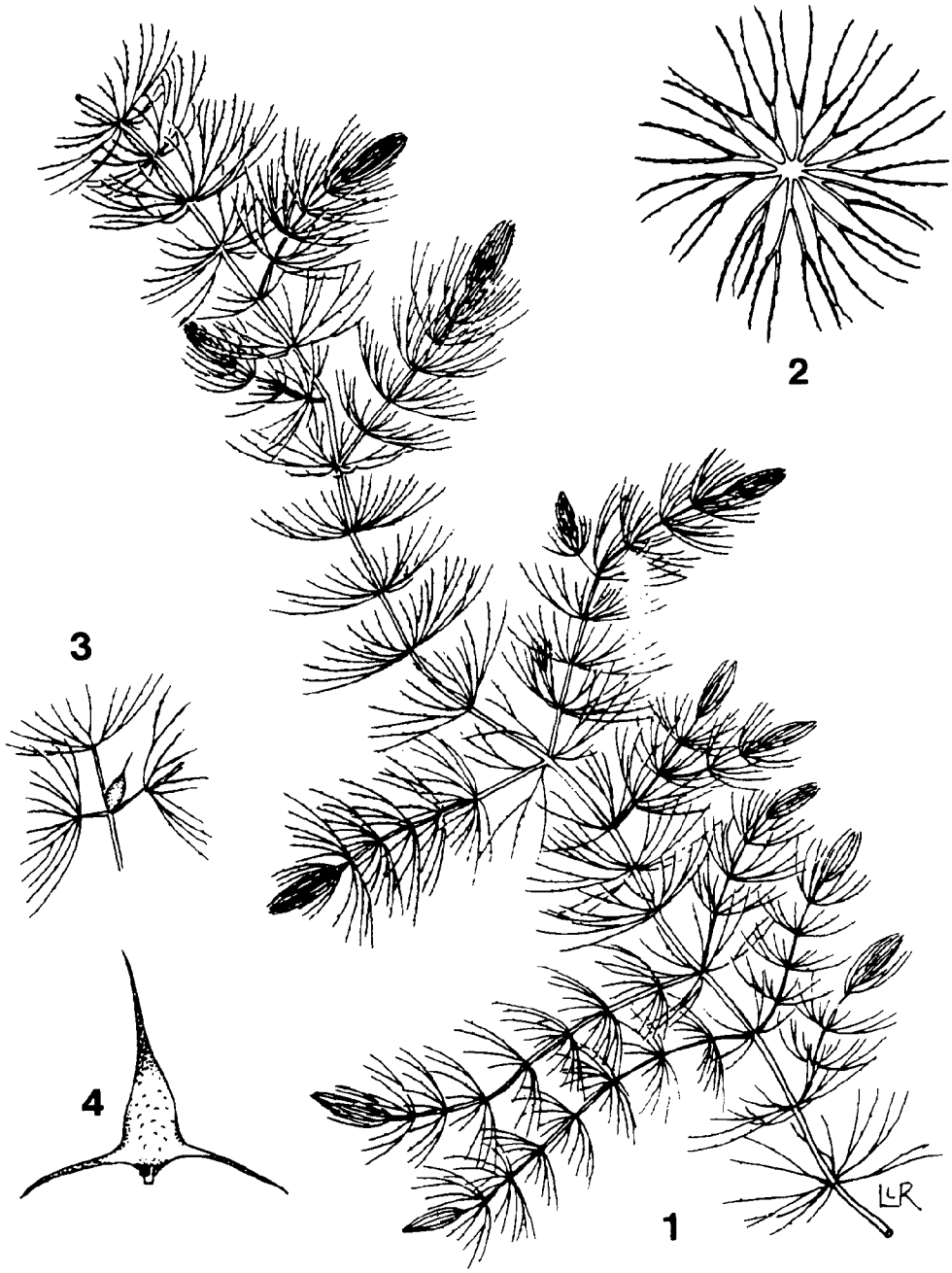


Figure 38. Illustration of *Ceratophyllum demersum* (Coontail): 1. habit, portion of plant; 2. leaf whorl; 3. flower in axil of whorl with branches; 4. fruit.

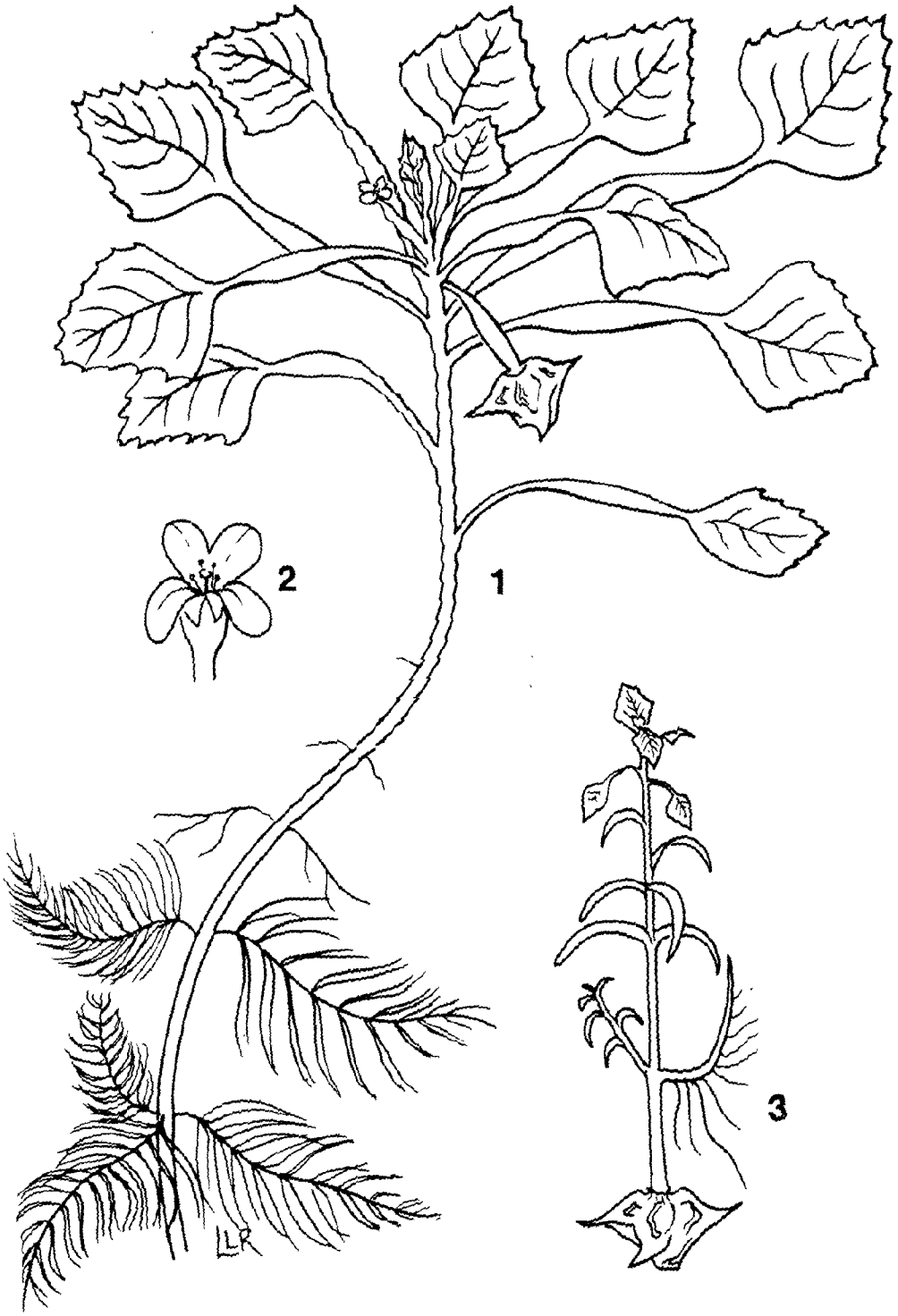


Figure 39. Illustration of *Trapa natans* (Water chestnut): 1. habit, portion of mature plant; 2. flower; 3. seedling.

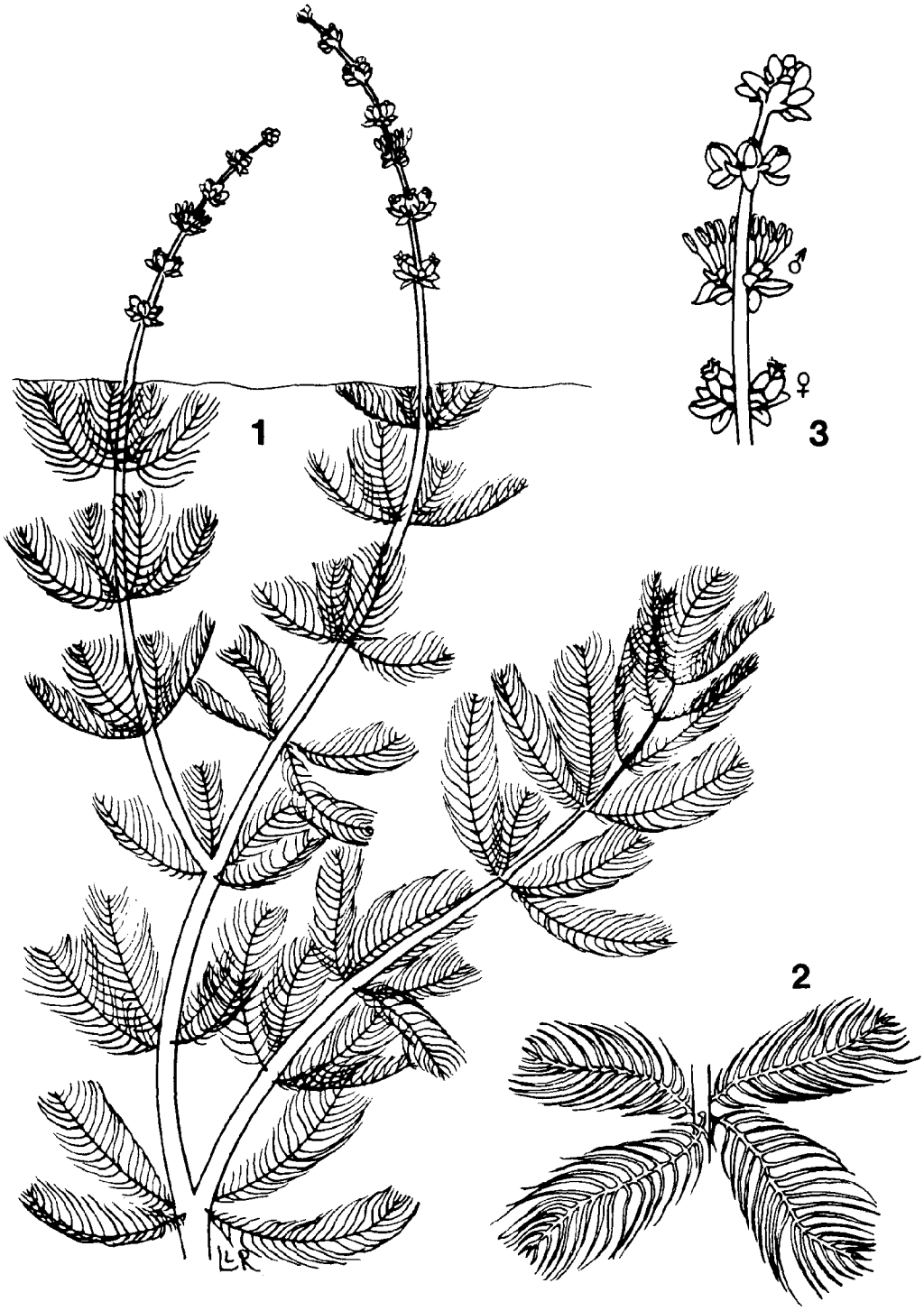


Figure 40. Illustration of *Myriophyllum spicatum* (Eurasian watermilfoil): 1. habit, upper portion of plant with flower spike borne above water; 2. leaf whorl; 3. female and male flowers on spike.

APPENDIX B

Latitude And Longitude Coordinate Points Defining the 21 Major Chesapeake Bay Sections and Chincoteague Bay. (For section locations and descriptions see Fig. 7 and Table 3.)

	Latitude Deg Min	Longitude Deg Min
SEC. 1. Susquehanna Flats		
	39 27.00	76 10.00
	39 39.15	76 10.00
	39 39.15	75 51.00
	39 27.50	76 00.00
	39 26.50	76 01.31
SEC. 2. Upper Eastern Shore		
	39 10.00	76 20.00
	39 20.00	76 12.50
	39 26.50	76 01.31
	39 27.50	76 00.00
	39 39.15	75 51.00
	39 39.15	75 45.00
	39 19.50	75 45.00
	39 20.00	76 00.00
	39 12.55	76 10.40
	39 09.25	76 16.00
SEC. 3. Upper Western Shore		
	39 12.40	76 49.00
	39 30.00	76 20.00
	39 27.00	76 10.00
	39 26.50	76 01.31
	39 20.00	76 12.50
	39 10.00	76 20.00
	39 00.00	76 20.00
	39 03.50	76 32.30
	39 06.82	76 35.40
	39 11.15	76 40.00
SEC. 4. Chester River		
	39 00.00	76 20.00
	39 10.00	76 20.00
	39 09.25	76 16.00
	39 12.55	76 10.40
	39 20.00	76 00.00
	39 19.50	75 45.00
	39 05.00	75 45.00
	39 05.00	76 00.00
	38 57.10	76 11.85
	39 00.00	76 19.10
SEC. 5. Central Western Shore		
	38 42.90	76 35.00
	38 55.00	76 37.50
	39 12.40	76 49.00
	39 11.15	76 40.00
	39 06.82	76 35.40
	39 03.50	76 32.30
	39 00.00	76 20.00
	38 55.00	76 25.00
	38 45.00	76 25.00
SEC. 6. Eastern Bay		
	38 45.00	76 25.00
	38 55.00	76 25.00
	39 00.00	76 20.00
	39 00.00	76 19.10
	38 57.10	76 11.85
	39 05.00	76 00.00
	38 50.00	76 01.65
	38 44.10	76 10.50
	38 50.00	76 16.50
	38 45.00	76 20.00
	38 42.50	76 20.50
SEC. 7. Choptank River		
	38 23.50	76 20.00
	38 45.00	76 25.00
	38 42.50	76 20.50
	38 45.00	76 20.00
	38 50.00	76 16.50
	38 44.10	76 10.50
	38 50.00	76 01.65
	39 05.00	76 00.00
	39 05.00	75 45.00
	38 45.00	75 45.00
	38 45.00	75 50.00
	38 21.93	75 55.00
	38 25.00	76 06.80

	Latitude Deg Min	Longitude Deg Min
SEC. 8. Patuxent River		
	38 15.00	76 25.45
	38 35.00	77 00.00
	38 58.00	76 45.00
	38 55.00	76 37.50
	38 42.90	76 35.00
	38 30.00	76 32.30
	38 21.66	76 23.50
	38 18.00	76 22.83
SEC. 9. Middle Western Shore		
	38 02.85	76 19.40
	38 05.00	76 21.54
	38 15.00	76 25.45
	38 18.00	76 22.83
	38 21.66	76 23.50
	38 30.00	76 32.30
	38 42.90	76 35.00
	38 45.00	76 25.00
	38 23.50	76 20.00
	38 05.00	76 10.00
SEC. 10. Lower Potomac River		
	37 53.40	76 14.45
	37 55.50	76 18.15
	37 53.85	76 28.00
	38 06.15	76 53.00
	38 15.00	77 06.40
	38 20.00	77 09.40
	38 24.20	77 14.08
	38 35.00	77 00.00
	38 15.00	76 25.45
	38 05.00	76 21.54
	38 02.85	76 19.40
	38 05.00	76 10.00
	37 50.00	76 10.00

	Latitude Deg Min	Longitude Deg Min
SEC. 11. Upper Potomac River		
	38 15.00	77 06.40
	38 20.00	77 24.80
	38 27.65	77 25.00
	39 01.80	77 17.10
	38 58.00	76 45.00
	38 35.00	77 00.00
	38 24.20	77 14.08
	38 20.00	77 09.40
SEC. 12. Middle Eastern Shore		
	38 11.10	76 13.30
	38 23.50	76 20.00
	38 25.00	76 06.80
	38 21.93	75 55.00
	38 45.00	75 50.00
	38 40.00	75 37.00
	38 00.00	75 38.00
	38 00.73	75 49.50
	37 57.10	75 50.30
	37 55.00	75 55.10
	38 11.70	75 59.00
	38 13.60	76 05.83
SEC. 13. Mid-Bay Island Complex		
	37 45.00	75 58.30
	37 50.00	76 10.00
	38 05.00	76 10.00
	38 11.10	76 13.30
	38 13.60	76 05.83
	38 11.70	75 59.00
	37 55.00	75 55.10
SEC. 14. Lower Eastern Shore		
	37 00.00	75 58.95
	37 20.00	76 10.00
	37 38.75	76 10.00
	37 50.00	76 10.00
	37 45.00	75 58.30
	37 55.00	75 55.10
	37 57.10	75 50.30
	38 00.73	75 49.50
	38 00.00	75 38.00
	38 00.00	75 30.00
	37 46.45	75 39.30
	37 20.00	75 55.50

	Latitude Deg Min	Longitude Deg Min
SEC. 15. Reedville		
	37 38.75	76 10.00
	37 37.40	76 21.40
	37 38.05	76 23.50
	37 44.35	76 23.00
	37 48.00	76 28.00
	37 53.85	76 28.00
	37 55.50	76 18.15
	37 53.40	76 14.45
	37 50.00	76 10.00
SEC. 16. Rappahannock River Complex		
	37 26.50	76 10.00
	37 25.00	76 18.08
	37 28.00	76 20.00
	37 29.00	76 25.00
	37 32.00	76 35.00
	37 49.15	76 48.00
	37 53.73	76 49.65
	37 58.00	76 45.45
	37 48.00	76 28.00
	37 44.35	76 23.00
	37 38.05	76 23.50
	37 37.40	76 21.40
	37 38.75	76 10.00
SEC. 17. New Point Comfort Region		
	37 17.45	76 16.16
	37 19.45	76 16.62
	37 20.00	76 17.40
	37 21.00	76 17.40
	37 22.25	76 19.50
	37 25.00	76 18.00
	37 26.50	76 10.00
	37 20.00	76 10.00

	Latitude Deg Min	Longitude Deg Min
SEC. 18. Mobjack Bay Complex		
	37 17.00	76 19.33
	37 16.25	76 22.50
	37 17.00	76 25.42
	37 16.50	76 28.50
	37 20.00	76 31.88
	37 25.75	76 31.00
	37 29.00	76 25.00
	37 28.00	76 20.00
	37 25.00	76 18.00
	37 22.25	76 19.50
	37 21.00	76 17.40
	37 20.00	76 17.40
	37 19.30	76 16.62
	37 17.45	76 16.16
SEC. 19. York River		
	37 14.00	76 22.50
	37 13.25	76 24.00
	37 12.50	76 27.50
	37 07.30	76 28.20
	37 14.00	76 36.50
	37 16.72	76 43.65
	37 26.29	76 49.77
	37 30.55	76 40.00
	37 28.56	76 35.00
	37 20.00	76 31.88
	37 16.50	76 28.50
	37 17.00	76 25.42
	37 16.25	76 22.50
	37 17.00	76 19.33
	37 14.00	76 19.33

Latitude Deg Min	Longitude Deg Min

SEC. 20. Lower Western Shore

Latitude Deg Min	Longitude Deg Min
36 49.11	75 58.05
36 45.75	76 07.00
36 55.85	76 16.00
36 57.79	76 16.00
36 58.00	76 17.70
37 01.05	76 18.52
37 03.68	76 19.80
37 00.60	76 24.00
37 07.30	76 28.20
37 12.50	76 27.50
37 13.25	76 24.00
37 14.00	76 22.50
37 14.00	76 19.33
37 17.00	76 19.33
37 17.45	76 16.16
37 20.00	76 10.00
37 00.00	75 58.95

SEC. 21. James River

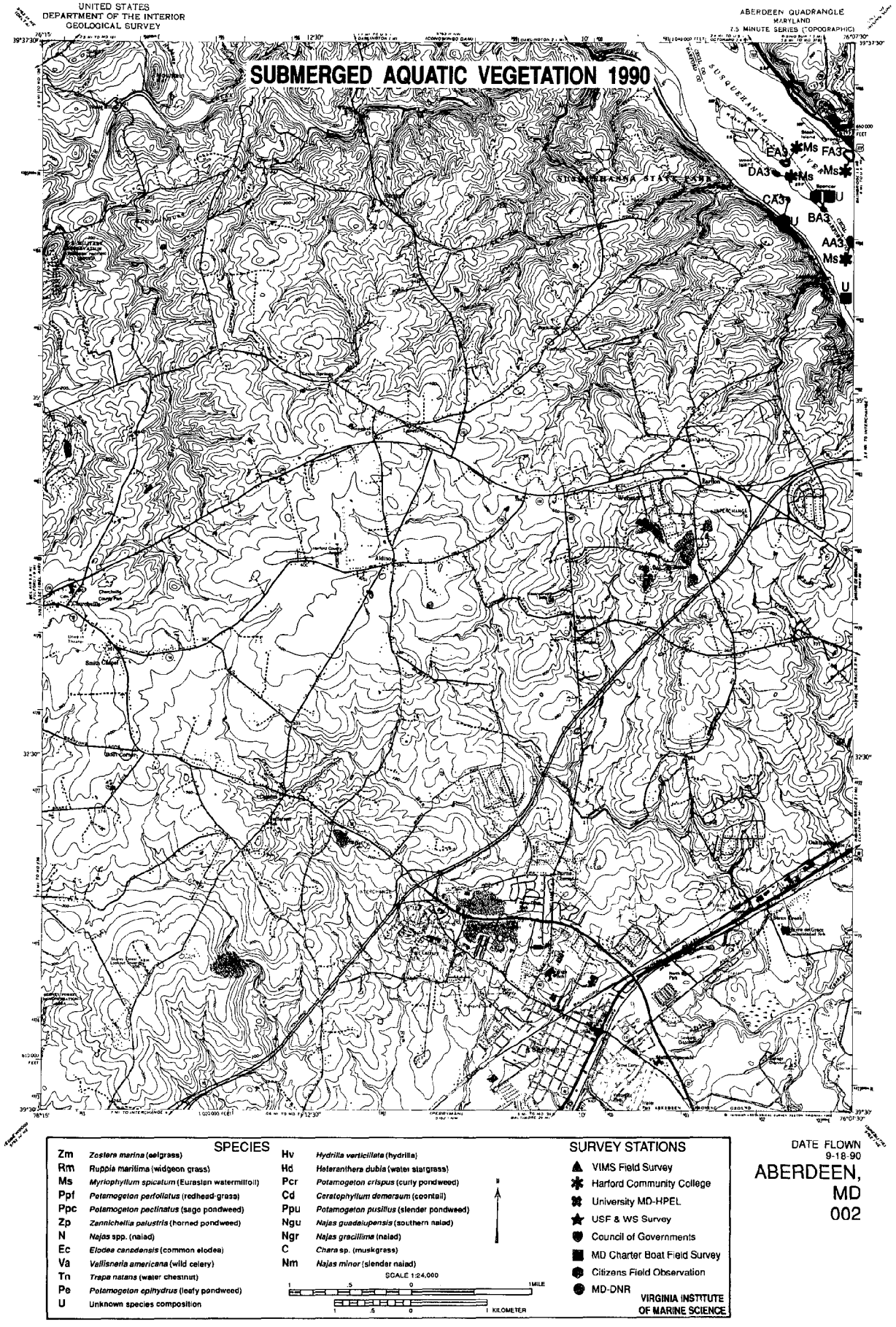
Latitude Deg Min	Longitude Deg Min
36 45.75	76 07.00
36 40.00	76 10.00
36 40.00	76 30.00
36 40.00	76 40.00
36 55.63	76 40.00
37 17.30	77 18.00
37 20.15	77 14.00
37 27.45	77 08.10
37 26.29	76 49.77
37 16.72	76 43.65
37 14.00	76 36.50
37 07.30	76 28.20
37 00.60	76 24.00
37 03.68	76 19.80
37 01.05	76 18.52
36 58.00	76 17.70
36 57.79	76 16.00
36 55.85	76 16.00

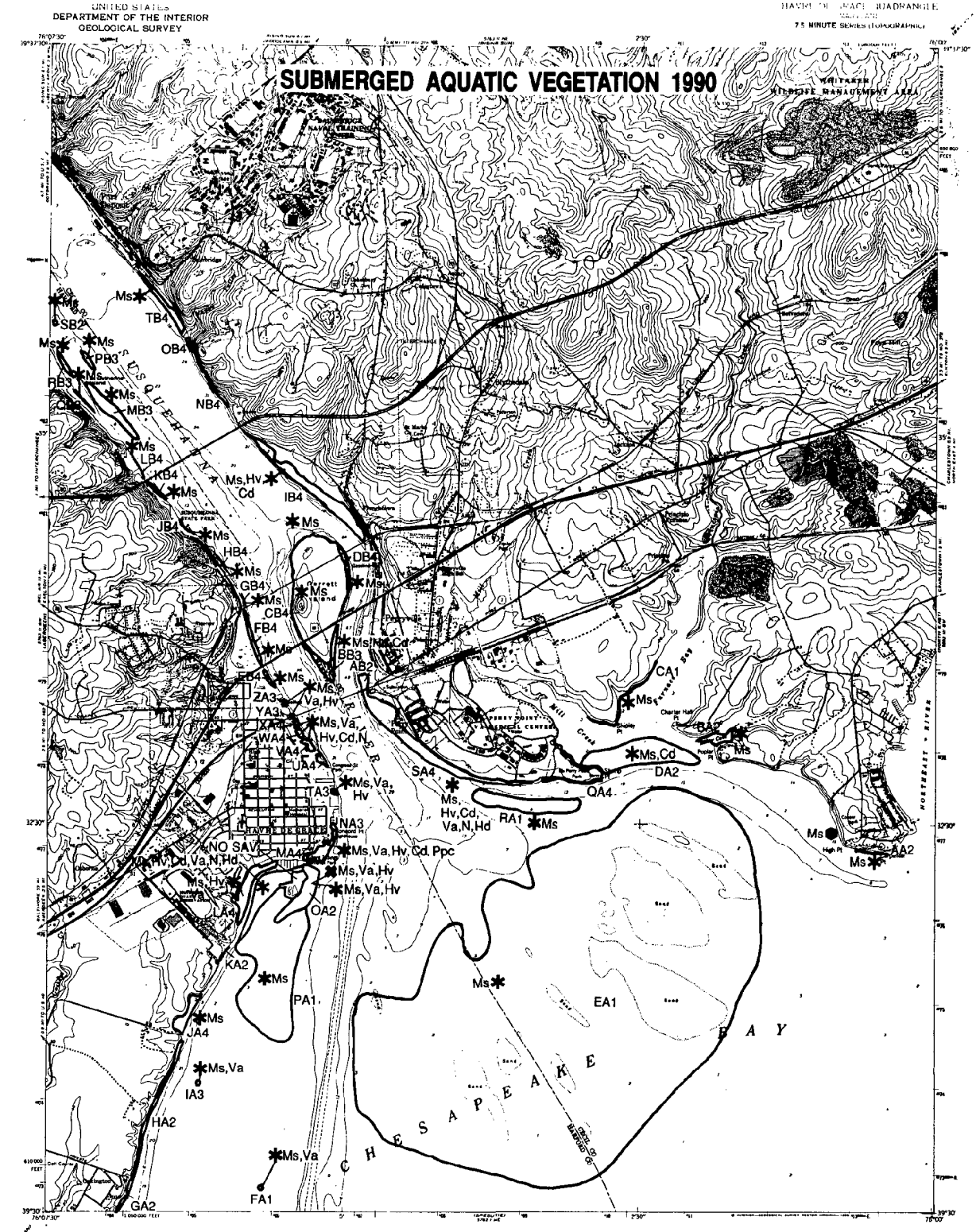
Chincoteague Bay

Latitude Deg Min	Longitude Deg Min
37 52.50	75 30.00
38 00.00	75 30.00
38 07.50	75 22.50
38 15.00	75 17.50
38 15.00	75 15.00
38 22.50	75 15.00
38 30.00	75 10.00
38 30.00	75 02.50
38 22.50	75 02.50
38 15.00	75 07.50
38 07.50	75 10.00
38 00.00	75 15.00
37 52.50	75 20.00
37 51.00	75 22.30
37 51.00	75 30.00

APPENDIX C

Topographic Quadrangles For The Chesapeake Bay And Chincoteague Bay Showing The 1990 Distribution And Abundance of SAV. (Boundaries Of Individual SAV Beds Are Delineated By Solid Lines. Each Is Identified With A Letter (A-Z) And A Number (1-4). These Numbers Represent The Density Classification Discussed In The Text And Fig. 6, i.e. 1 = <10%; 2 = 10-40%; 3 = 40-70%; 4 = 70-100%. Ground Truthing Represented By Symbols And Species Codes Which Are Explained In The Legend On Each Map.)


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ABERDEEN QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
SUSQUEHANNA RIVER
SUSQUEHANNA STATE PARK
EA3
FA3
DA3
CA3
BA3
AA3
Ms
U
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
9-18-90
ABERDEEN, MD
002



SPECIES

Zm	*Zostera marina* (eelgrass)
Rm	*Ruppia maritima* (widgeon grass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)
Ppf	*Potamogeton perfoliatus* (redhead-grass)
Ppc	*Potamogeton pectinatus* (sago pondweed)
Zp	*Zannichellia palustris* (horned pondweed)
N	*Najas* spp. (naiad)
Ec	*Elodea canadensis* (common elodea)
Va	*Vallisneria americana* (wild celery)
Tn	*Trapa natans* (water chestnut)
Pe	*Potamogeton epihydrus* (leafy pondweed)
U	Unknown species composition
Hv	*Hydrilla verticillata* (hydrilla)
Hd	*Heteranthera dubia* (water stargrass)
Pcr	*Potamogeton crispus* (curly pondweed)
Cd	*Ceratophyllum demersum* (coontail)
Ppu	*Potamogeton pusillus* (slender pondweed)
Ngu	*Najas guadalupensis* (southern naiad)
Ngr	*Najas gracillima* (naiad)
C	*Chara* sp. (muskgrass)
Nm	*Najas minor* (slender naiad)

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- ■ MD Charter Boat Field Survey
- Citizens Field Observation
- ● MD-DNR

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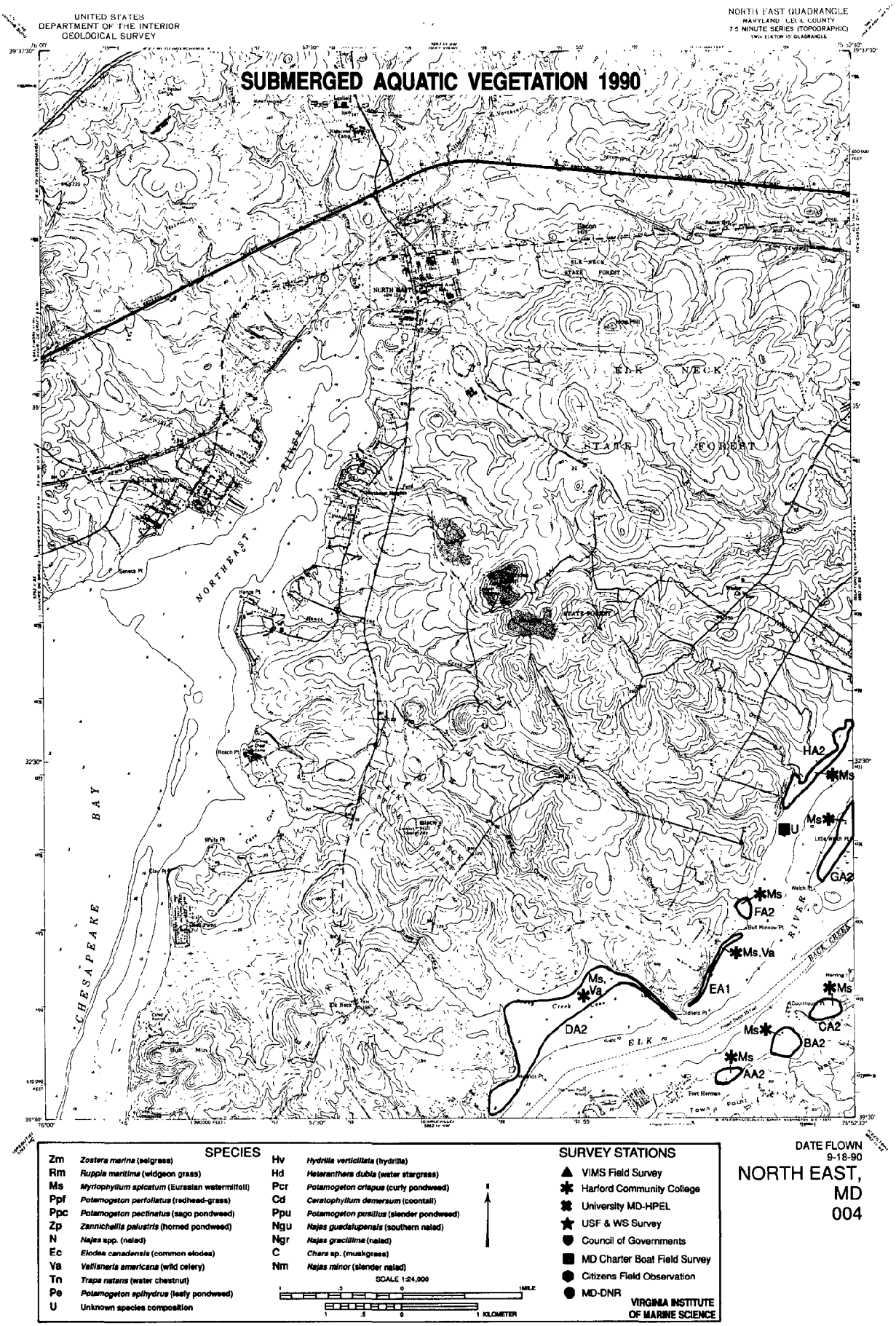
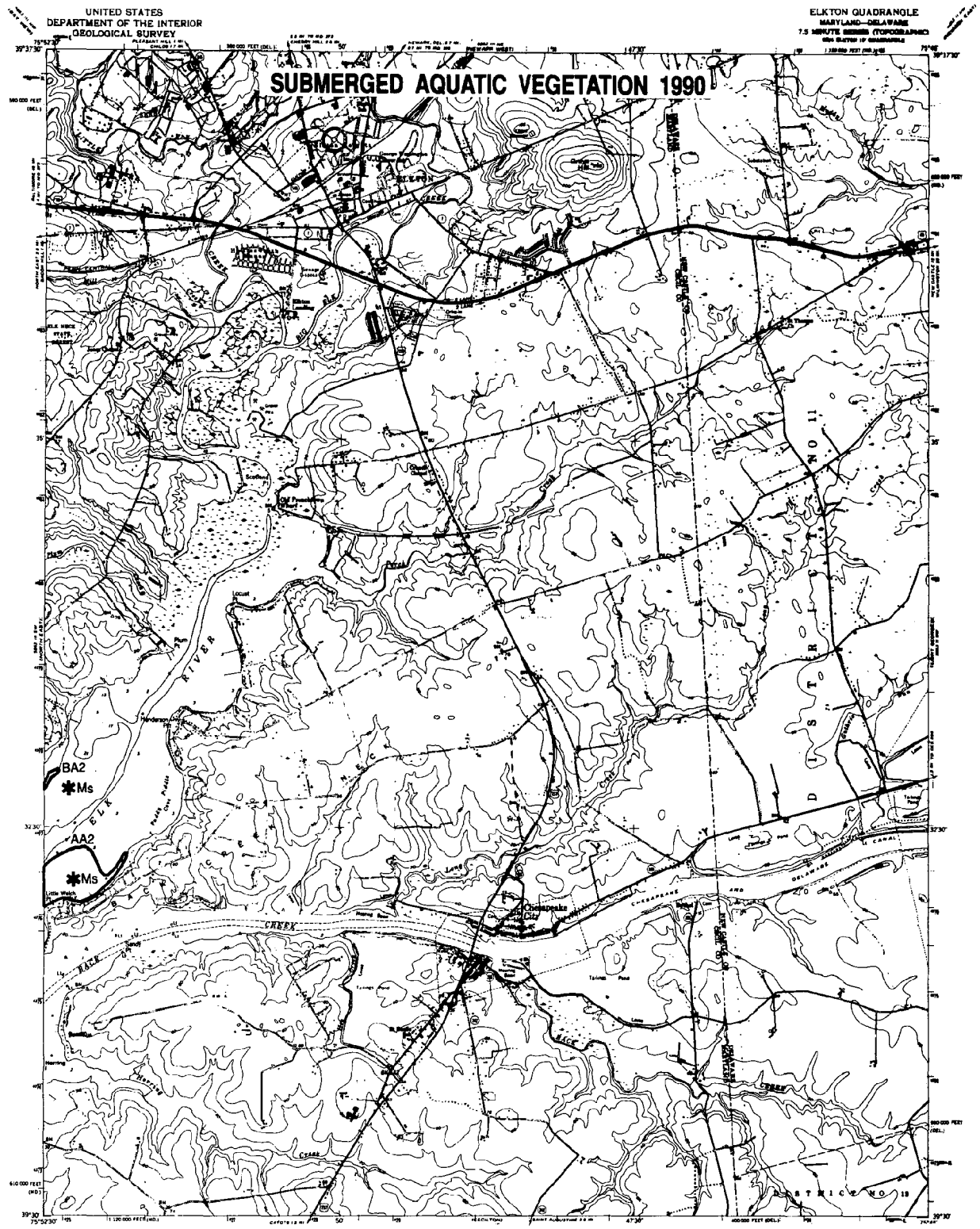
10-6-90

HAVRE DE GRACE, MD
003


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
NORTH EAST QUADRANGLE
MARYLAND CECIL COUNTY
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
ELK NECK
STATE FOREST
NORTHEAST RIVER
CHESAPEAKE BAY
BACK CREEK
HA2
Ms
U
GA2
FA2
Ms,Va
EA1
DA2
CA2
BA2
AA2
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
9-18-90
NORTH EAST, MD
004



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬢ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

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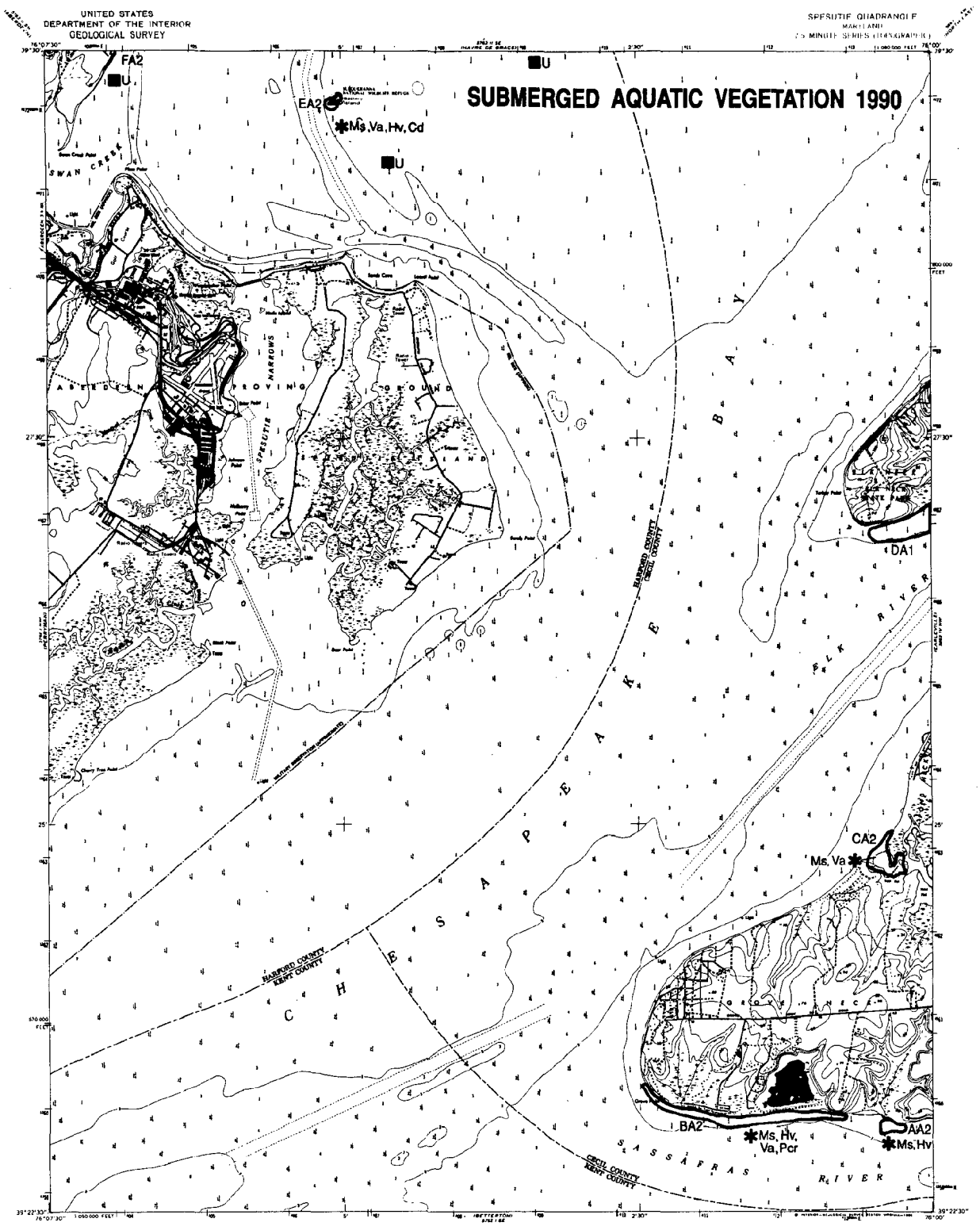
9-18-90

ELKTON,
MD-DE
005



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS	
▲	VIMS Field Survey
✱	Harford Community College
✖	University MD-HPEL
★	USF & WS Survey
⬢	Council of Governments
■	MD Charter Boat Field Survey
⬢	Citizens Field Observation
●	MD-DNR

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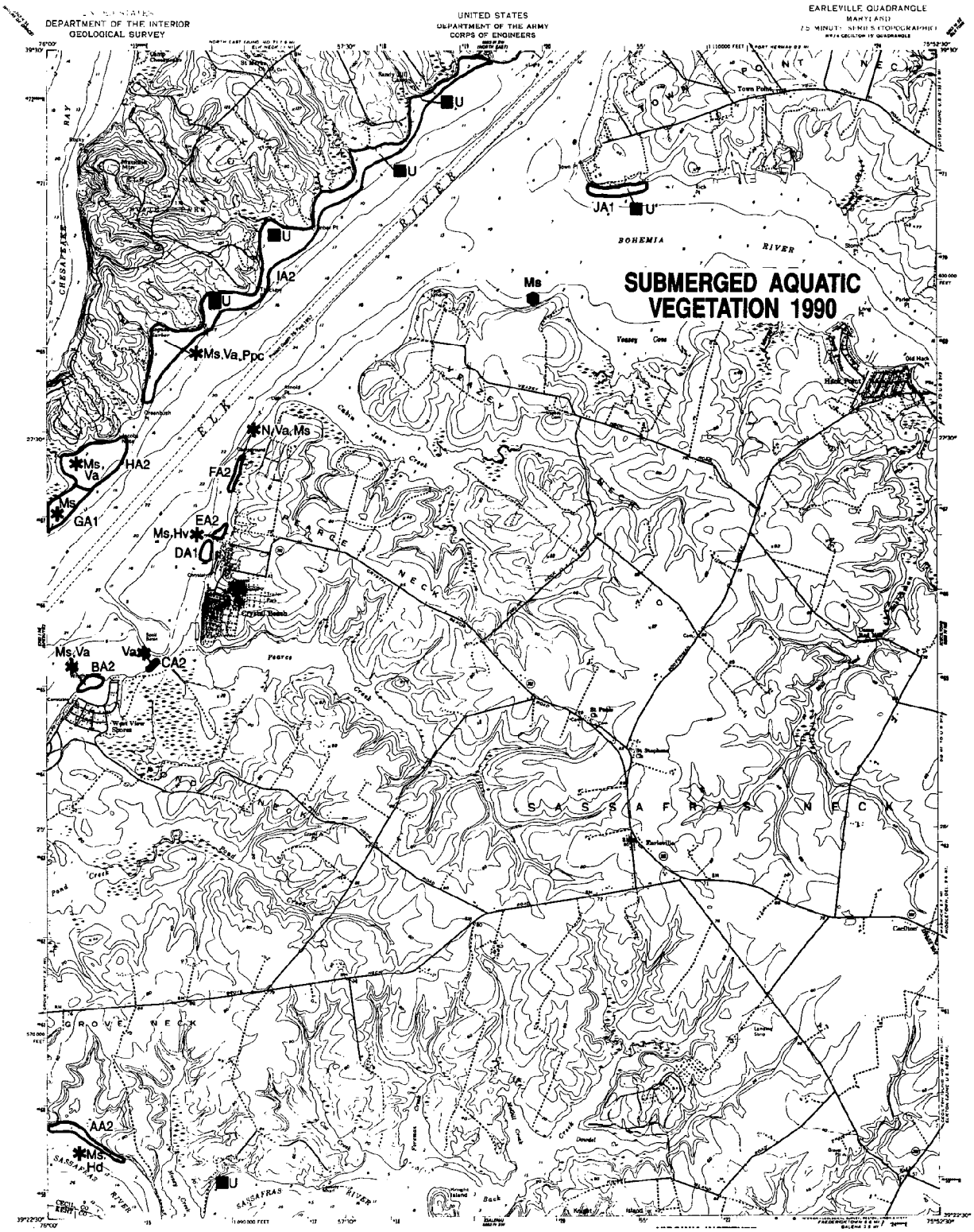
9-18-90

SPESUTIE, MD
009



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE .5 0

1 KILOMETER .5 0

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⛊ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

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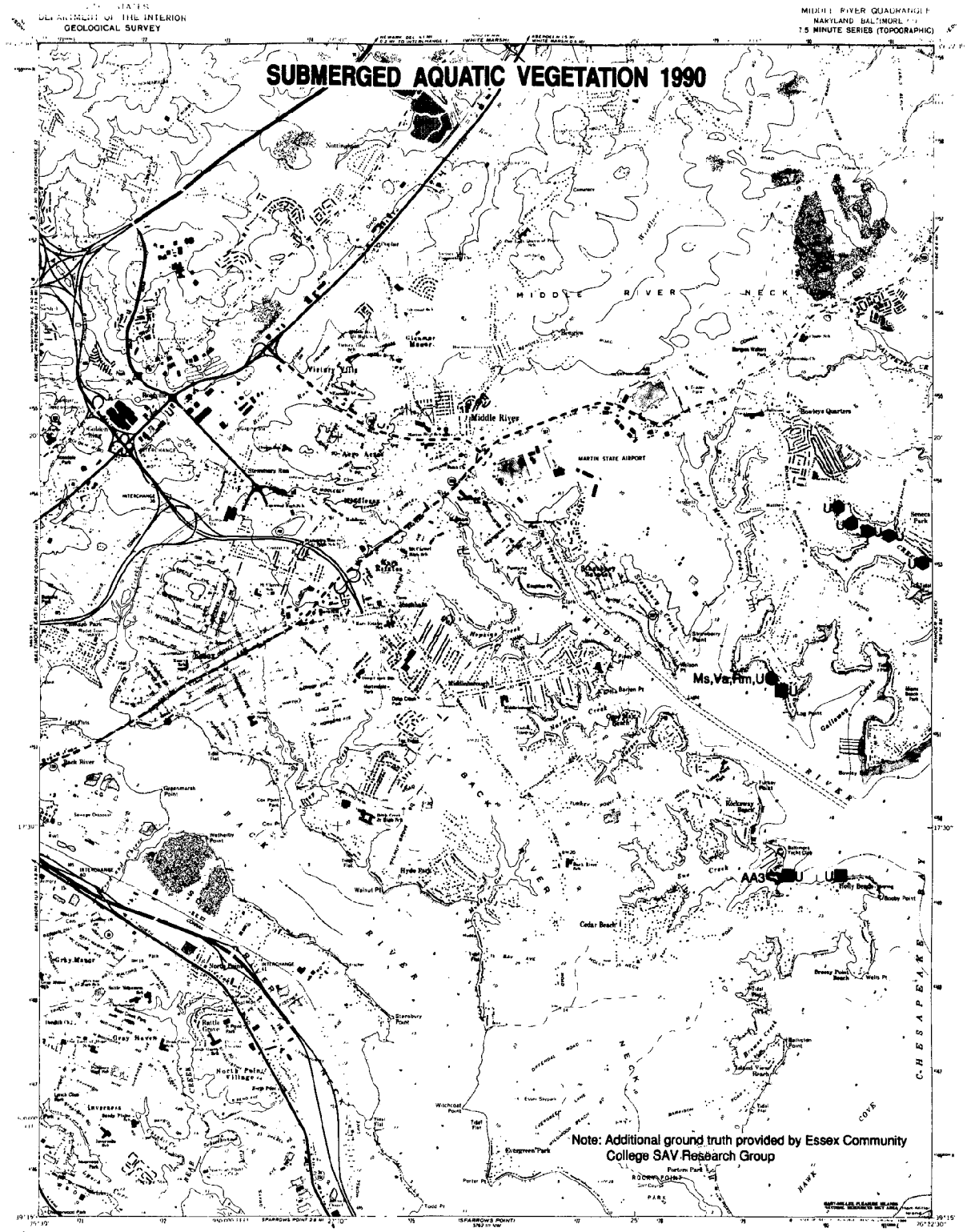
9-18-90

EARLEVILLE, MD
010



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

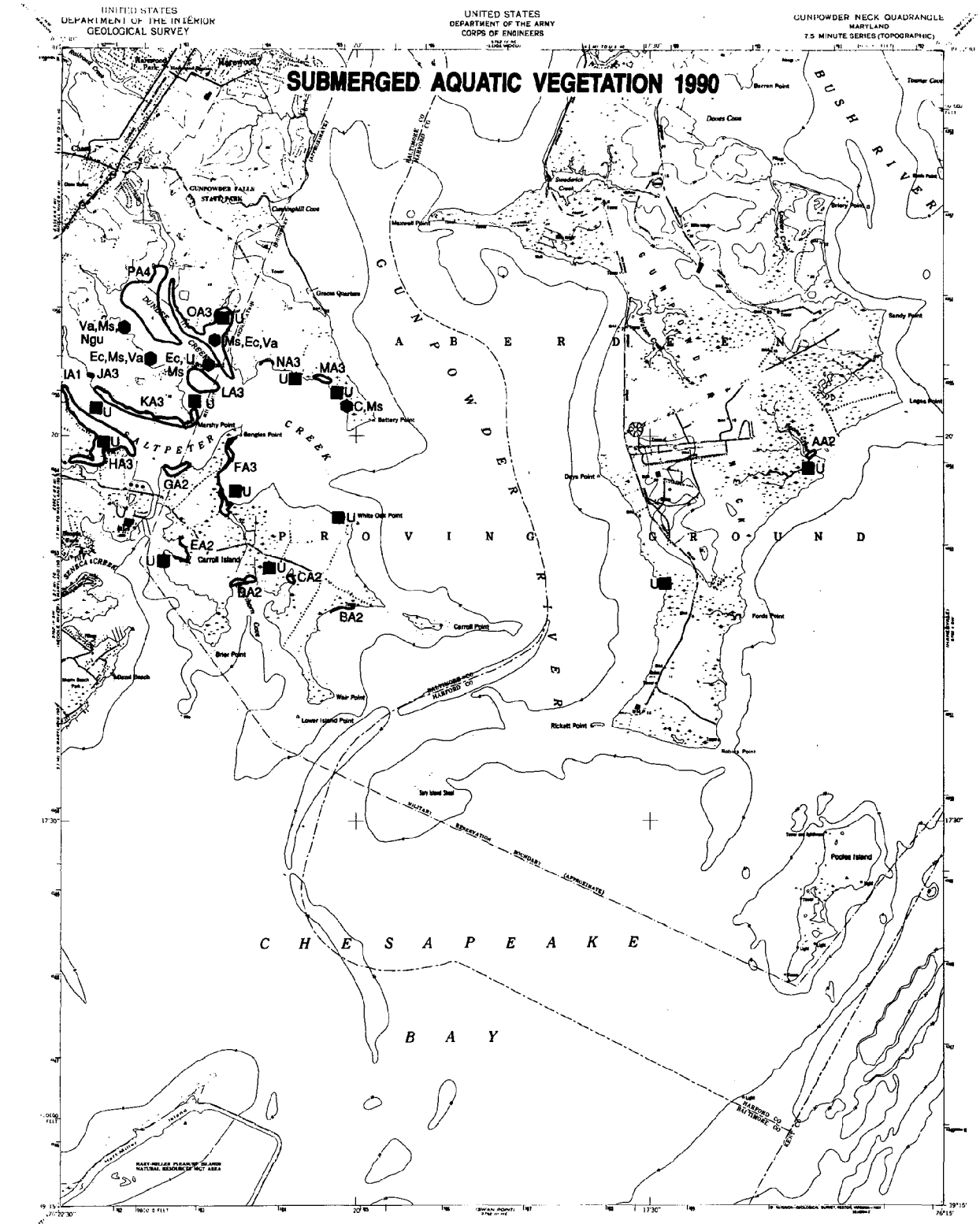
SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
10-1-90

MIDDLE RIVER, MD
013



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

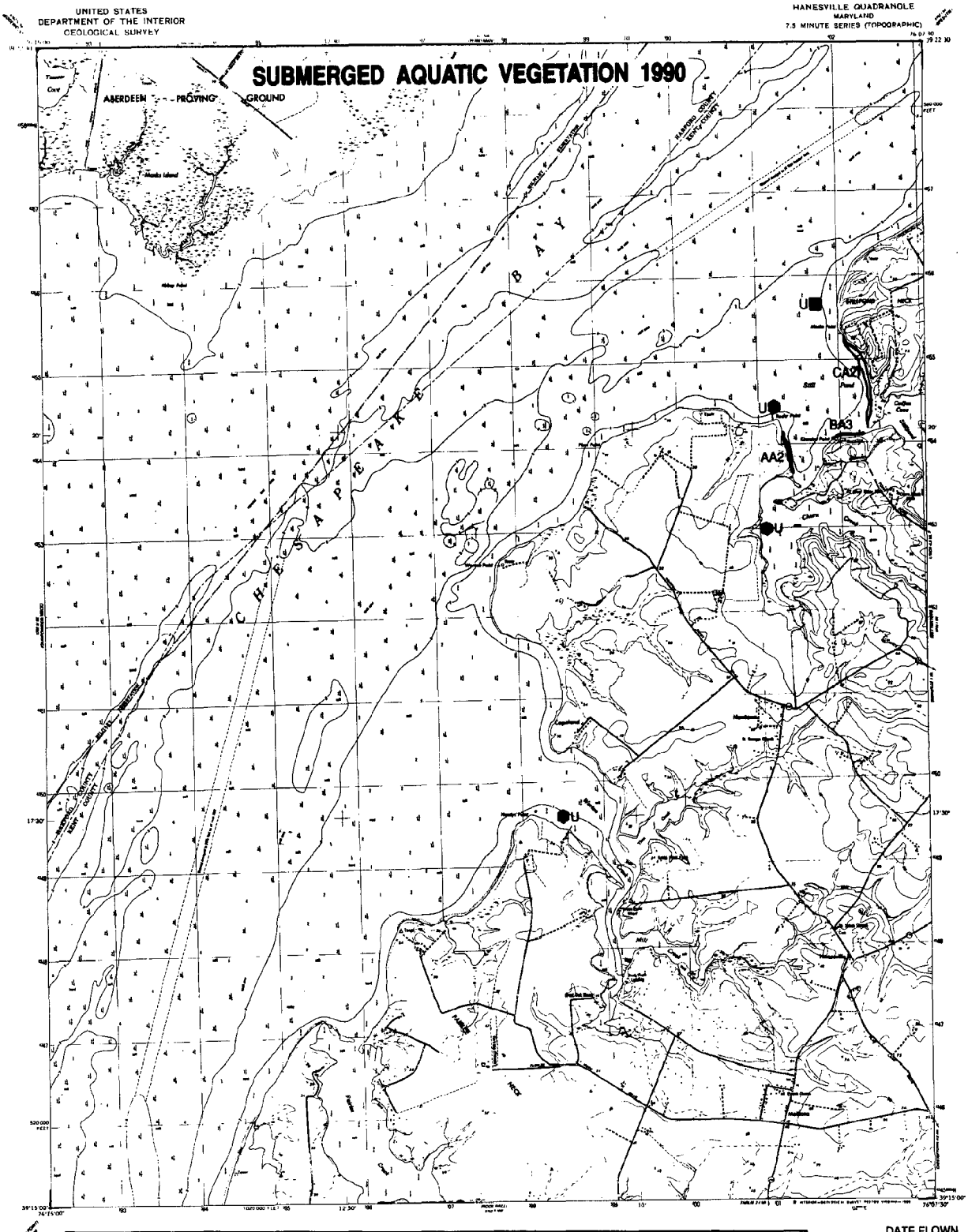
SURVEY STATIONS

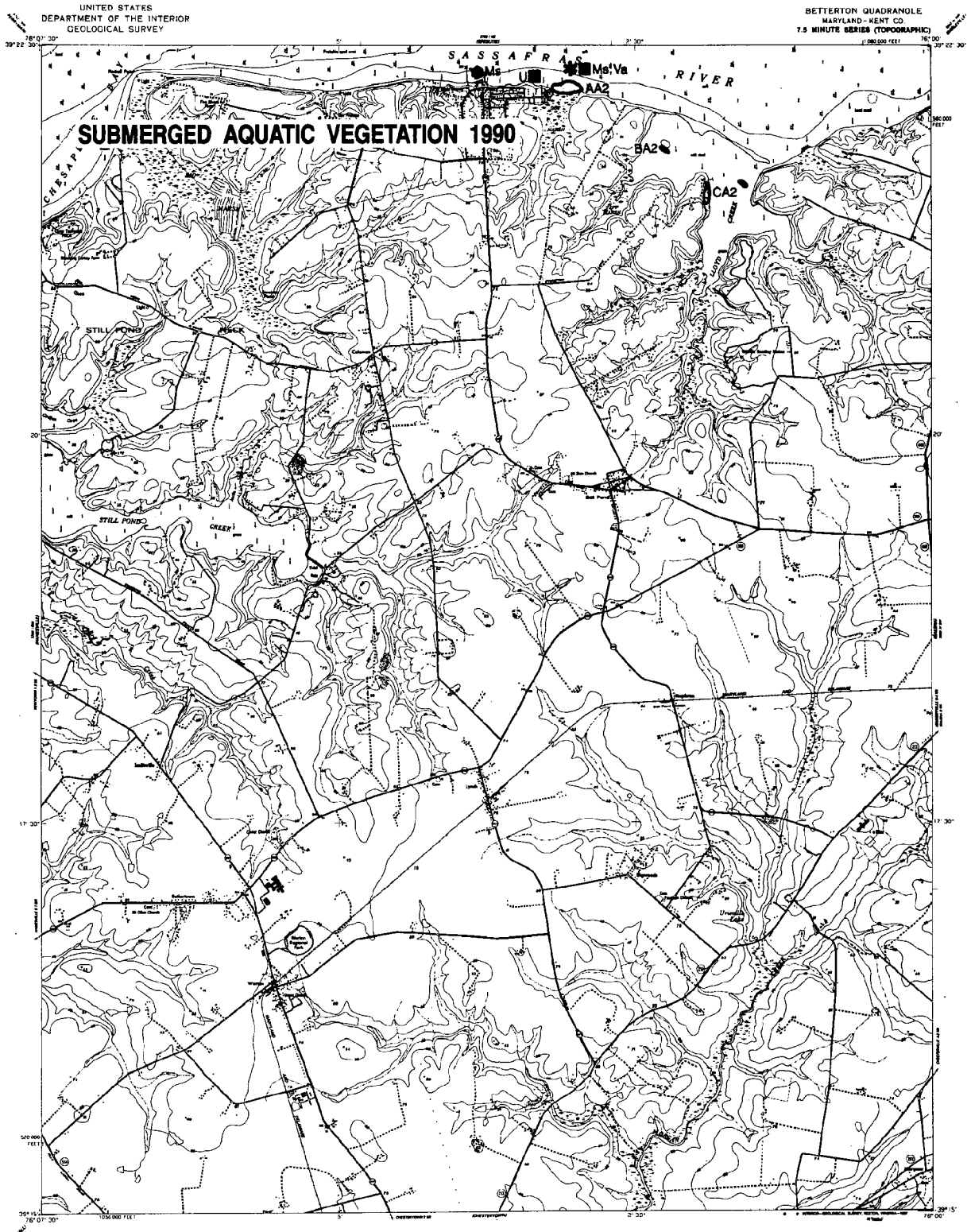
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬢ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
10-6-90

GUNPOWDER NECK, MD
014


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
HANESVILLE QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
ABERDEEN PROVING GROUND
CHESAPEAKE BAY
U
CA2
BA3
AA2
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
9-01-90
HANESVILLE, MD
015



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

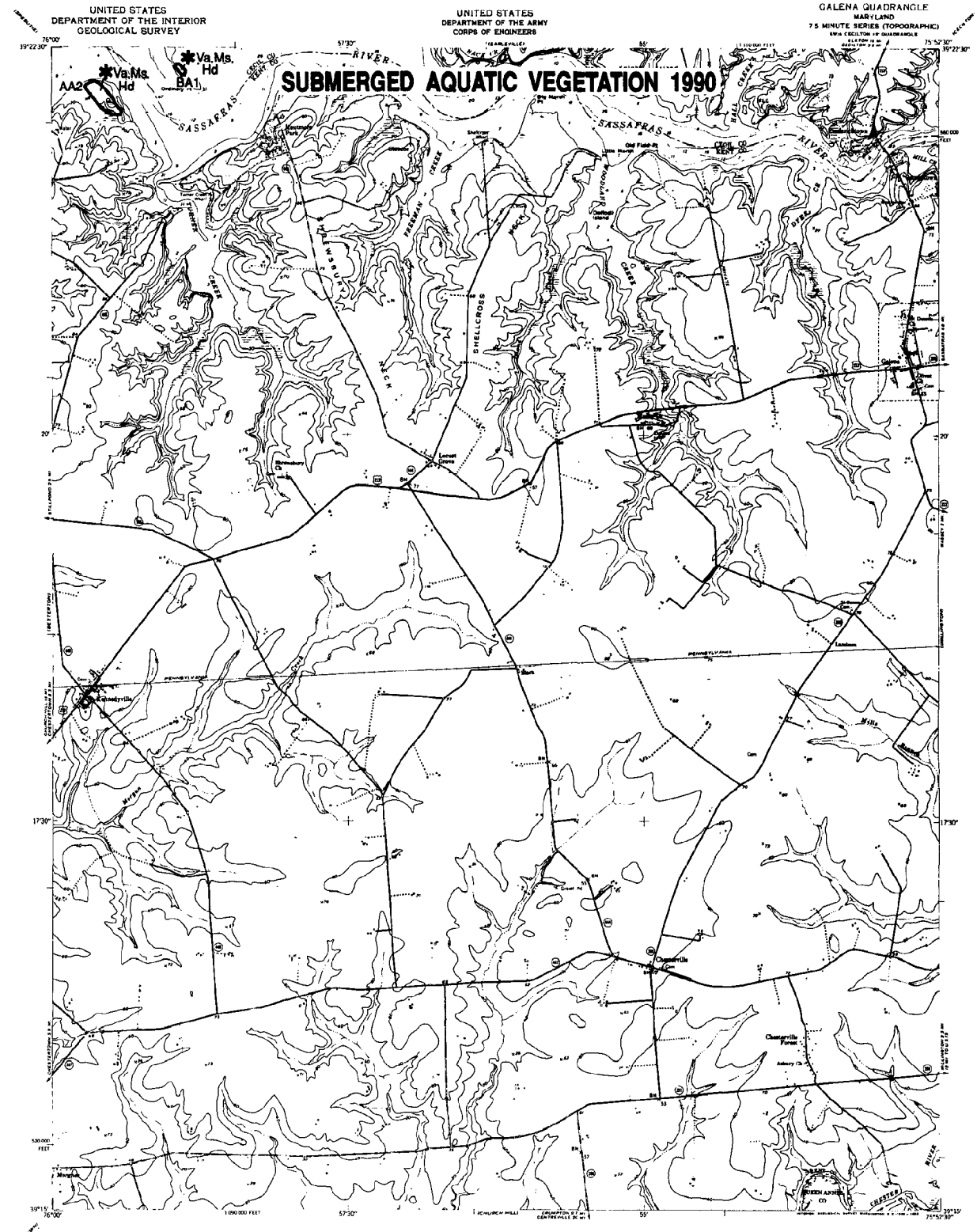
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-18-90

BETTERTON, MD
016



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ♥ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-18-90

GALENA,
MD
017

	SPECIES		
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

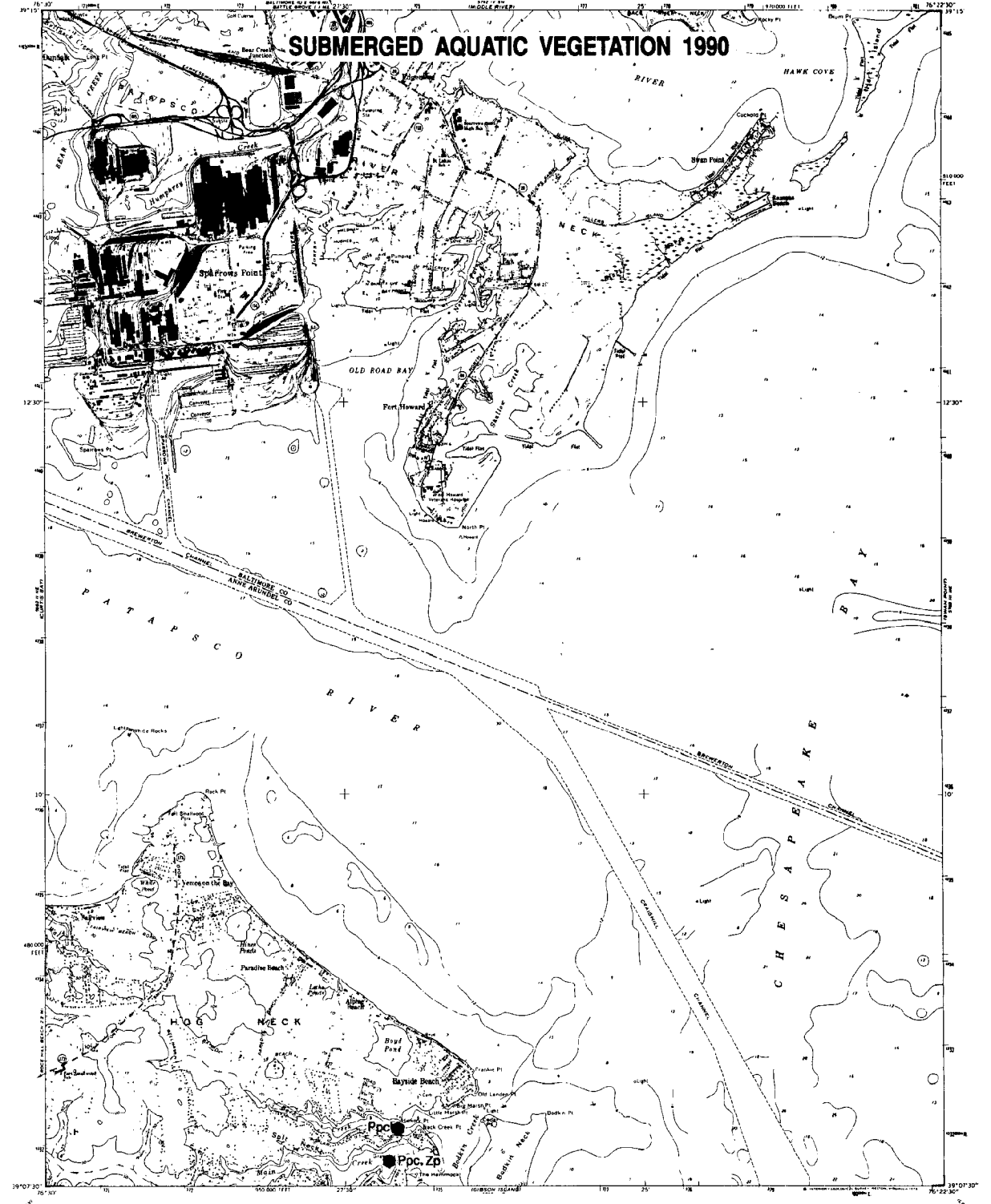
DATE FLOWN
8-1-90

CURTIS BAY, MD
018

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SPARROWS POINT QUADRANGLE
MARY. AND
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 5 0 1 MILE

1 5 0 1 KILOMETER

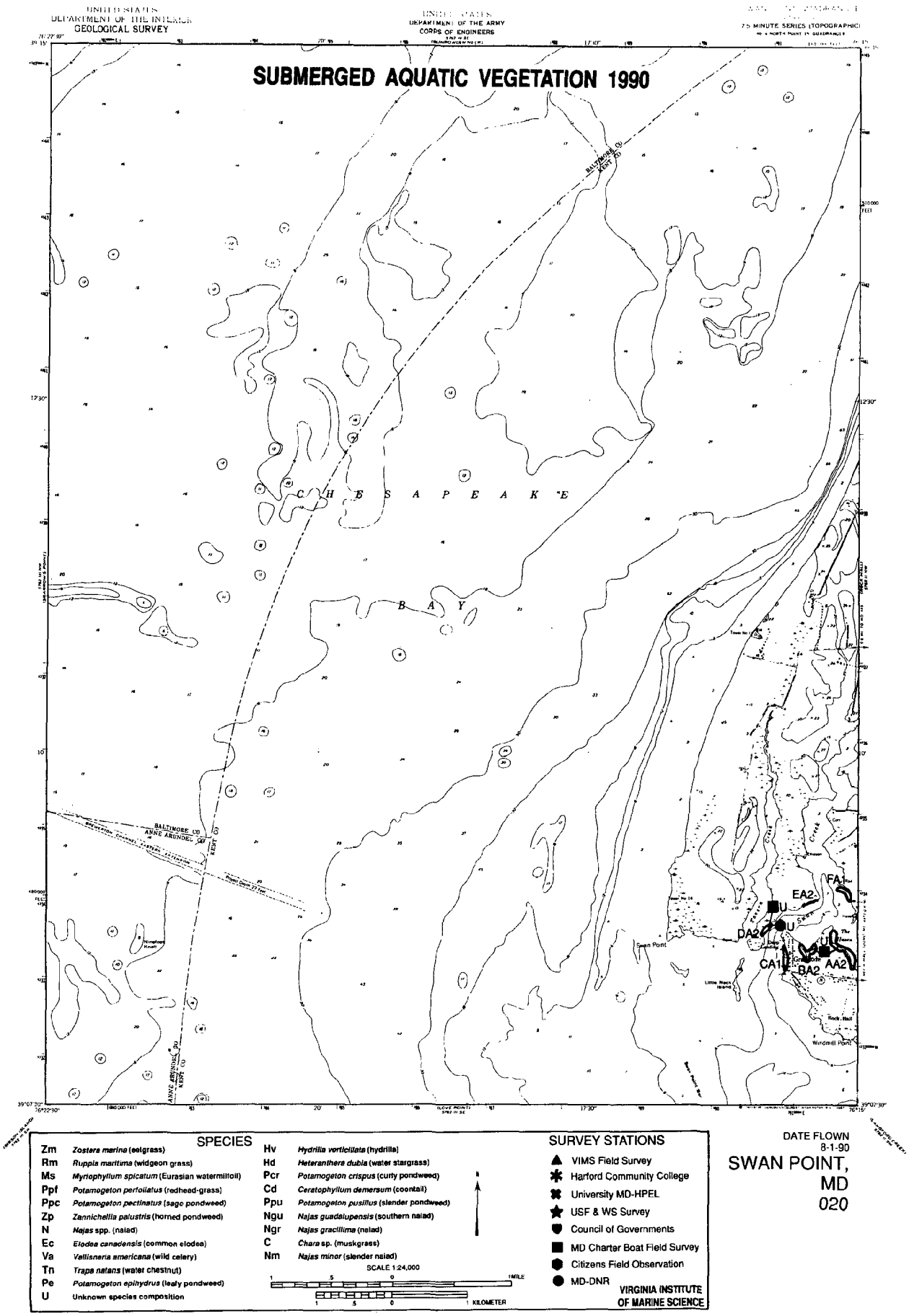
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬢ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

SPARROWS POINT, MD
019


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
C H E S A P E A K E
B A Y
BALTIMORE CO
ANNE ARUNDEL CO
KENT CO
QUEEN ANNES CO
Swan Point
Rock Hall
Windmill Point
Little Neck Islands
EA2
FA
DA2
CA1
BA2
AA2
U
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
8-1-90
SWAN POINT, MD
020

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
ROCK HALL QUADRANGLE
MARYLAND - KENT CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
CHESAPEAKE BAY
AA2
BA3
CA3
DA3
Rm
EA3
FA4
Rm
GA2
Rock Hall
Edesville
Skinners Neck
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppl Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
8-1-90
ROCK HALL, MD
021

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

ROUND BAY QUADRANGLE
MARYLAND–ANNE ARUNDEL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

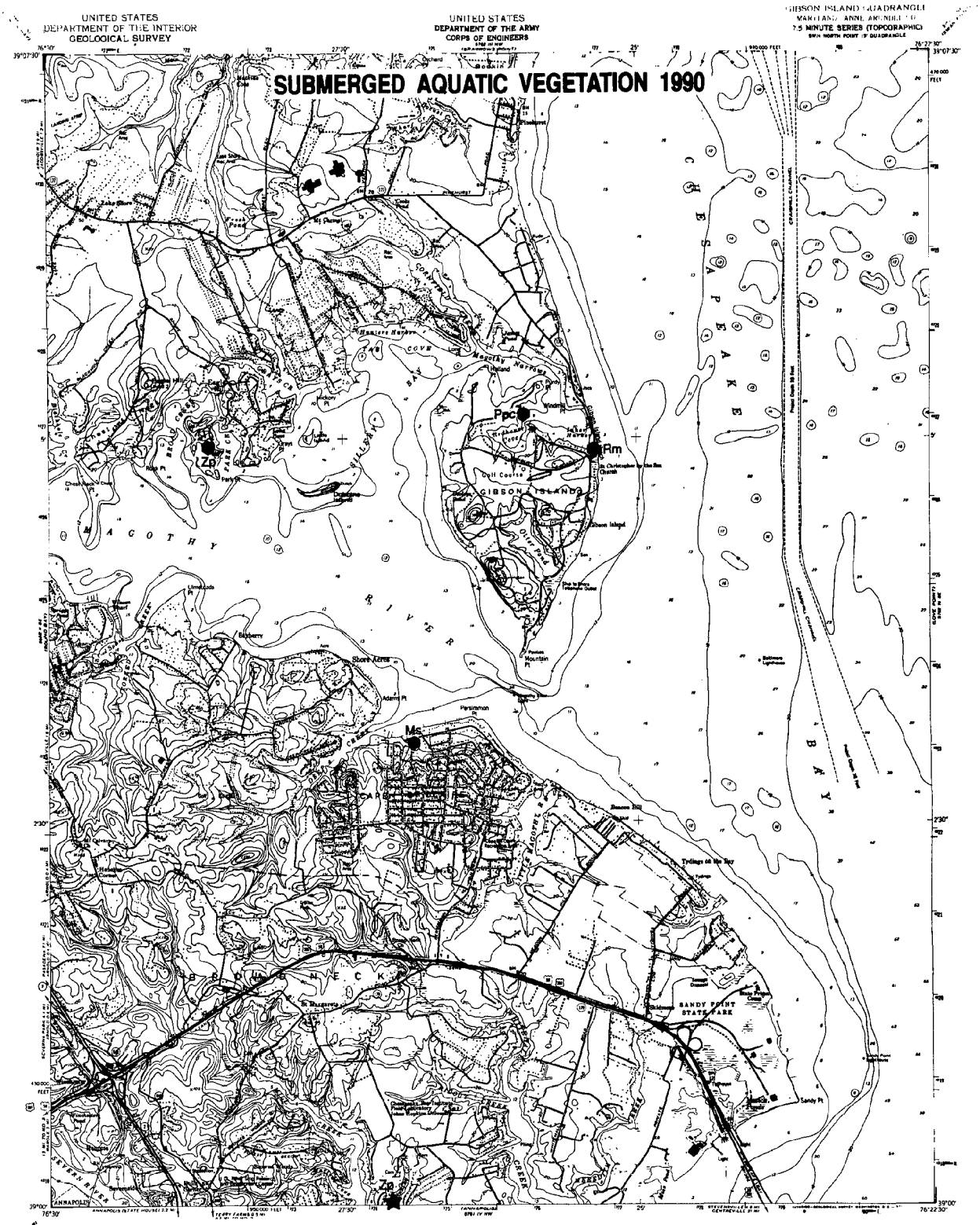
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

ROUND BAY, MD
023



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

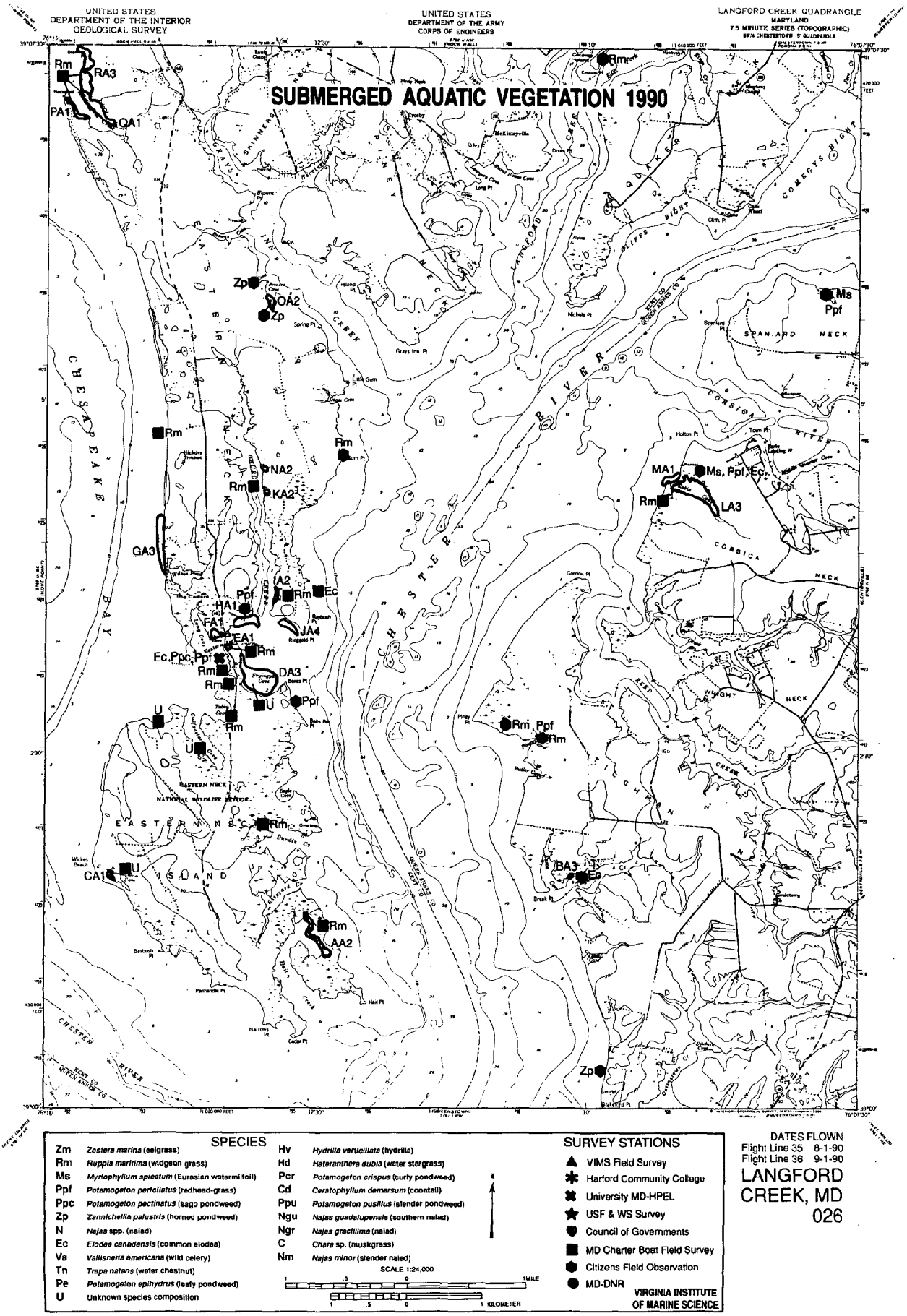
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⛊ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

GIBSON ISLAND, MD 024



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadelupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

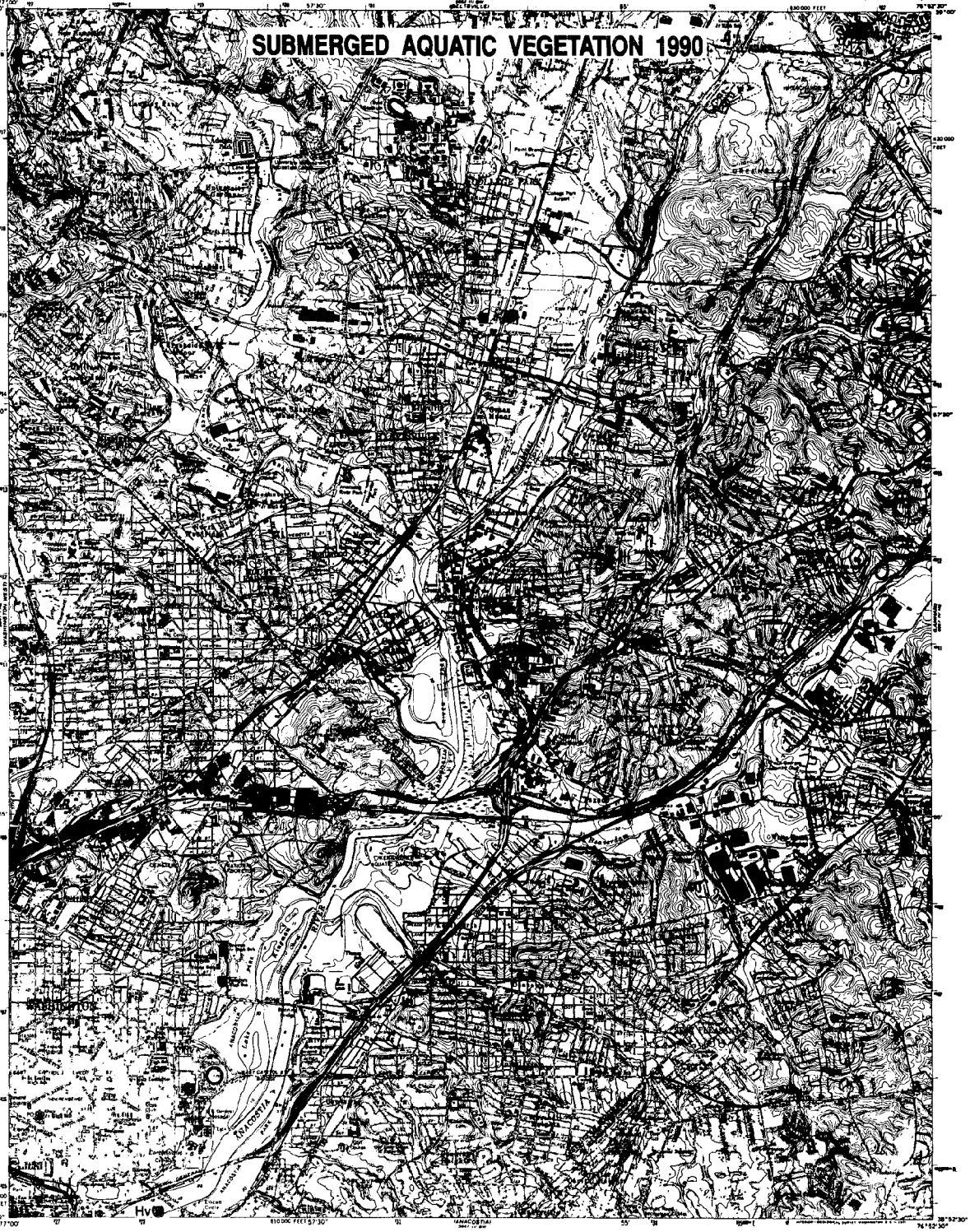
DATES FLOWN
Flight Line 35 8-1-90
Flight Line 36 9-1-90

LANGFORD CREEK, MD
026

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WASHINGTON EAST QUADRANGLE
MARYLAND-DISTRICT OF COLUMBIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-18-90

WASHINGTON EAST, DC-MD
29

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SOUTH RIVER QUADRANGLE
MARYLAND—ANNE ARUNDEL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
ANNAPOLIS
SOUTH RIVER
Rm
Zp
Zp
Woodland Beach
Edgewater
Galesville
Deale
Beverly Beach
Cloverly
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
8-1-90
SOUTH RIVER, MD
030

Species		
Zm	*Zostera marina* (eelgrass)	
Rm	*Ruppia maritima* (widgeon grass)	
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	
Ppf	*Potamogeton perfoliatus* (redhead-grass)	
Ppc	*Potamogeton pectinatus* (sago pondweed)	
Zp	*Zannichellia palustris* (horned pondweed)	
N	*Najas* spp. (naiad)	
Ec	*Elodea canadensis* (common elodea)	
Va	*Vallisneria americana* (wild celery)	
Tn	*Trapa natans* (water chestnut)	
Pe	*Potamogeton epihydrus* (leafy pondweed)	
U	Unknown species composition	
Hv	*Hydrilla verticillata* (hydrilla)	
Hd	*Heteranthera dubia* (water stargrass)	
Pcr	*Potamogeton crispus* (curly pondweed)	
Cd	*Ceratophyllum demersum* (coontail)	
Ppu	*Potamogeton pusillus* (slender pondweed)	
Ngu	*Najas guadalupensis* (southern naiad)	
Ngr	*Najas gracillima* (naiad)	
C	*Chara* sp. (muskgrass)	
Nm	*Najas minor* (slender naiad)	

SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER

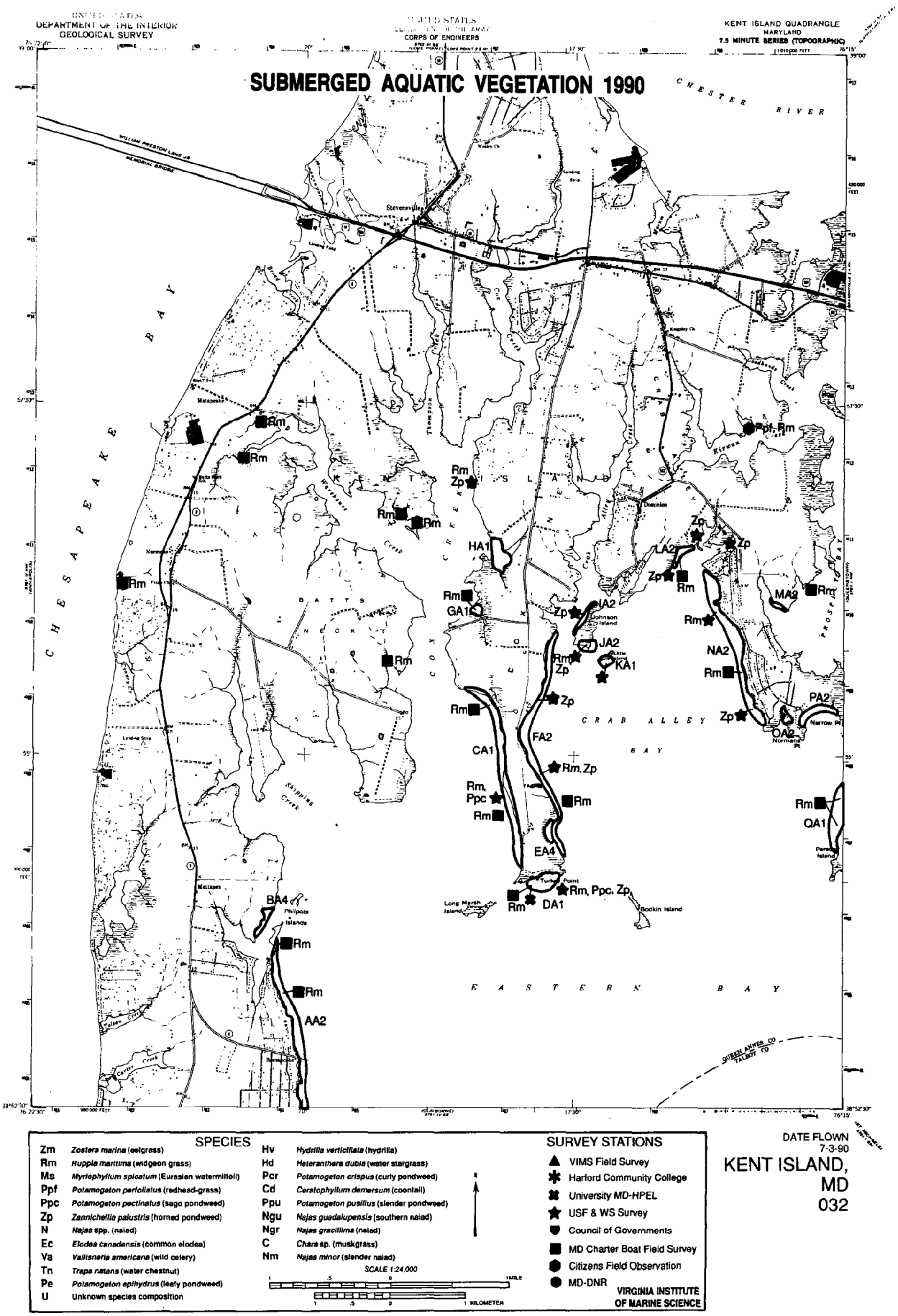
SURVEY STATIONS

- ▲ VIMS Field Survey
- Harford Community College
- University MD-HPEL
- ★ USF & WS Survey
- Council of Governments
- ■ MD Charter Boat Field Survey
- Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

ANNAPOLIS, MD
031



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

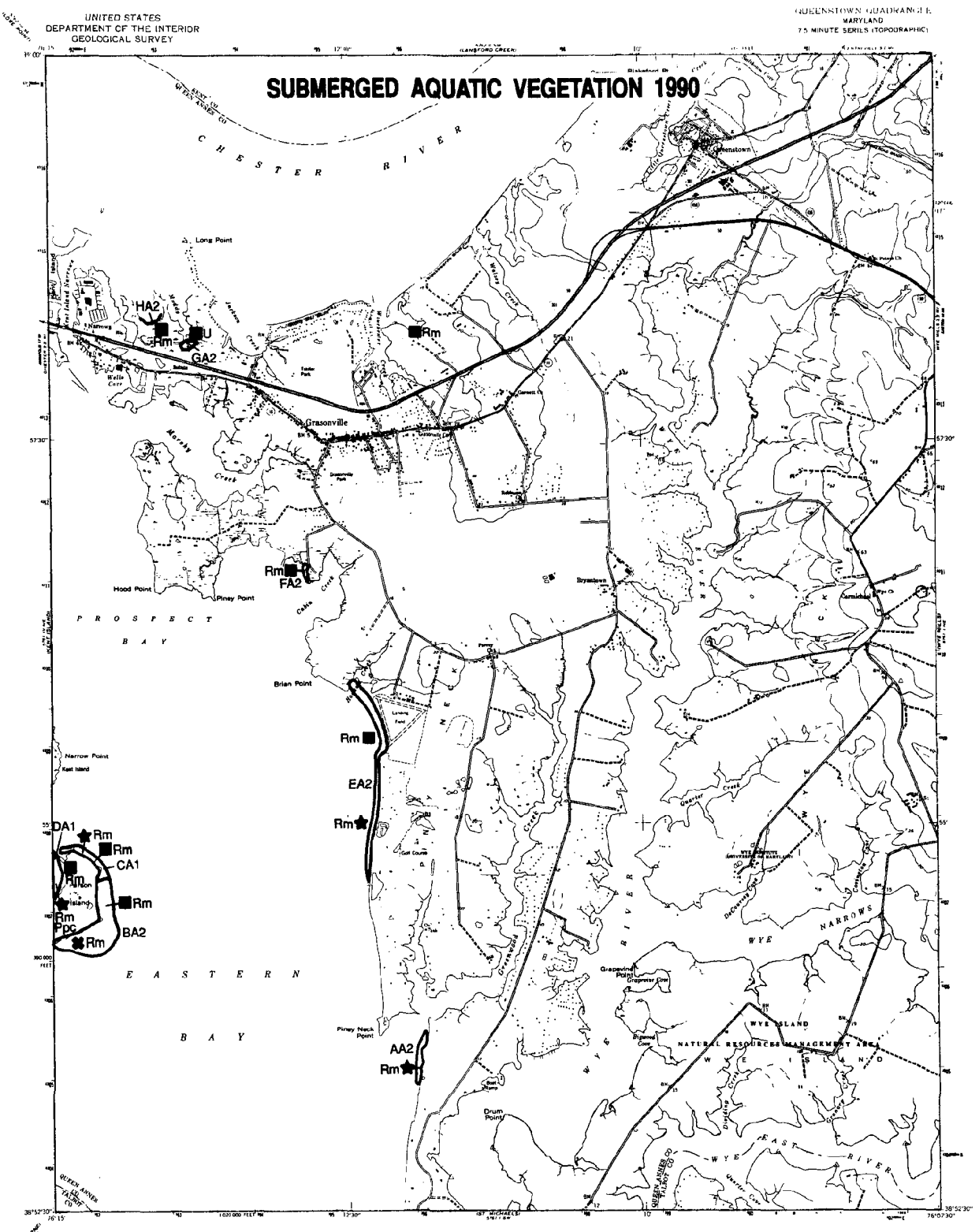
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
7-3-90

KENT ISLAND, MD
032



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (ledy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

SURVEY STATIONS	
▲	VIMS Field Survey
✱	Harford Community College
✖	University MD-HPEL
★	USF & WS Survey
●	Council of Governments
■	MD Charter Boat Field Survey
⬢	Citizens Field Observation
●	MD-DNR

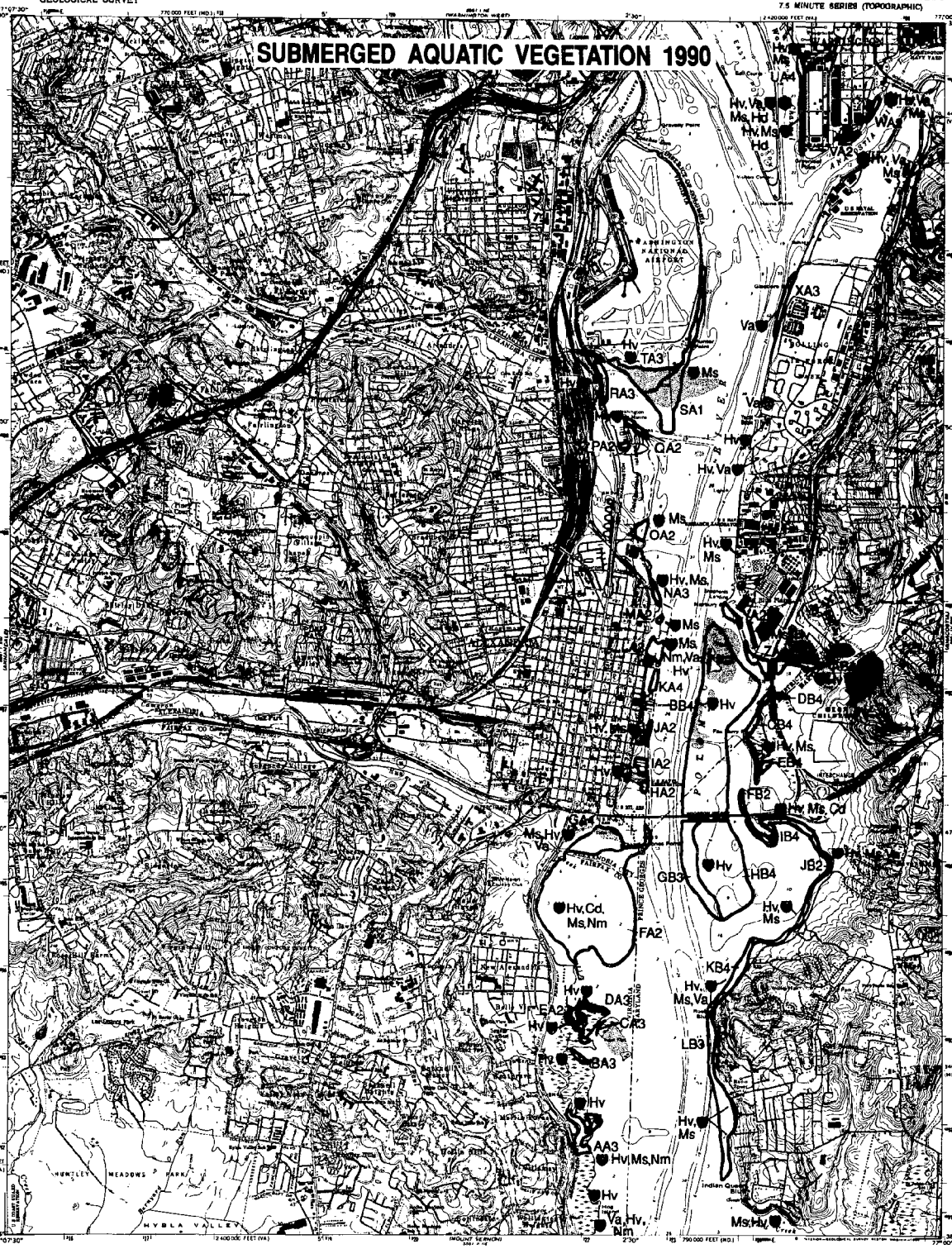
VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
7-3-90

QUEENSTOWN, MD
033

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALEXANDRIA QUADRANGLE
VIRGINIA–DISTRICT OF COLUMBIA–MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppl	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

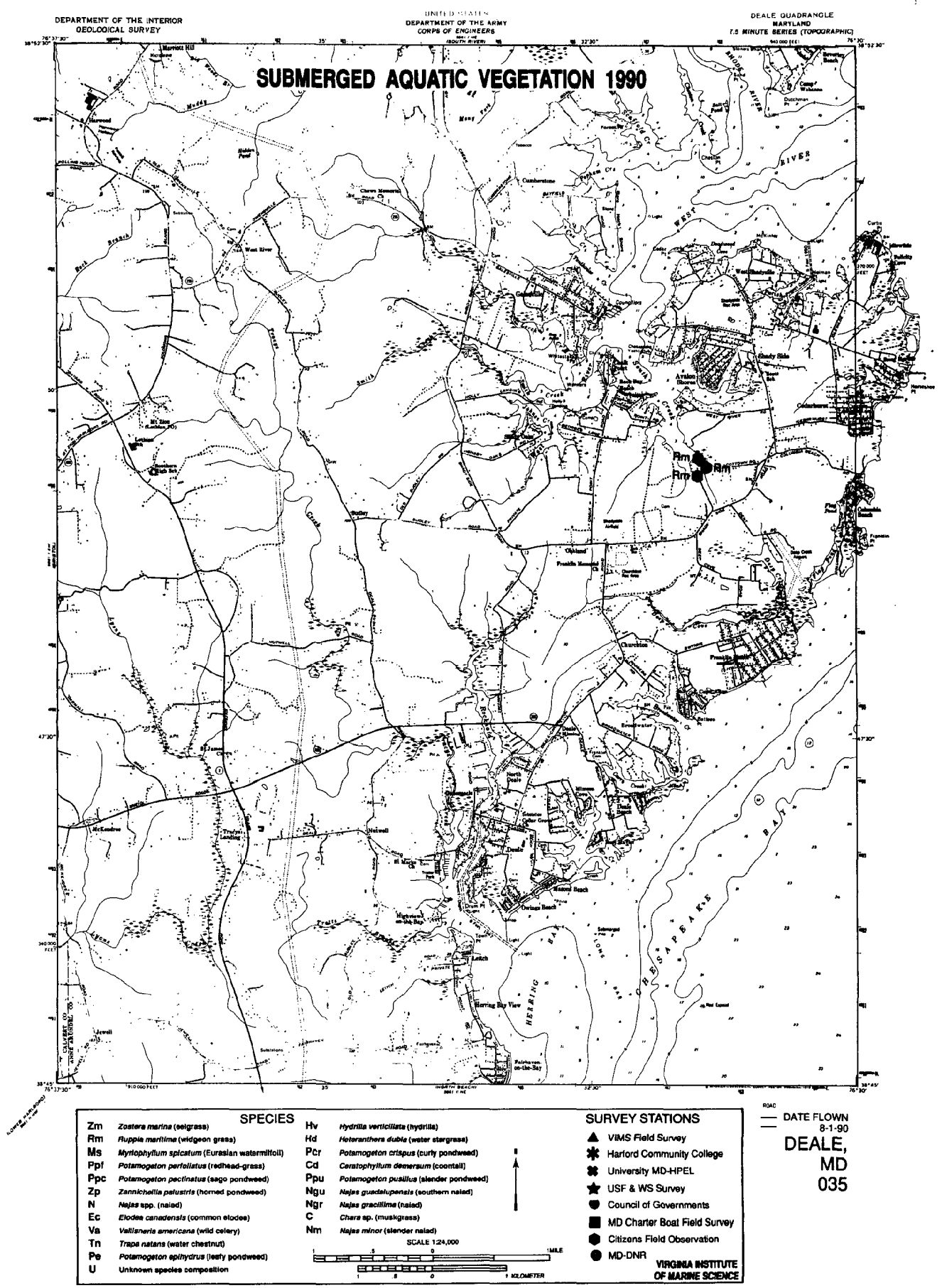
SURVEY STATIONS

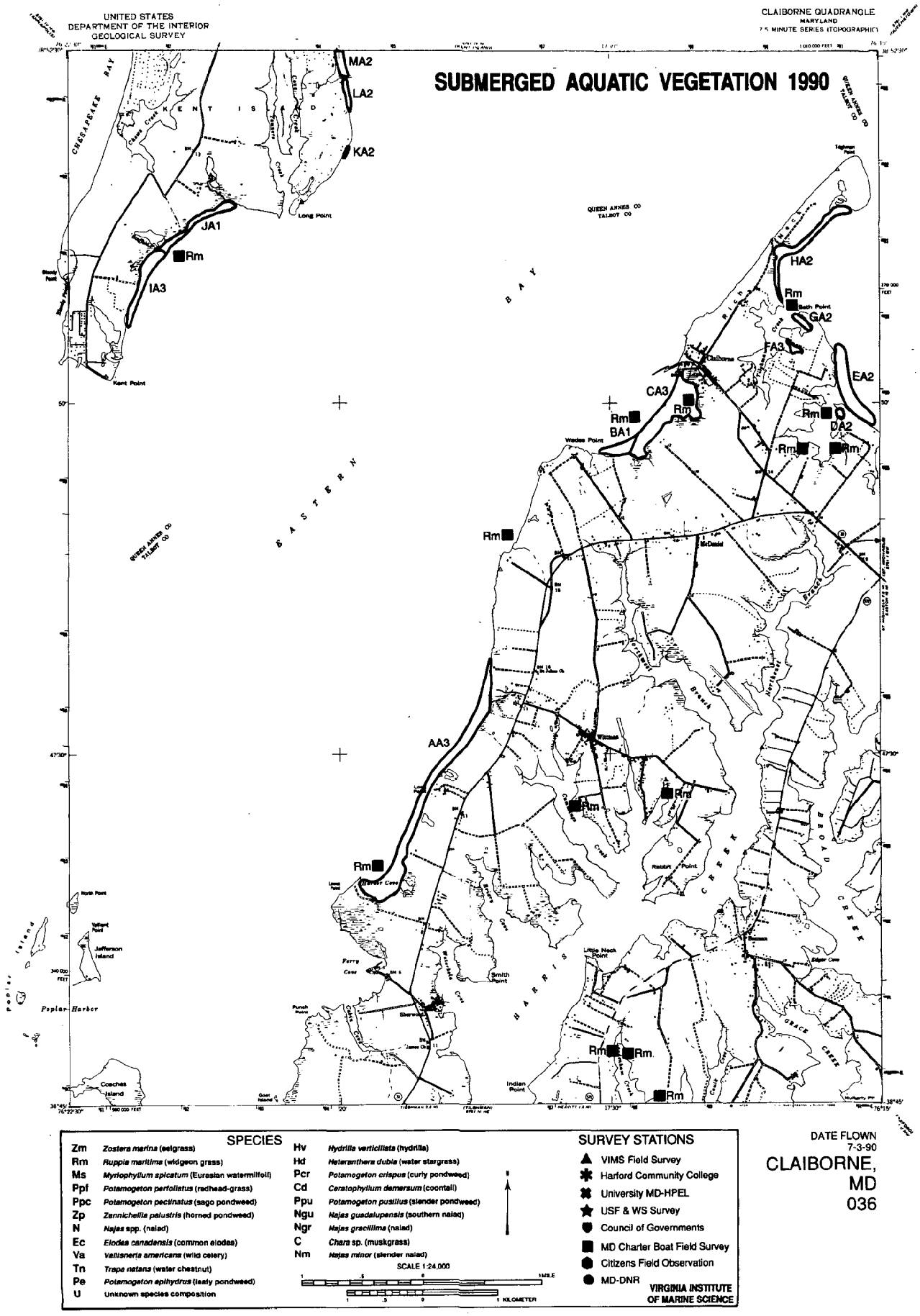
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-18-90

ALEXANDRIA,
VA-DC-MD
034


DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
DEALE QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
Rm
Rm
Rm
CHESAPEAKE BAY
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
PCr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
ROAD
DATE FLOWN
8-1-90
DEALE, MD
035



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

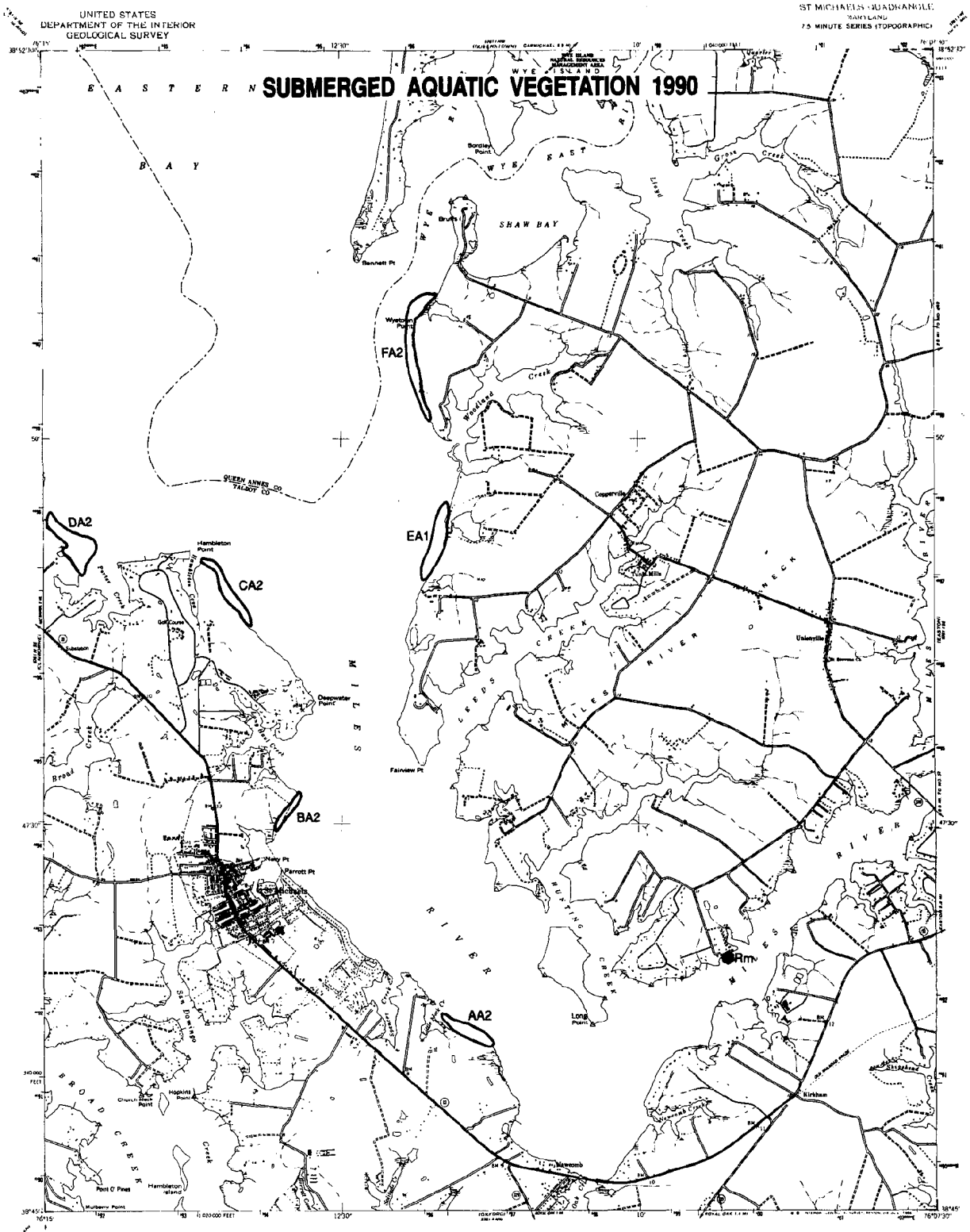
SURVEY STATIONS

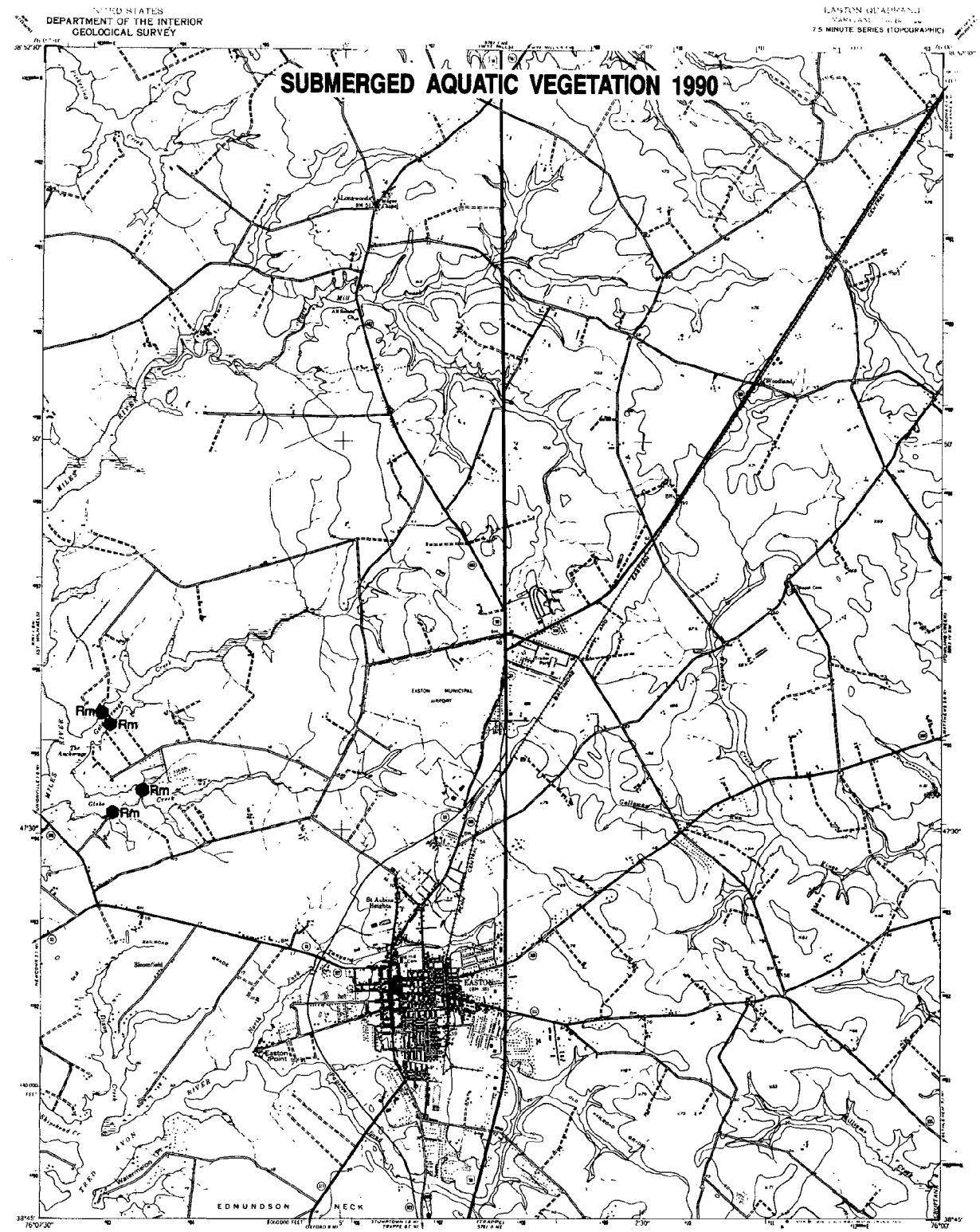
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
7-3-90

CLAIBORNE,
MD
036


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
ST MICHAELS QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
EASTERN BAY
WYE ISLAND
WYE EAST
SHAW BAY
FA2
DA2
EA1
CA2
BA2
AA2
MILES RIVER
LEEDS CREEK
HUNTING CREEK
BROAD CREEK
QUEEN ANNES CO
TALBOT CO
St Michaels
Rm
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
7-3-90
ST. MICHAELS, MD
037



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppt	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

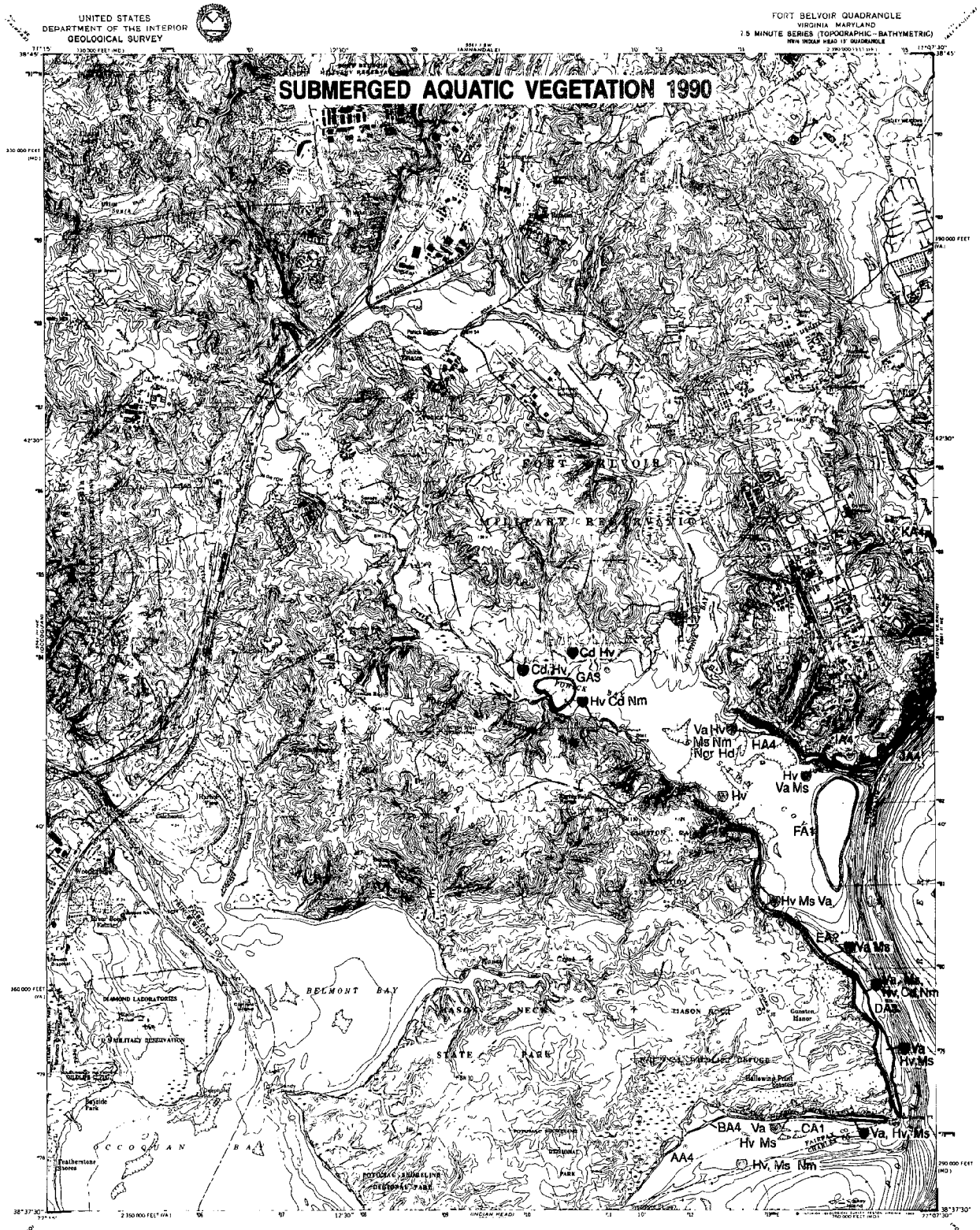
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-1-90

EASTON, MD
038



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

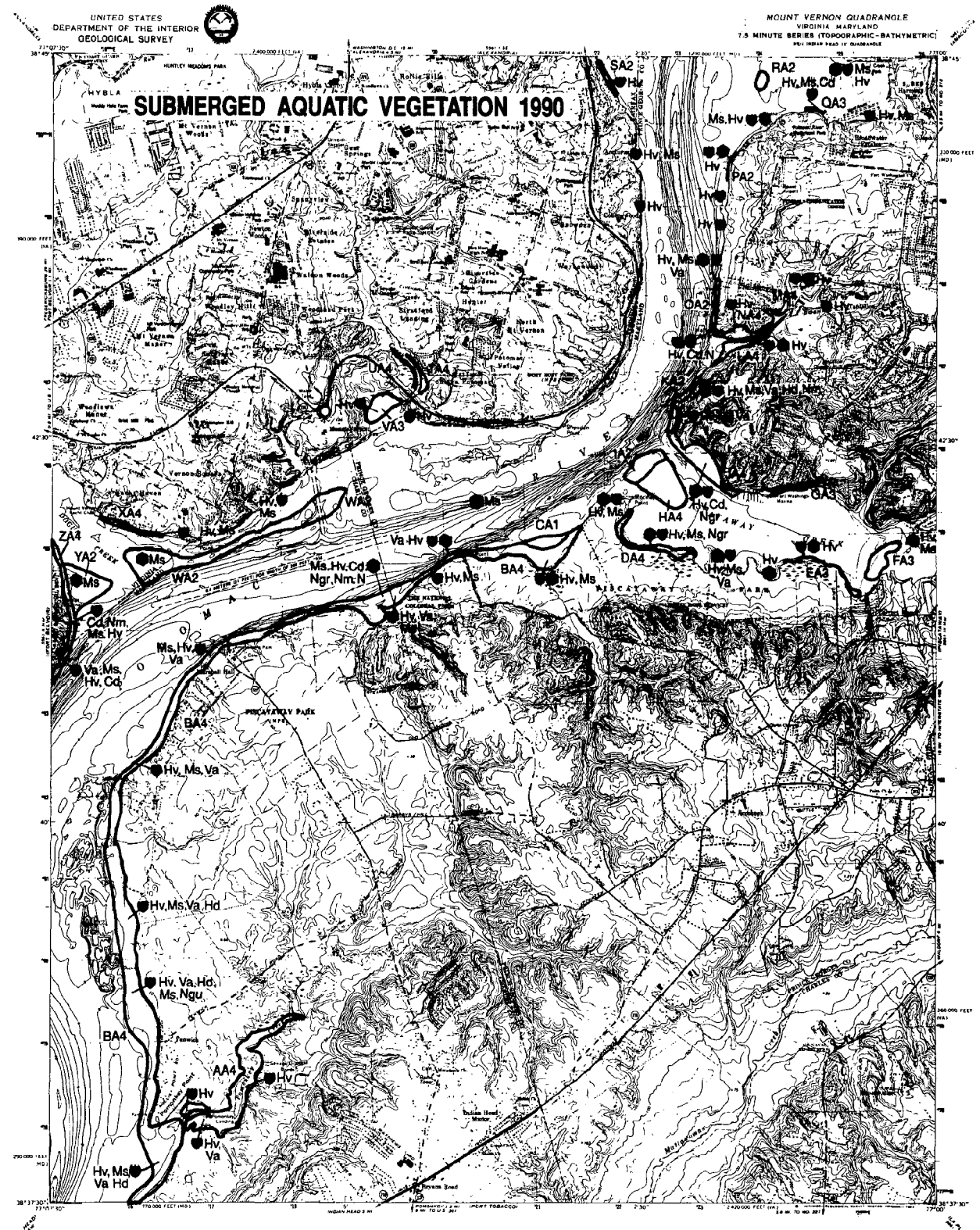
SURVEY STATIONS

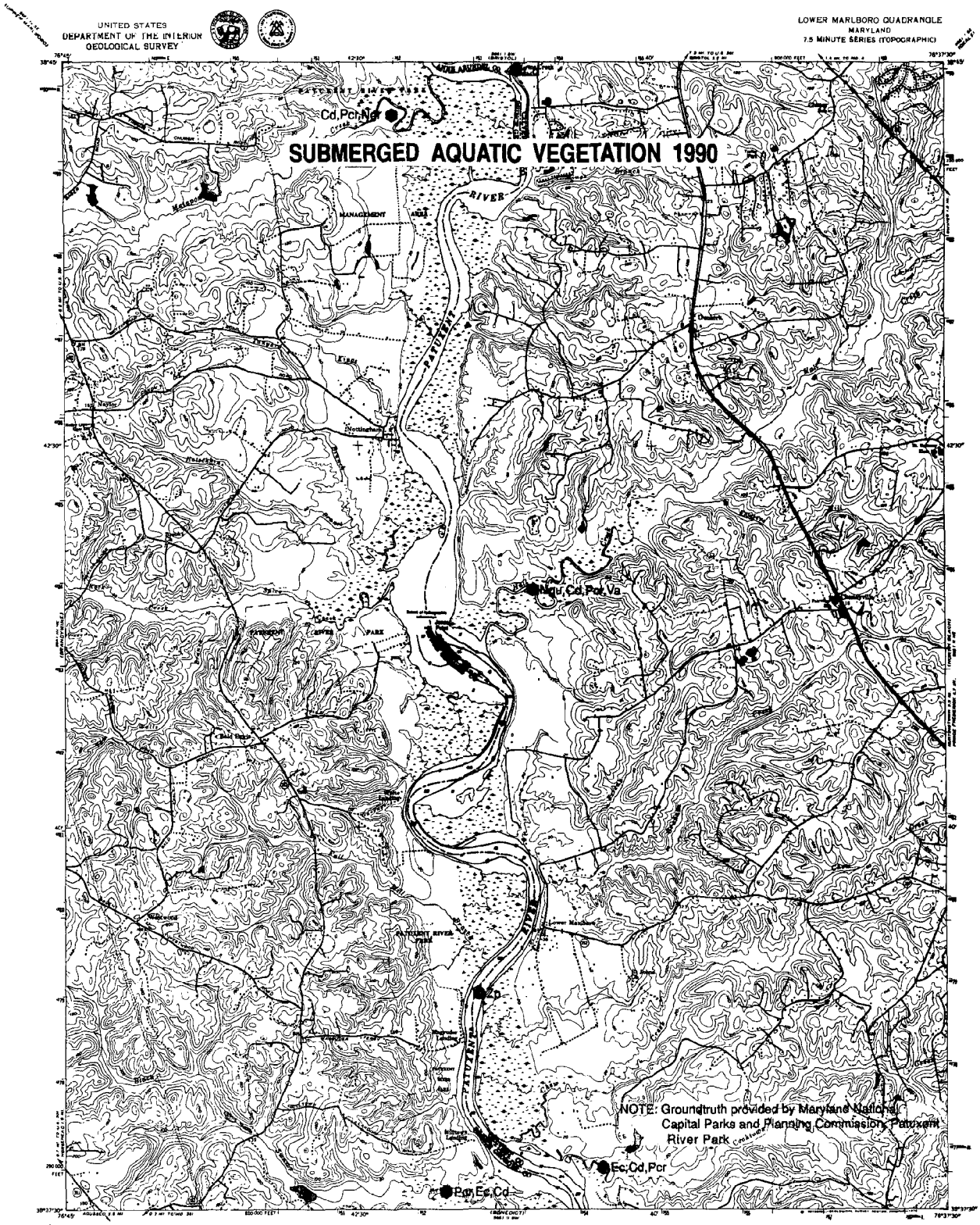
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-31-90

FORT BELVOIR,
VA-MD
039


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MOUNT VERNON QUADRANGLE
VIRGINIA MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC-BATHYMETRIC)
SUBMERGED AQUATIC VEGETATION 1990
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
8-31-90
MT. VERNON,
VA-MD
040



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

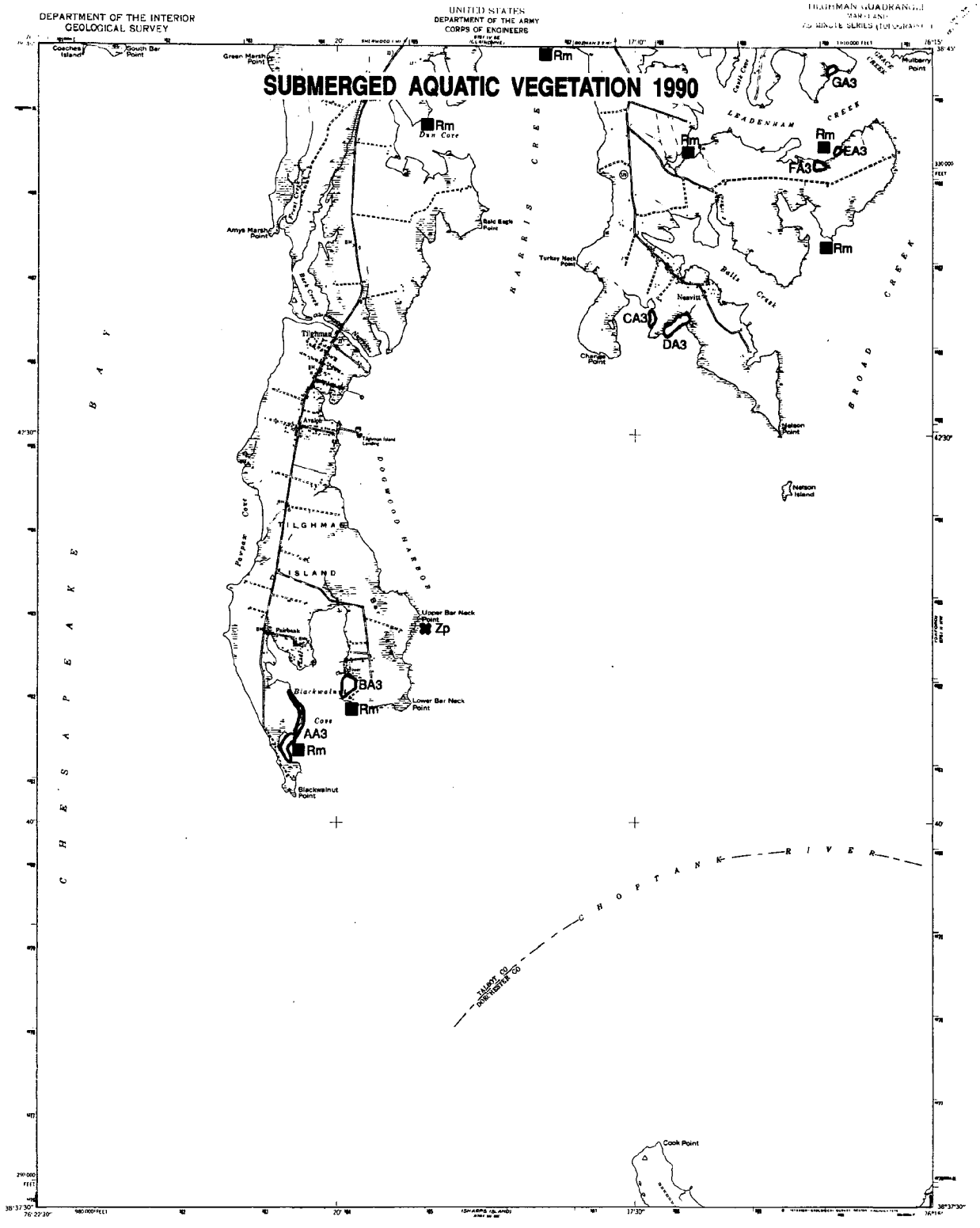
SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

LOWER MARLBORO, MD
41



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

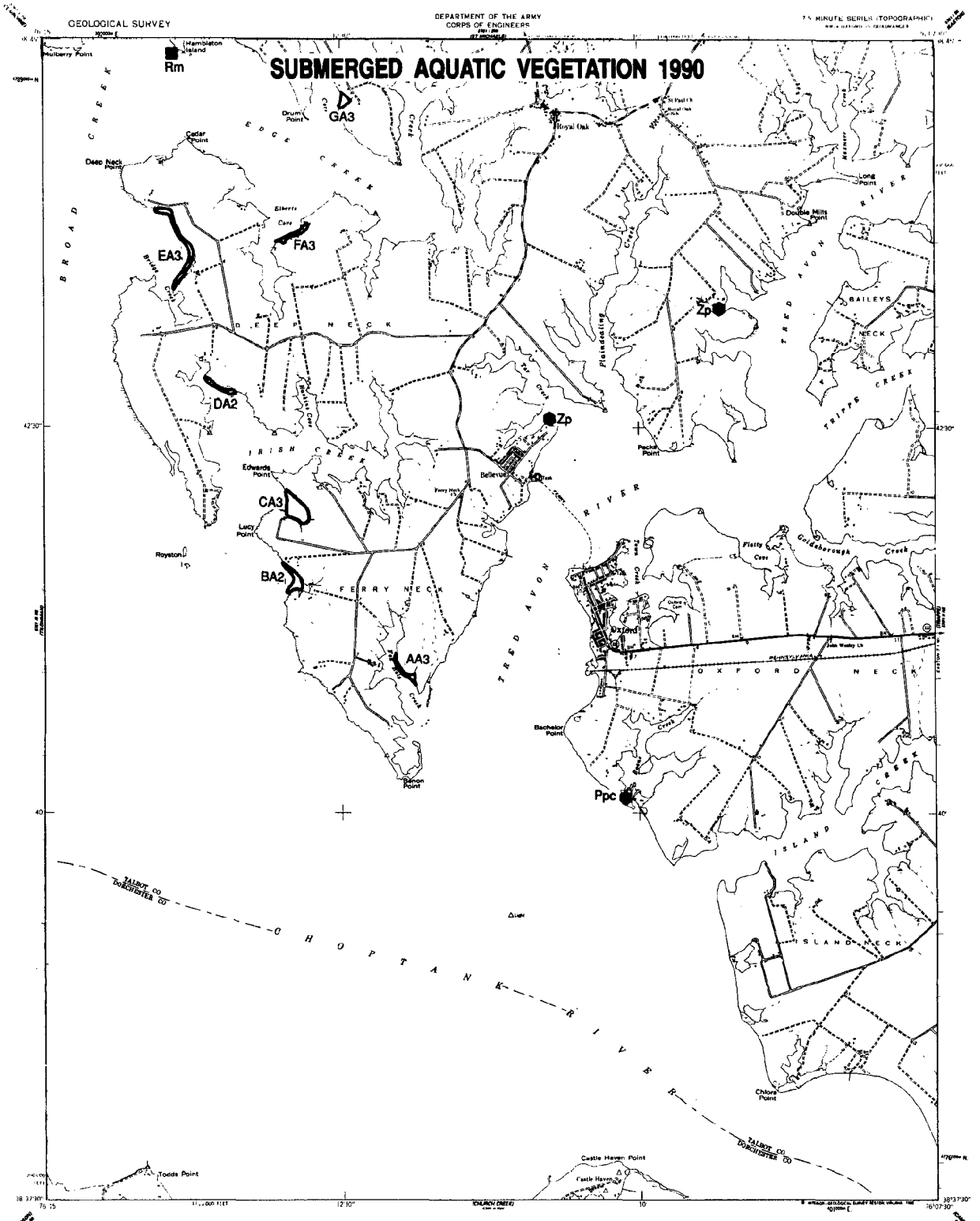
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ● Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
7-3-90

TILGHMAN, MD
043



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SURVEY STATIONS

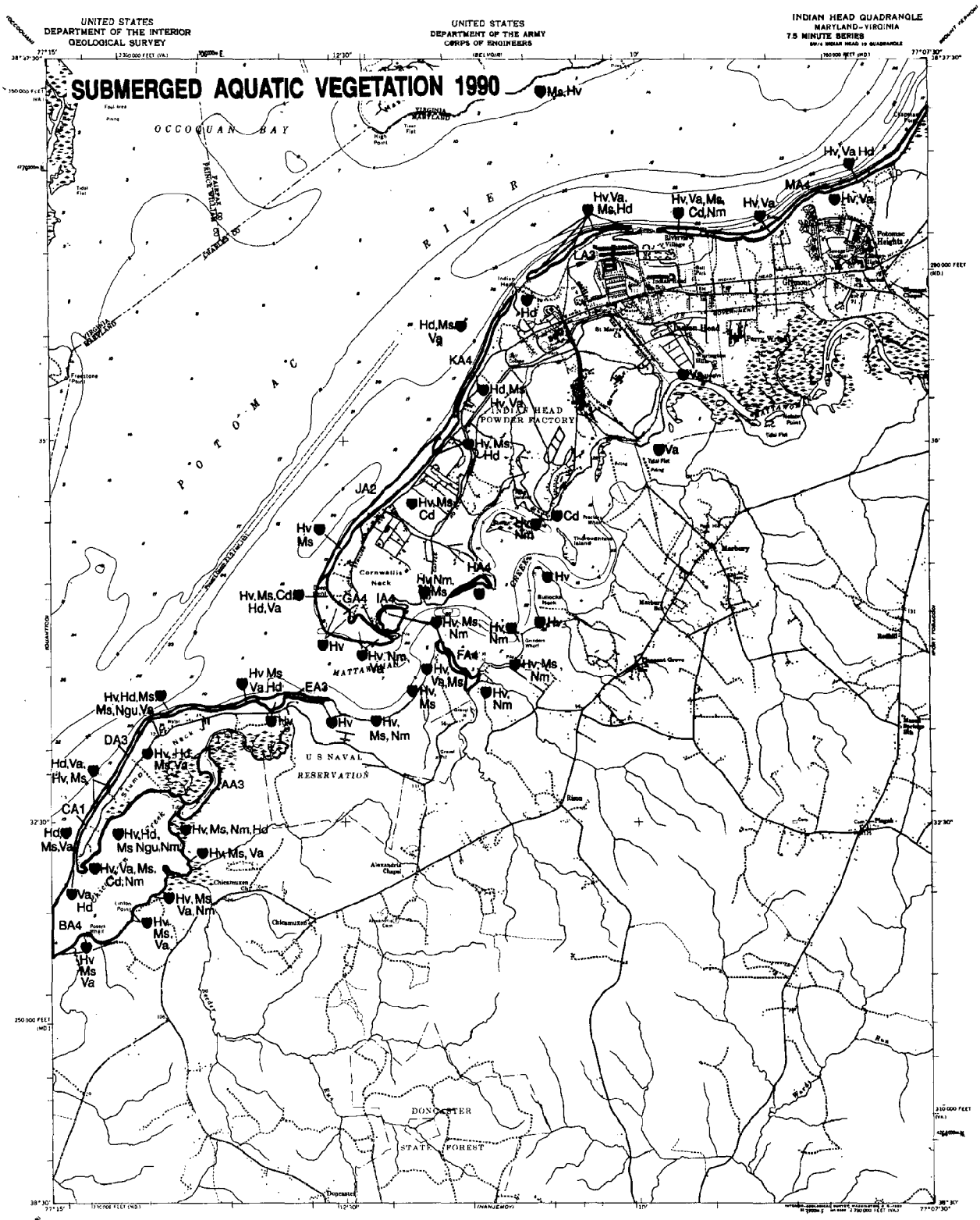
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
7-3-90

OXFORD, MD
044

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
QUANTICO QUADRANGLE
VIRGINIA MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC - BATHYMETRIC)
SUBMERGED AQUATIC VEGETATION 1990
IA4
Hv, Nm, Cd
Ms
Hv
Hd
Hv, Ms
HA4
Hv
Hv, Ms, Va, Hd
Hv
GA4
Hv
Hv, Va
Cd, Hd
Hv, Cd, Hd, Va
Hv, Ms
Hv, Cd, Ms
GA4
Hv, Cd
Hv
Hv, Va
Hv
Hv
Hv, Ms, Cd
Hv, Cd, Hd
Hv, Cd, Hd, Va
Hv, Ms, Cd
FA4
Hv, Ms
Hv, Ms, Va, Cd, Hd
DA4
Hv, Va, Cd, Hd
Va, Ms
Hv
CA4
Hv, Ms
Hv
Hv, Ms
Hv, Va
Hv, Va, Ms
Hd, Nm
EA4
Hv, Va
Hd, Ms
Hv, Va
Ms, Hd
AA4
Ms, Hd
Cd, Ngu
Hv
Hd
Hv, Cd, Hd
BA4
NO SAV
Ms, Hv, Va, Hd
Hv
Hd
Ms
Hv, Ms, Va, Cd, Hd, Ngu
Hv, Ms, Hd
MARINE CORPS DEVELOPMENT AND EDUCATION COMMAND
(QUANTICO)
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppl Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
8-31-90
QUANTICO,
VA-MD
047



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

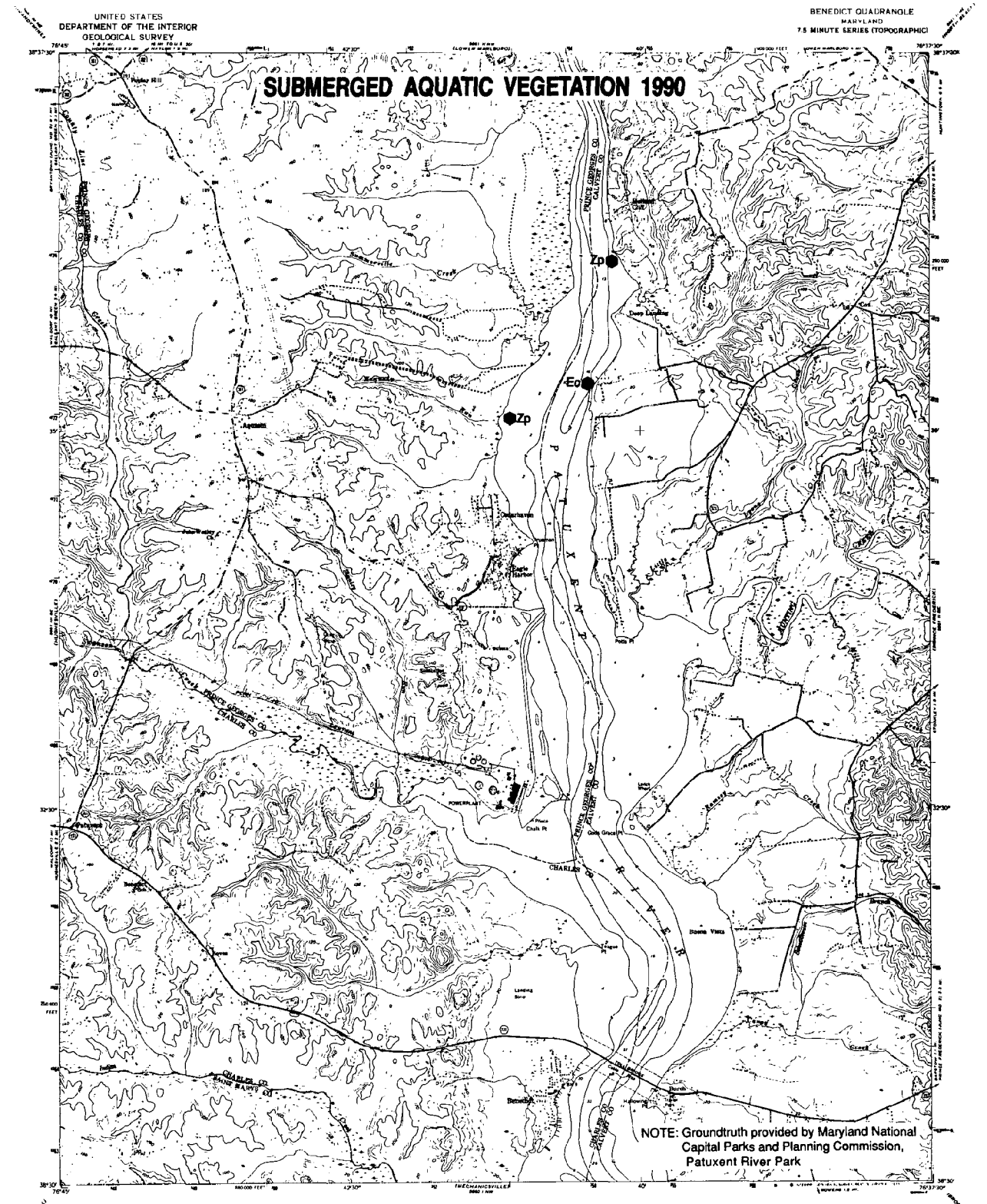
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-31-90

INDIAN HEAD, MD-VA
048



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 .5 0 1 KILOMETER

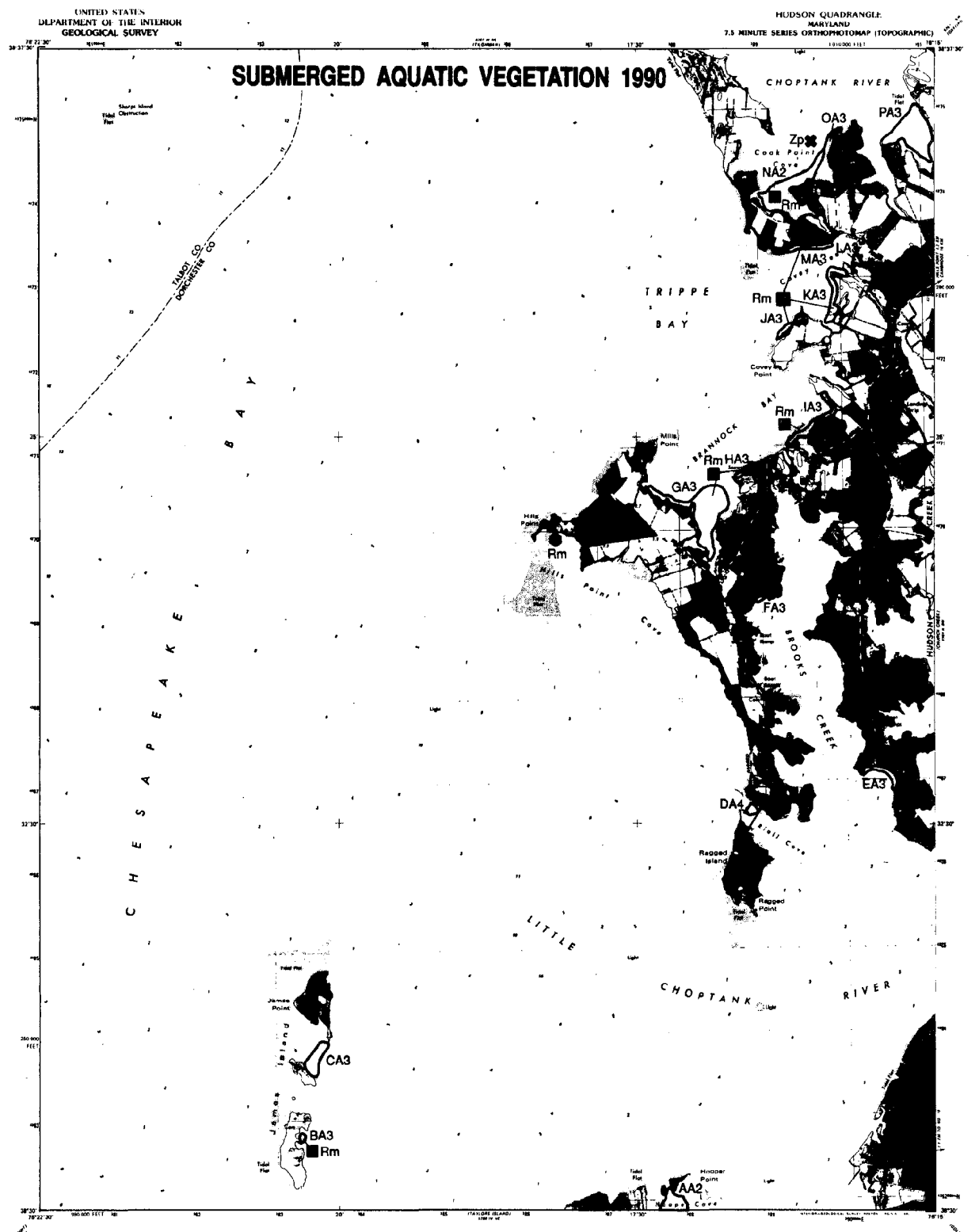
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

BENEDICT, MD
049



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 .5 0 1 KILOMETER

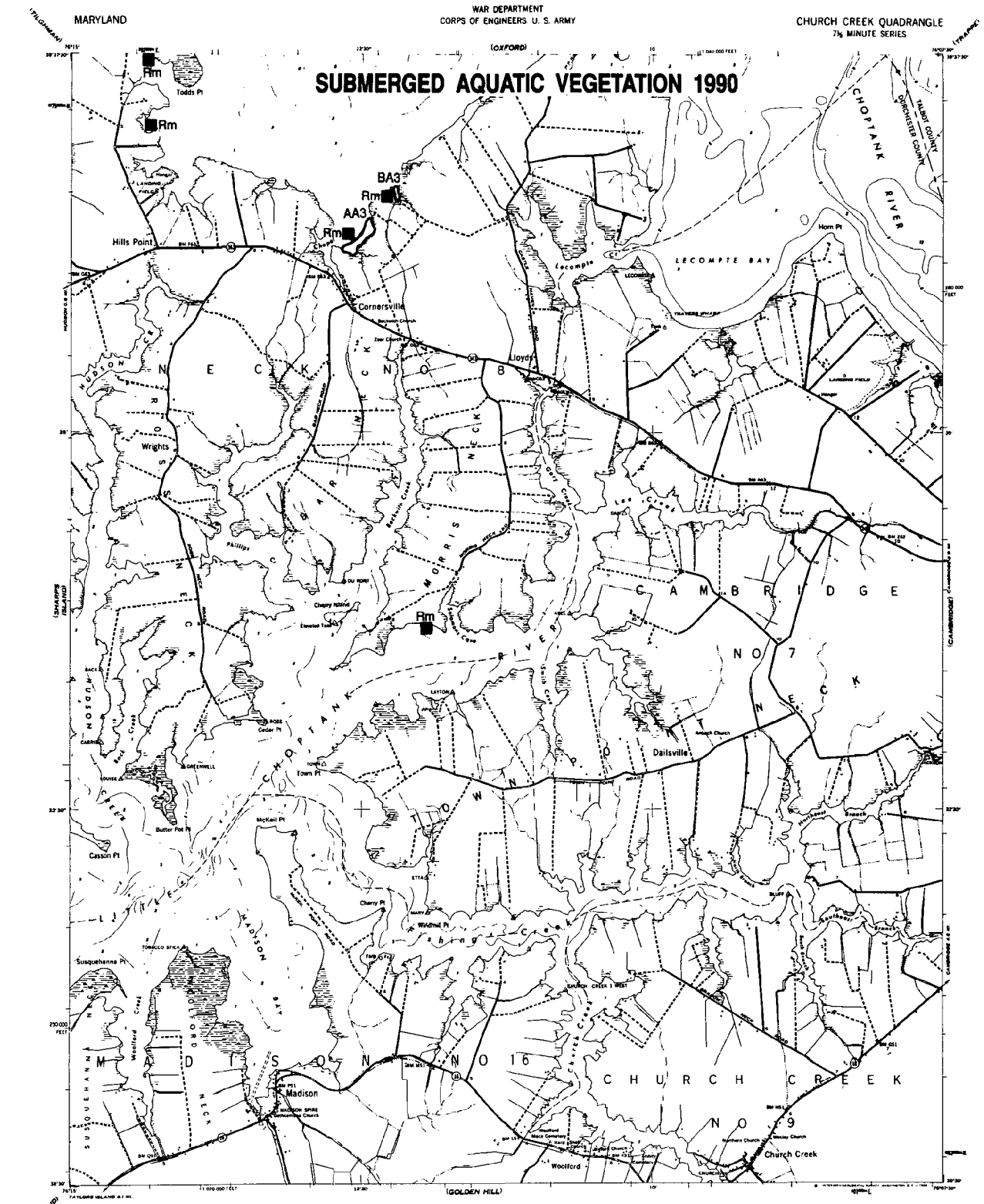
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-1-90

HUDSON, MD
051



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

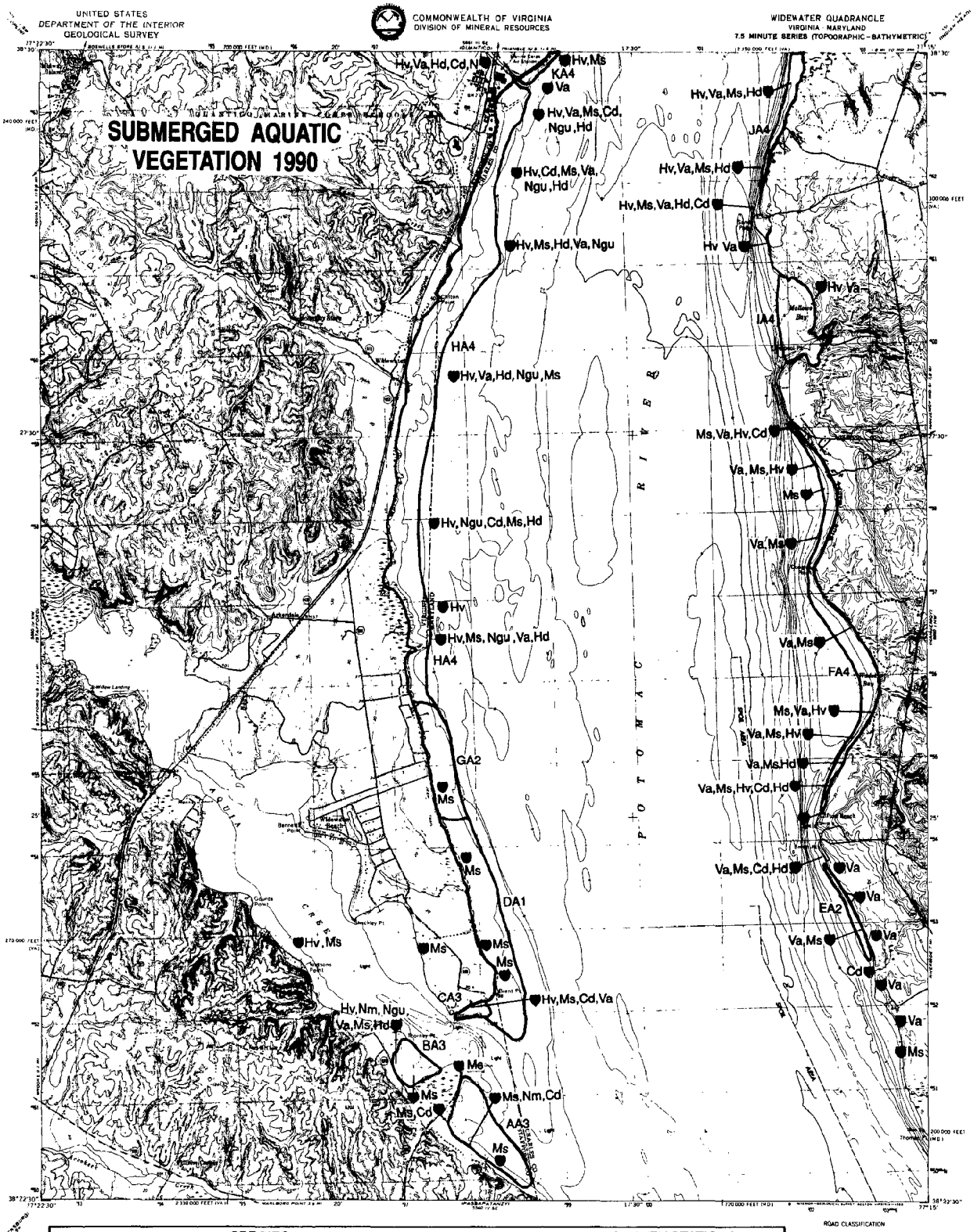
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⛊ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-1-90

CHURCH CREEK, MD
052



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-31-90

WIDEWATER, VA-MD
055

SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

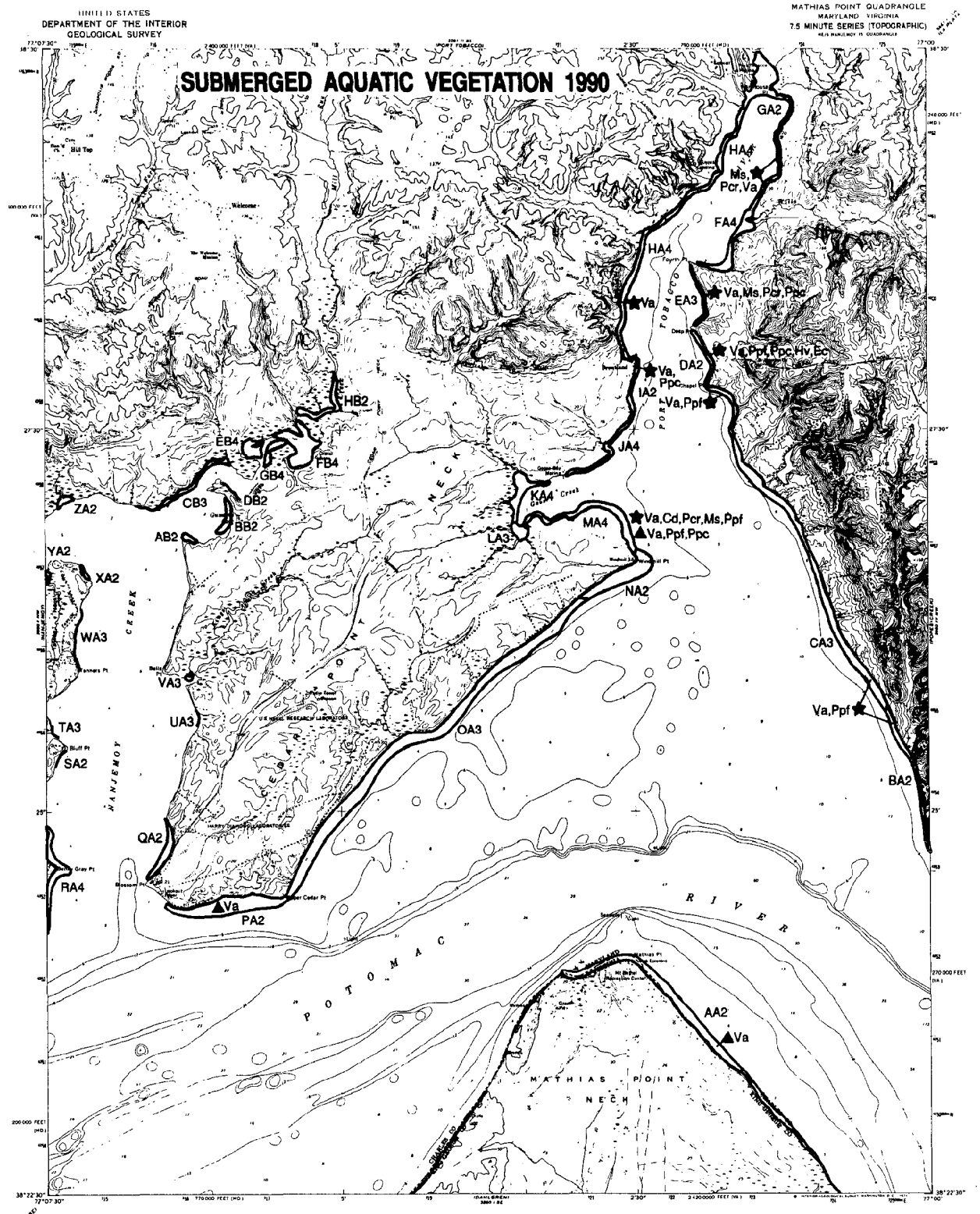
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-31-90

NANJEMOY, MD
056



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

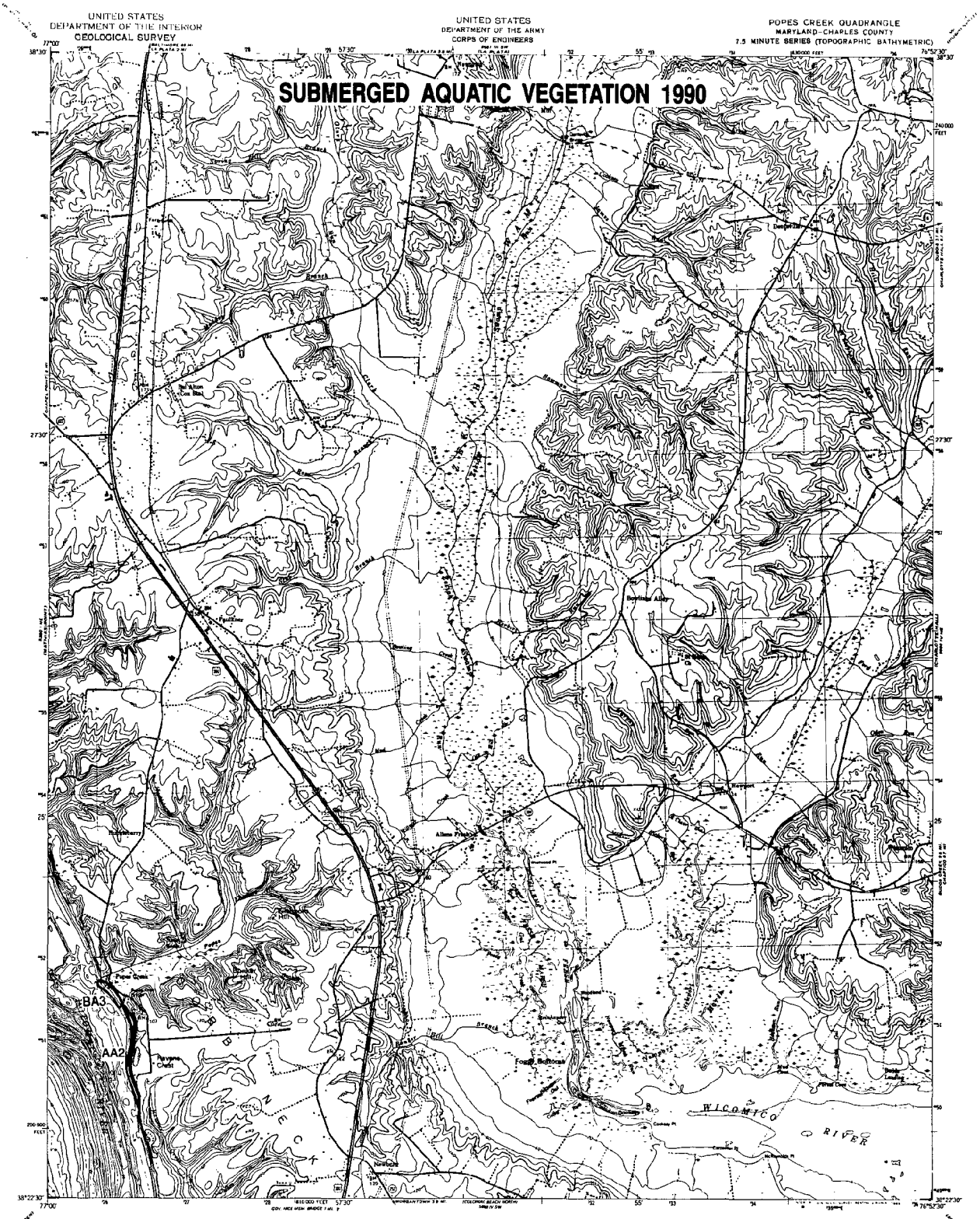
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATES FLOWN
Flight Lines 118, 119, 120 8-31-90
Flight Lines 76, 133 · 9-11-90

MATHIAS POINT, MD-VA
057



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

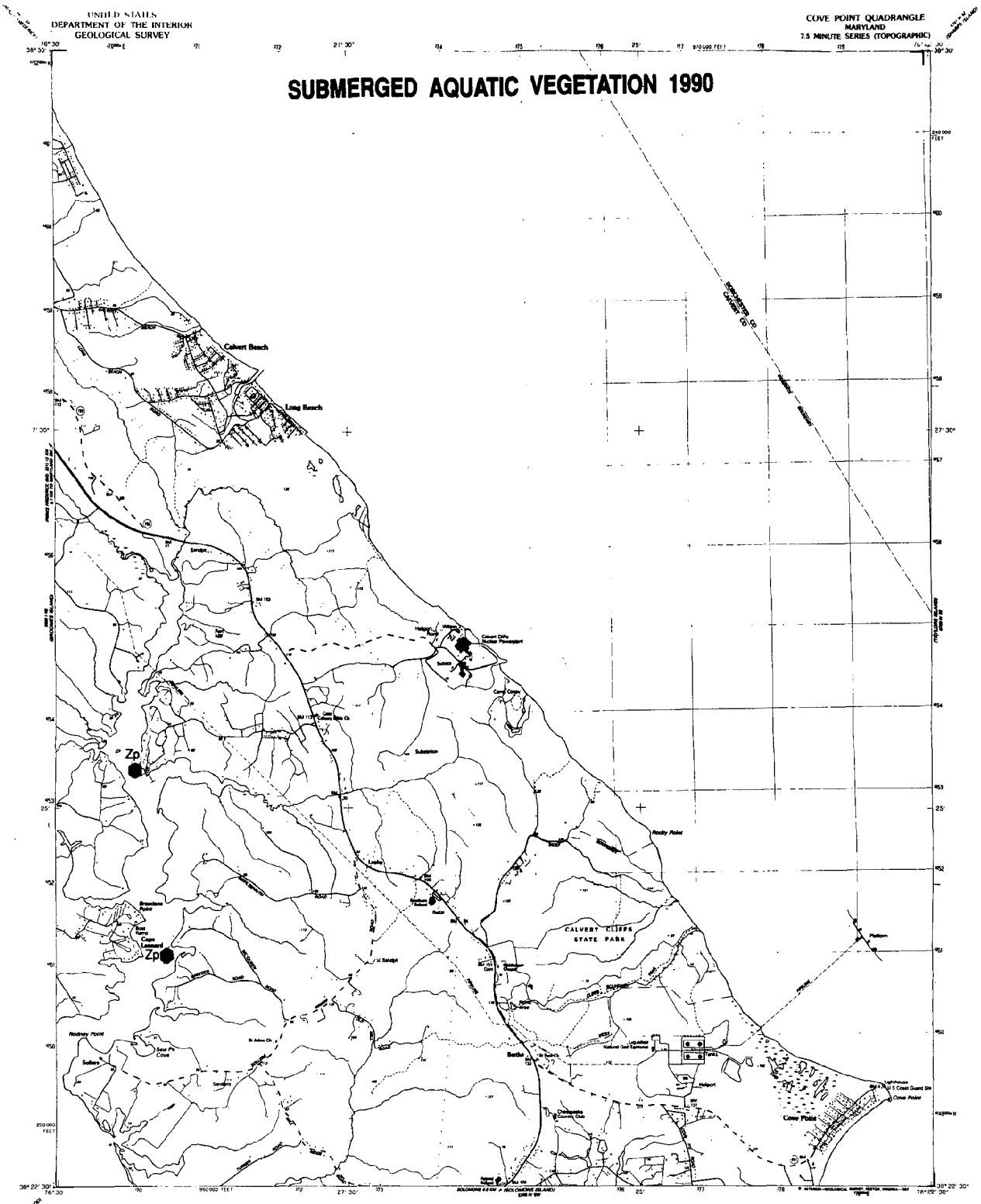
SURVEY STATIONS

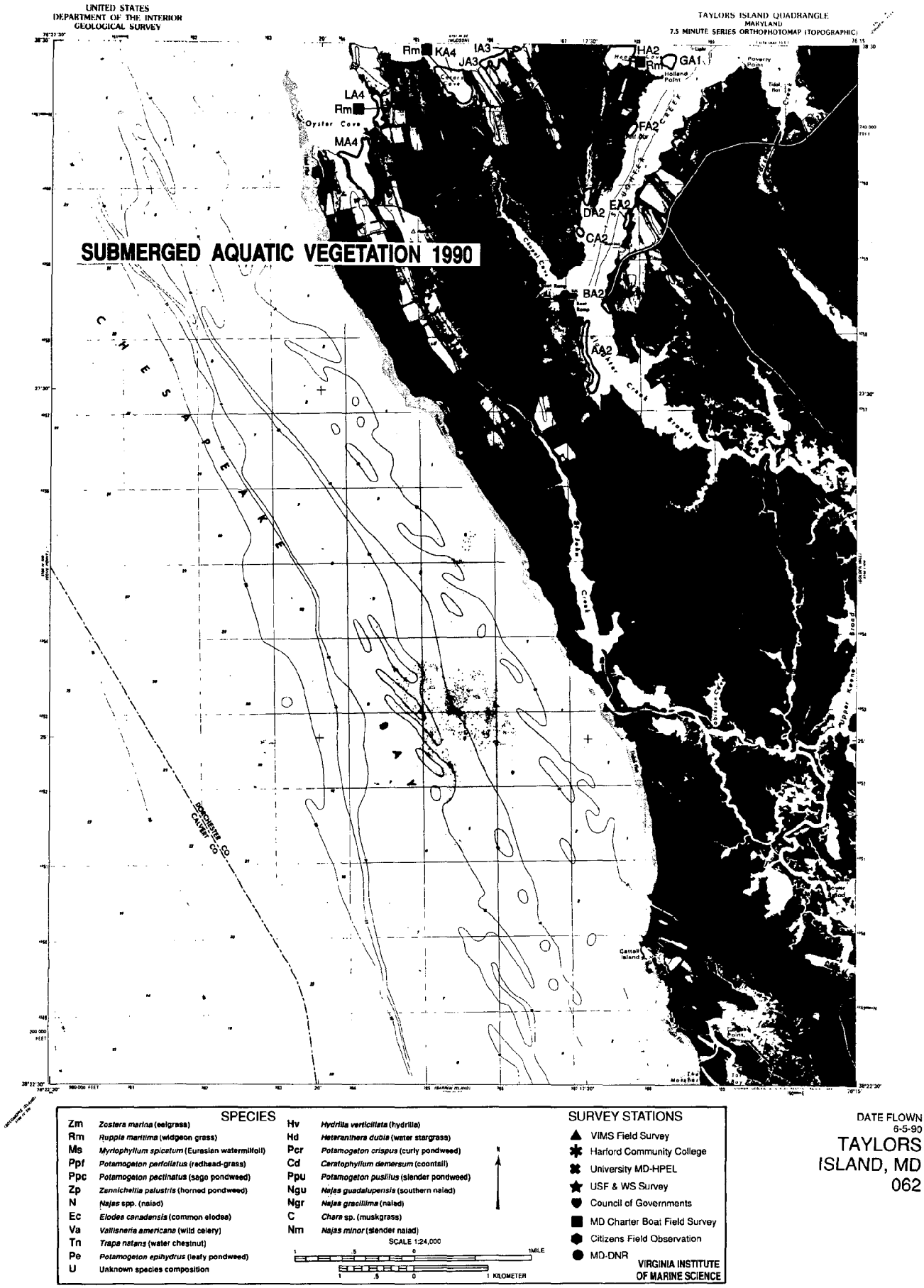
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬢ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-11-90

POPES CREEK, MD
058


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COVE POINT QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
Calvert Beach
Long Beach
Zp
Zp
CALVERT CLIFFS
STATE PARK
Cove Point
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
N
SCALE 1:24,000
1 .5 0 1MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE
OF MARINE SCIENCE
DATE FLOWN
8-1-90
COVE POINT,
MD
061


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
TAYLORS ISLAND QUADRANGLE
MARYLAND
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
Rm
KA4
IA3
JA3
HA2
GA1
LA4
Oyster Cove
MA4
FA2
DA2
EA2
CA2
BA2
AA2
Holland Point
Poverty Point
Cattail Island
DORCHESTER CO
CALVERT CO
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
TAYLORS ISLAND, MD
062

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GOLDEN HILL QUADRANGLE
MARYLAND DORCHESTER CO
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

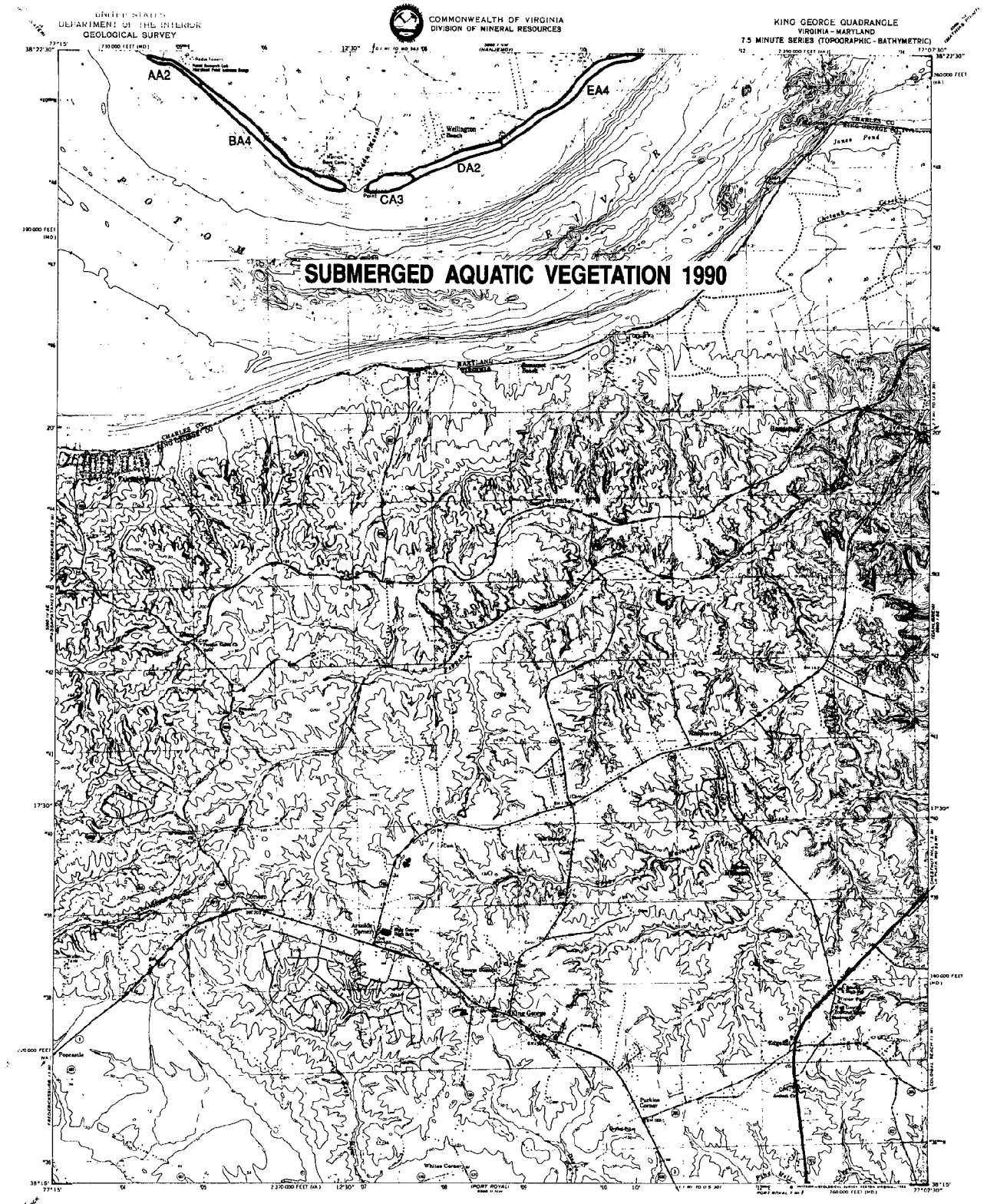
SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

GOLDEN HILL, MD
063



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 5 0 1 MILE

1 .5 0 1 KILOMETER

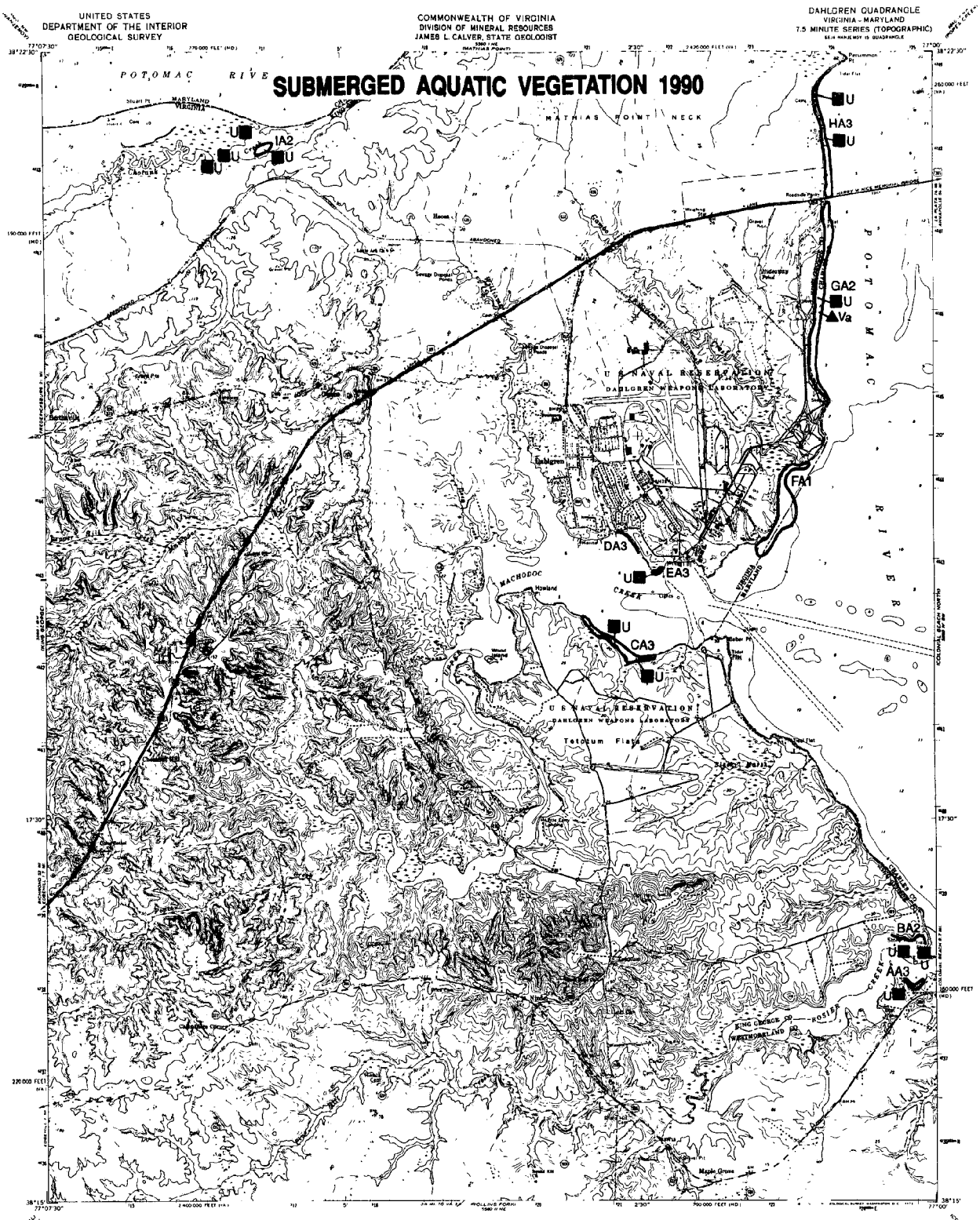
SURVEY STATIONS

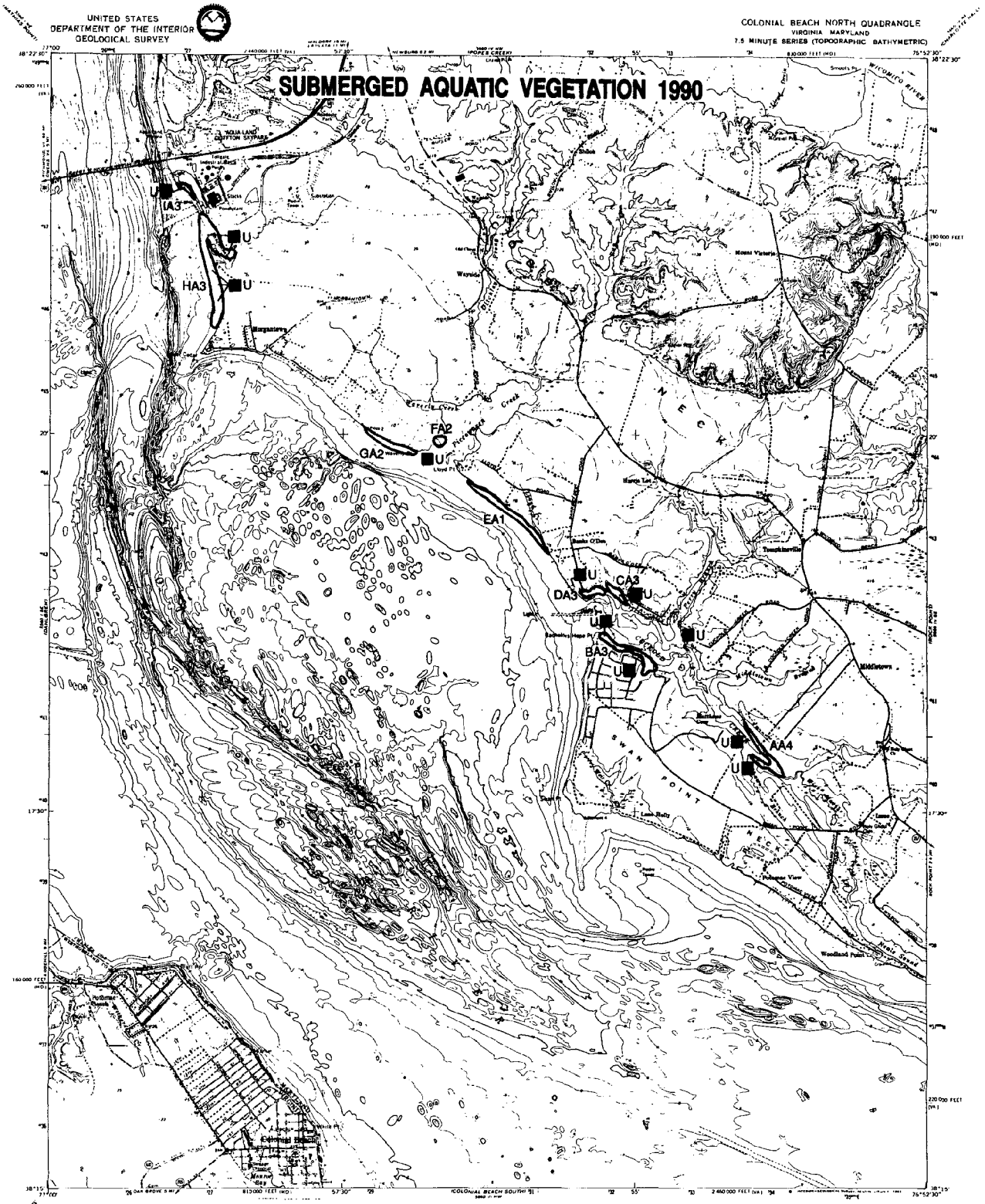
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-31-90

KING GEORGE,
VA-MD
065


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
DAHLGREN QUADRANGLE
VIRGINIA - MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
POTOMAC RIVER
MATTAWOMAN CREEK
MACHODOC CREEK
MATTAWOMAN NECK
U S NAVAL RESERVATION
DAHLGREN WEAPONS LABORATORY
IA2
HA3
GA2
Va
FA1
DA3
EA3
CA3
BA2
AA3
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sego pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
9-11-90
DAHLGREN
VA-MD
066



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

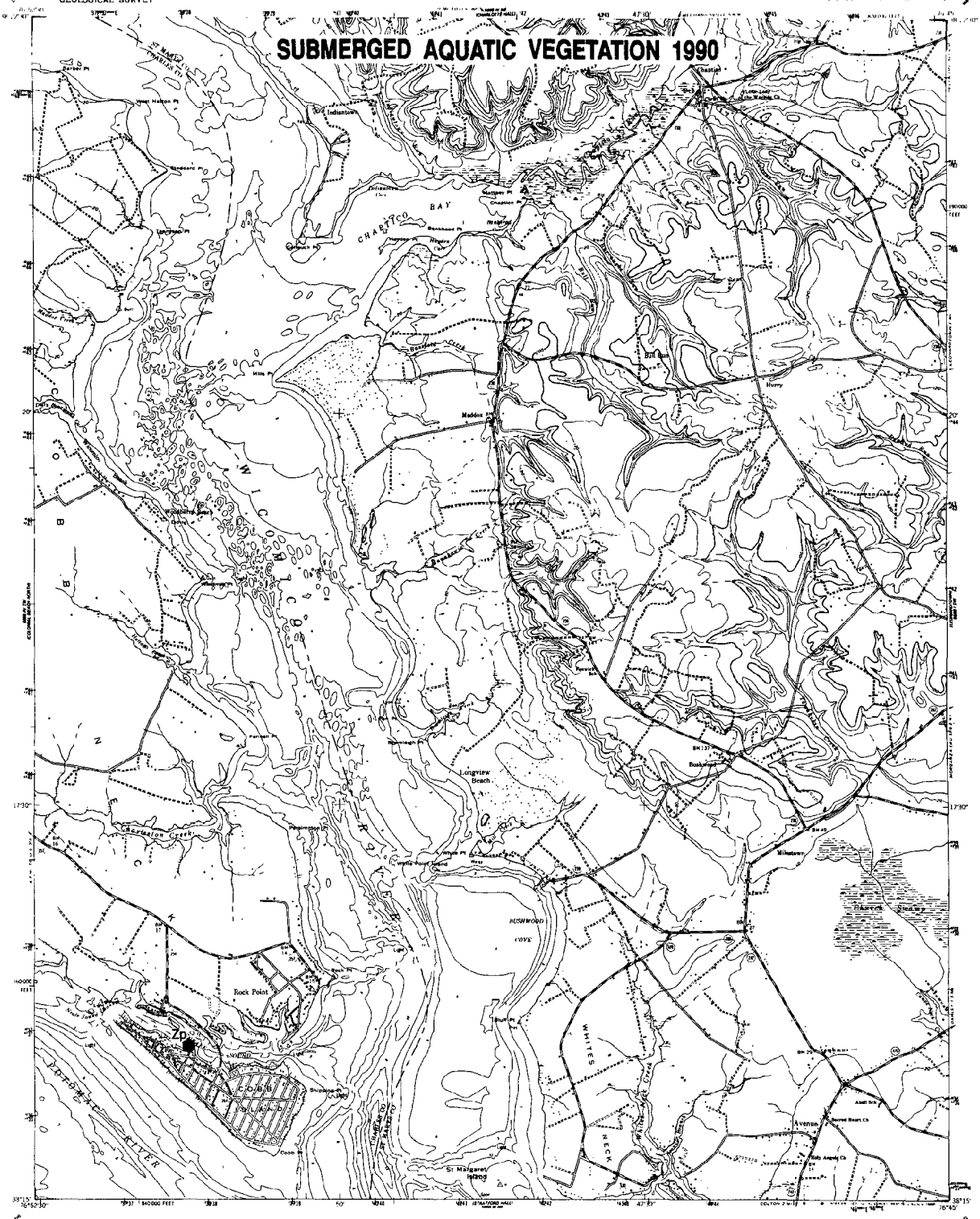
DATE FLOWN
8-1-90

COLONIAL BEACH
NORTH, VA-MD
067

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ROCK POINT QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC - BATHYMETRIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (radhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

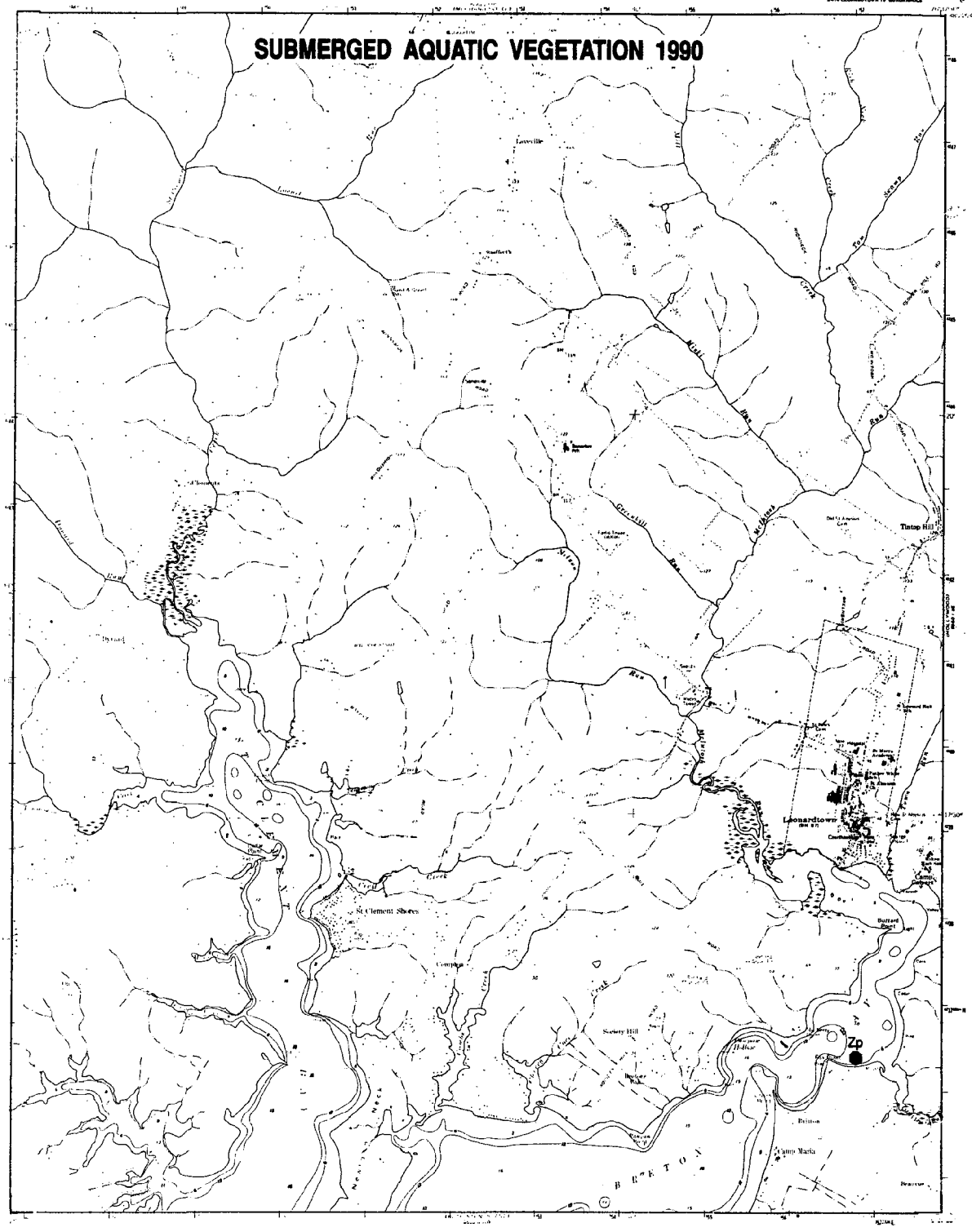
DATE FLOWN
8-1-90

ROCK POINT, MD
068

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

LEONARDTOWN QUADRANGLE
MARYLAND - ST. MARYS CO.
7.5 MINUTE SERIES

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)
Rm	*Ruppia maritima* (widgeon grass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)
Ppf	*Potamogeton perfoliatus* (redhead-grass)
Ppc	*Potamogeton pectinatus* (sago pondweed)
Zp	*Zannichellia palustris* (horned pondweed)
N	*Najas* spp. (naiad)
Ec	*Elodea canadensis* (common elodea)
Va	*Vallisneria americana* (wild celery)
Tn	*Trapa natans* (water chestnut)
Pe	*Potamogeton epihydrus* (leafy pondweed)
U	Unknown species composition
Hv	*Hydrilla verticillata* (hydrilla)
Hd	*Heteranthera dubia* (water stargrass)
Pcr	*Potamogeton crispus* (curly pondweed)
Cd	*Ceratophyllum demersum* (coontail)
Ppu	*Potamogeton pusillus* (slender pondweed)
Ngu	*Najas guadalupensis* (southern naiad)
Ngr	*Najas gracillima* (naiad)
C	*Chara* sp. (muskgrass)
Nm	*Najas minor* (slender naiad)

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

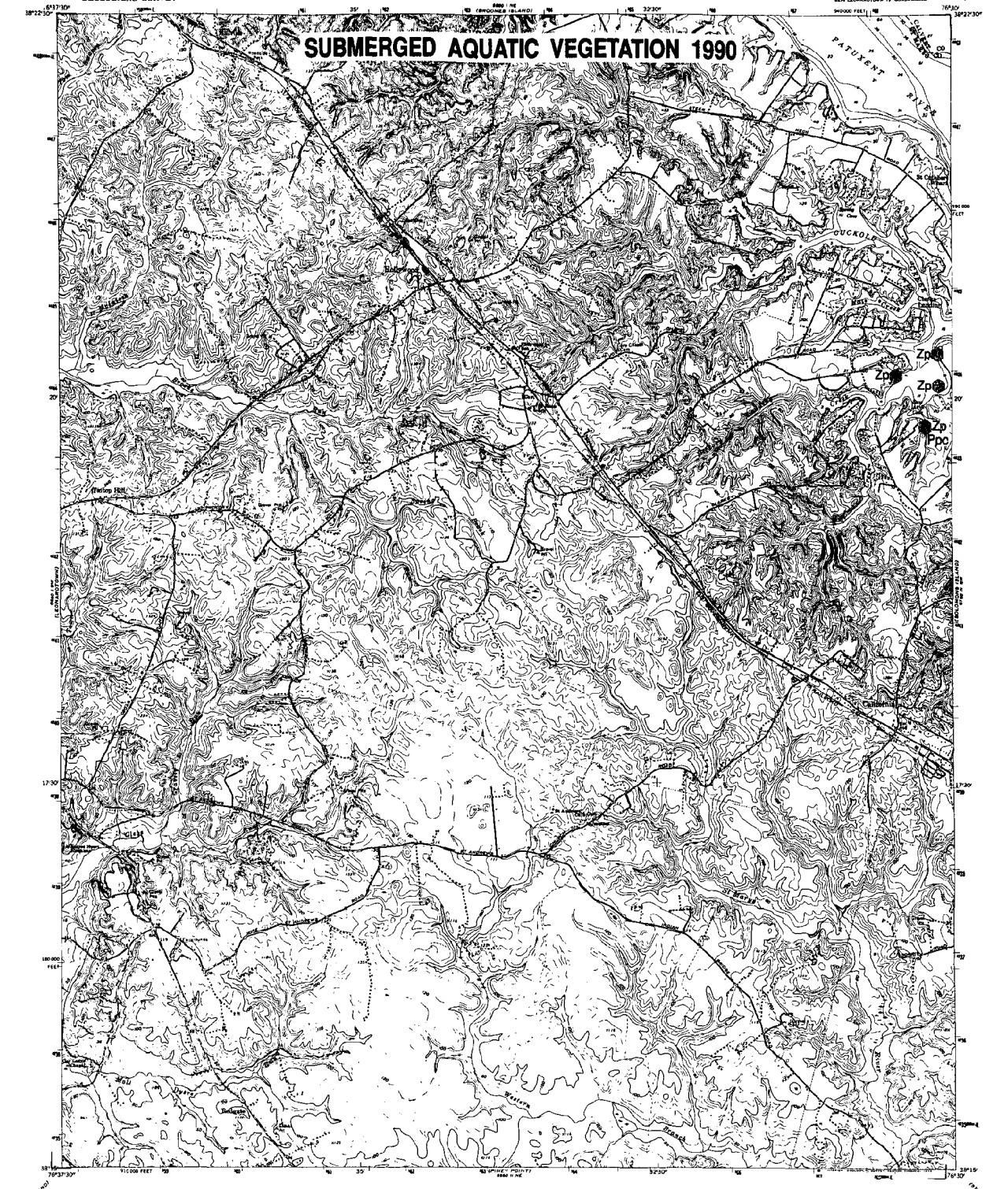
DATE FLOWN
8-1-90

LEONARDTOWN, MD
069

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HOLLYWOOD QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 0 1 KILOMETER

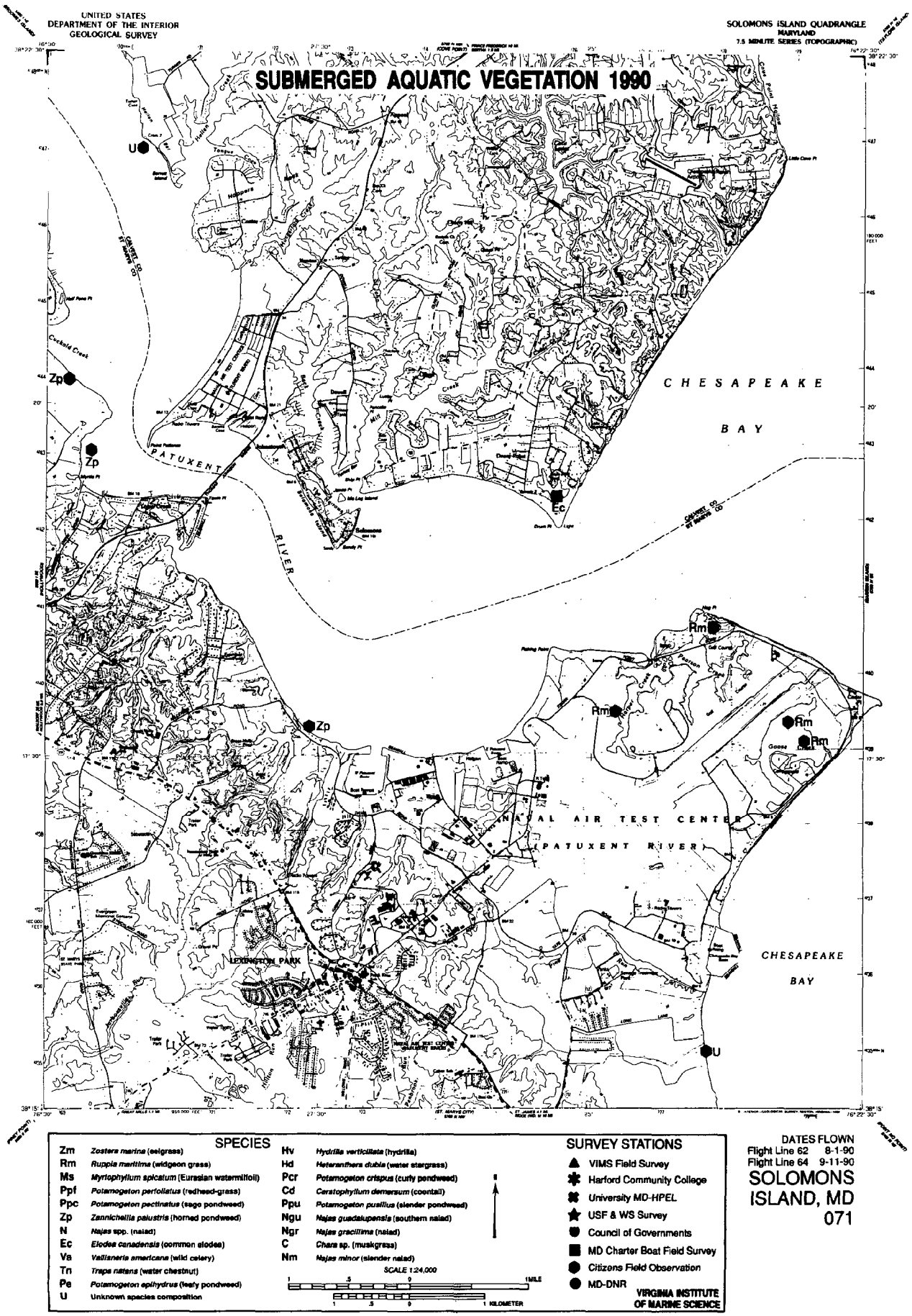
SURVEY STATIONS

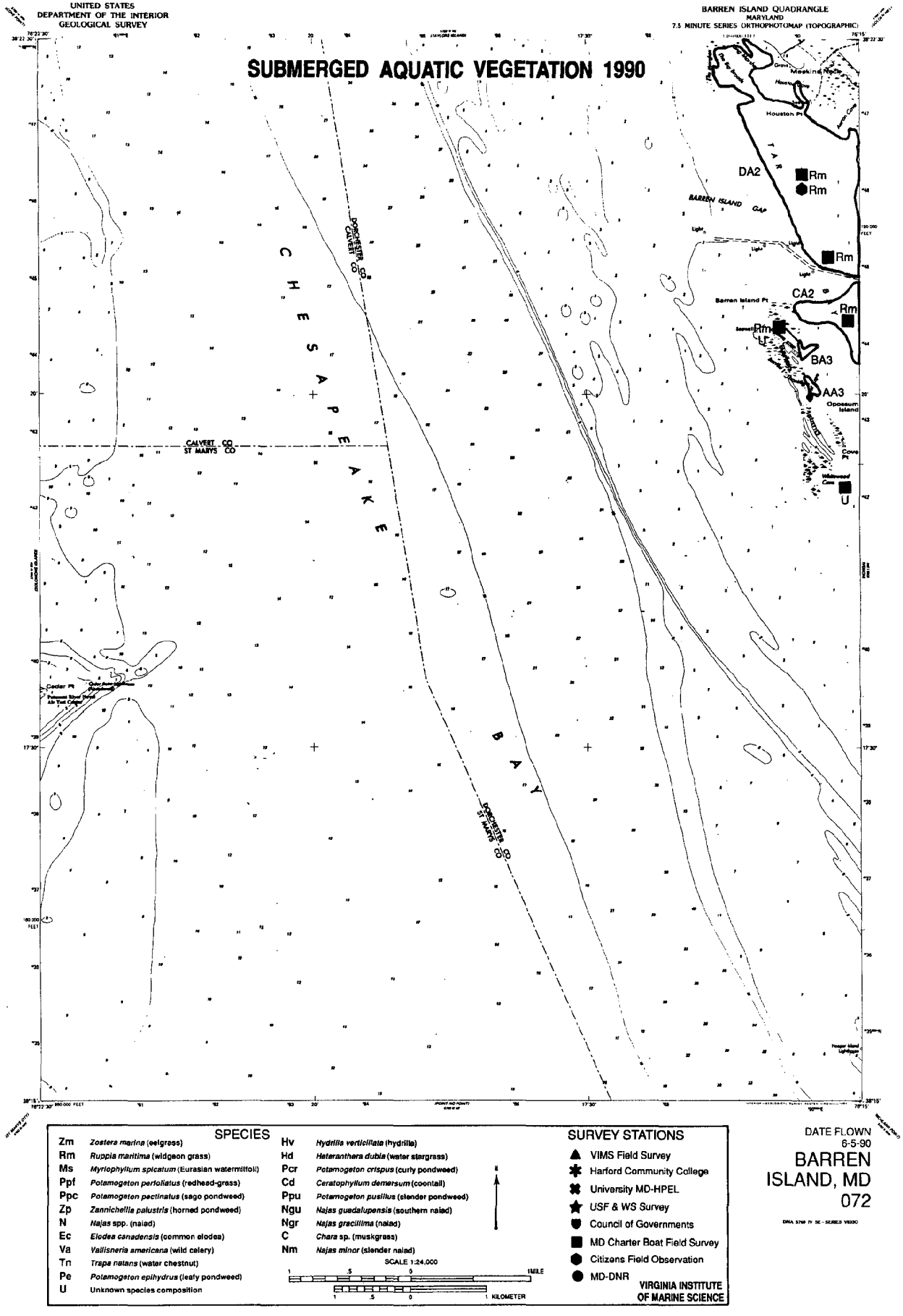
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
9-11-90

HOLLYWOOD, MD
070


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
SOLOMONS ISLAND QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
CHESAPEAKE
BAY
PATUXENT
RIVER
NAVAL AIR TEST CENTER
PATUXENT RIVER
CHESAPEAKE
BAY
LEXINGTON PARK
CALVERT CO
ST MARYS CO
U
Zp
Ec
Rm
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Vs Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATES FLOWN
Flight Line 62 8-1-90
Flight Line 64 9-11-90
SOLOMONS ISLAND, MD
071


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
BARREN ISLAND QUADRANGLE
MARYLAND
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
CHESAPEAKE BAY
TAR
BARREN ISLAND GAP
DORCHESTER CO
CALVERT CO
ST MARYS CO
Houston Pt
Barren Island Pt
Opossum Island
Cedar Pt
DA2
CA2
BA3
AA3
Rm
U
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
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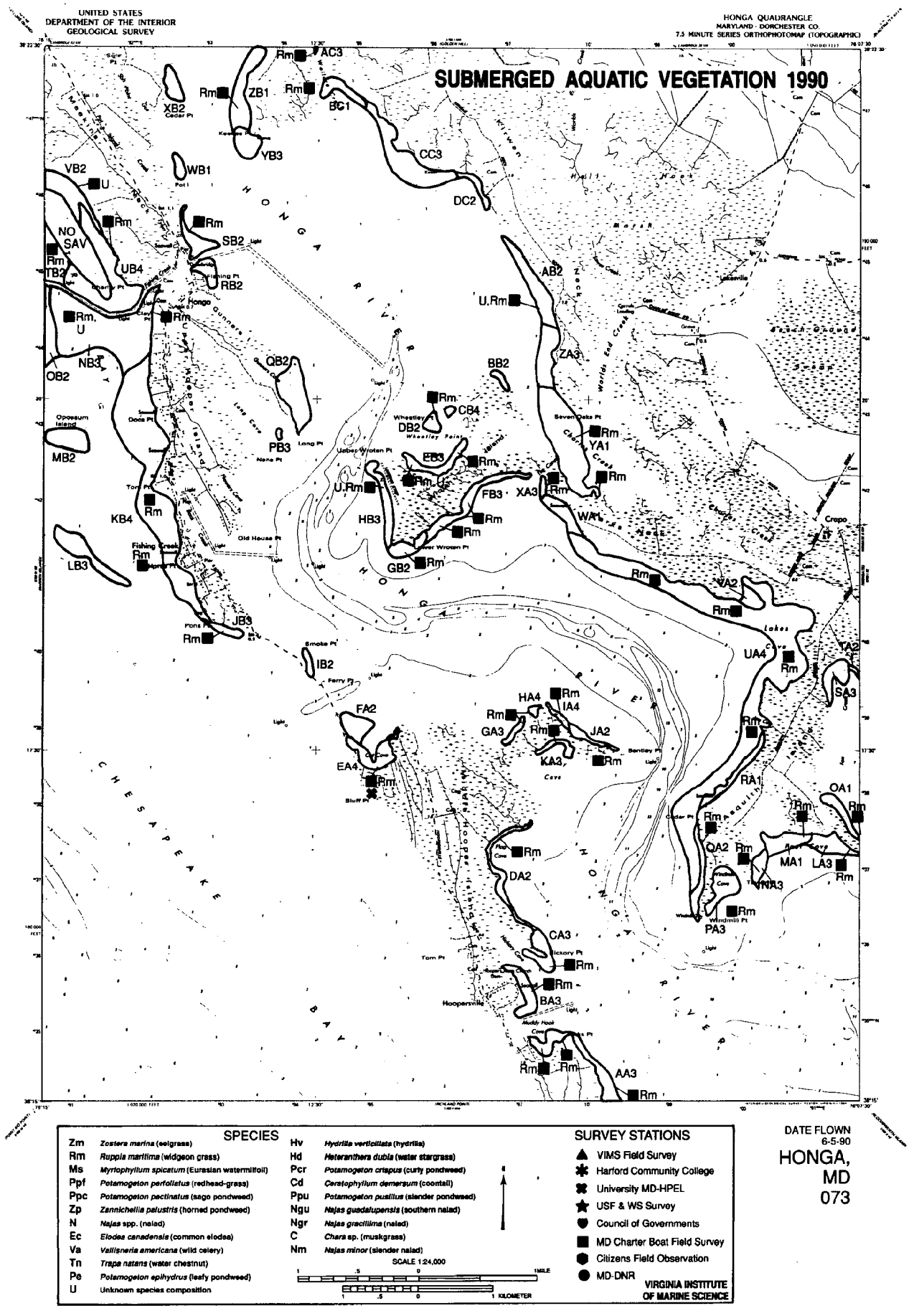
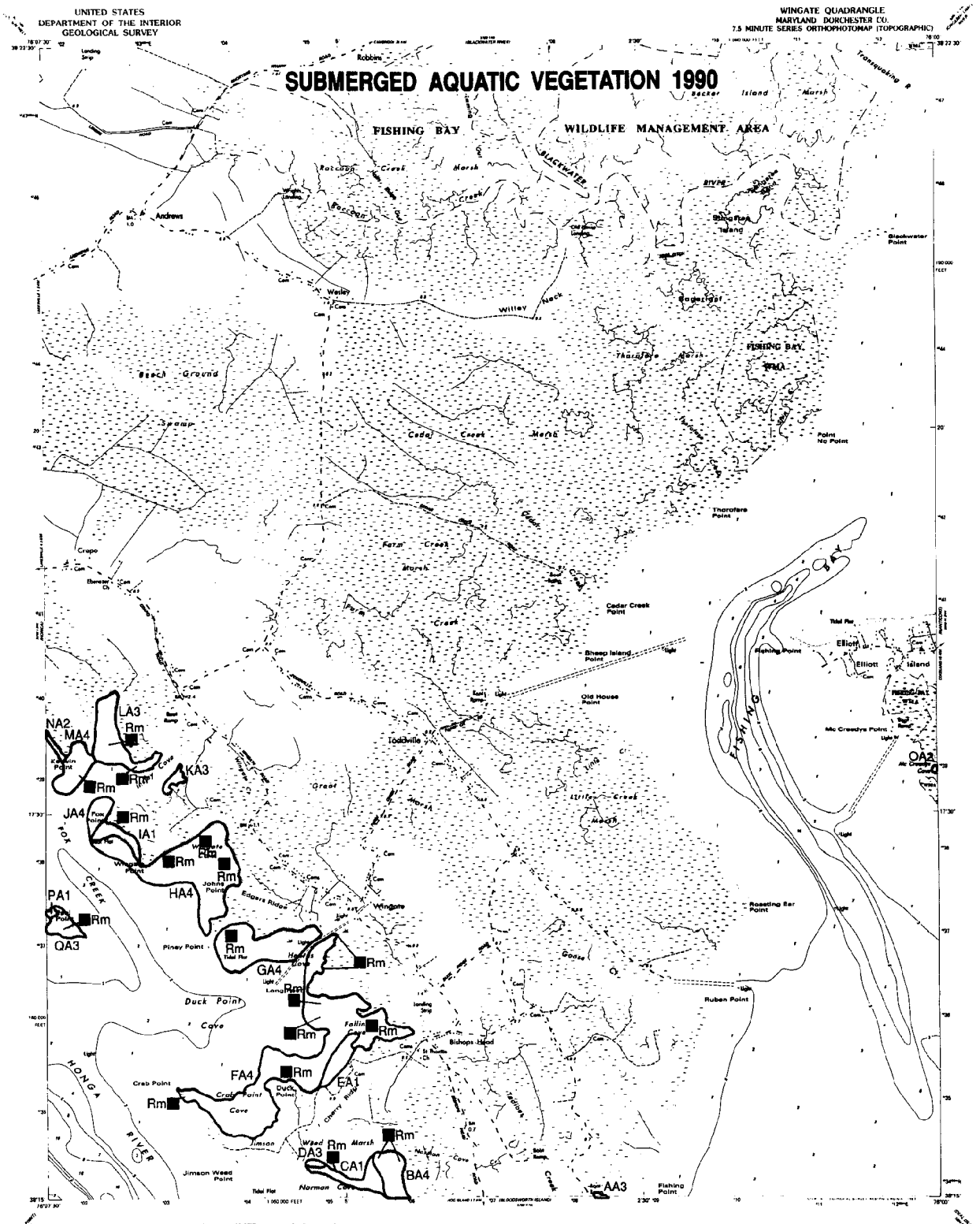
1 .5 0 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
BARREN ISLAND, MD
072


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
HONGA QUADRANGLE
MARYLAND - DORCHESTER CO.
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
HONGA RIVER
CHESAPEAKE BAY
Hoopers Island
Tar Bay
Fishing Creek
Old House Pt
Tom Pt
Hoopersville
Muddy Hook
Bishops Head
Bluff Pt
Ferry Pt
Smoke Pt
Bishop Pt
Long Pt
Nono Pt
Opossum Island
Wheatley Point
Upper Wroten Pt
Lower Wroten Pt
Severn Oaks Pt
Bentley Pt
Cedar Pt
Windmill Pt
Hickory Pt
Crapo
Lakes
Rm
AC3
ZB1
BC1
XB2
YB3
CC3
DC2
VB2
U
WB1
NO SAV
SB2
TB2
UB4
RB2
U.Rm
AB2
ZA3
NB3
OB2
QB2
BB2
CB4
DB2
PB3
EB3
YA1
MB2
U.Rm
FB3
XA3
HB3
WA1
KB4
GB2
YA2
LB3
JB3
UA4
TA2
IB2
SA3
HA4
IA4
FA2
GA3
JA2
KA3
EA4
RA1
OA1
QA2
MA1
LA3
NA3
PA3
DA2
CA3
BA3
AA3
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
HONGA,
MD
073



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

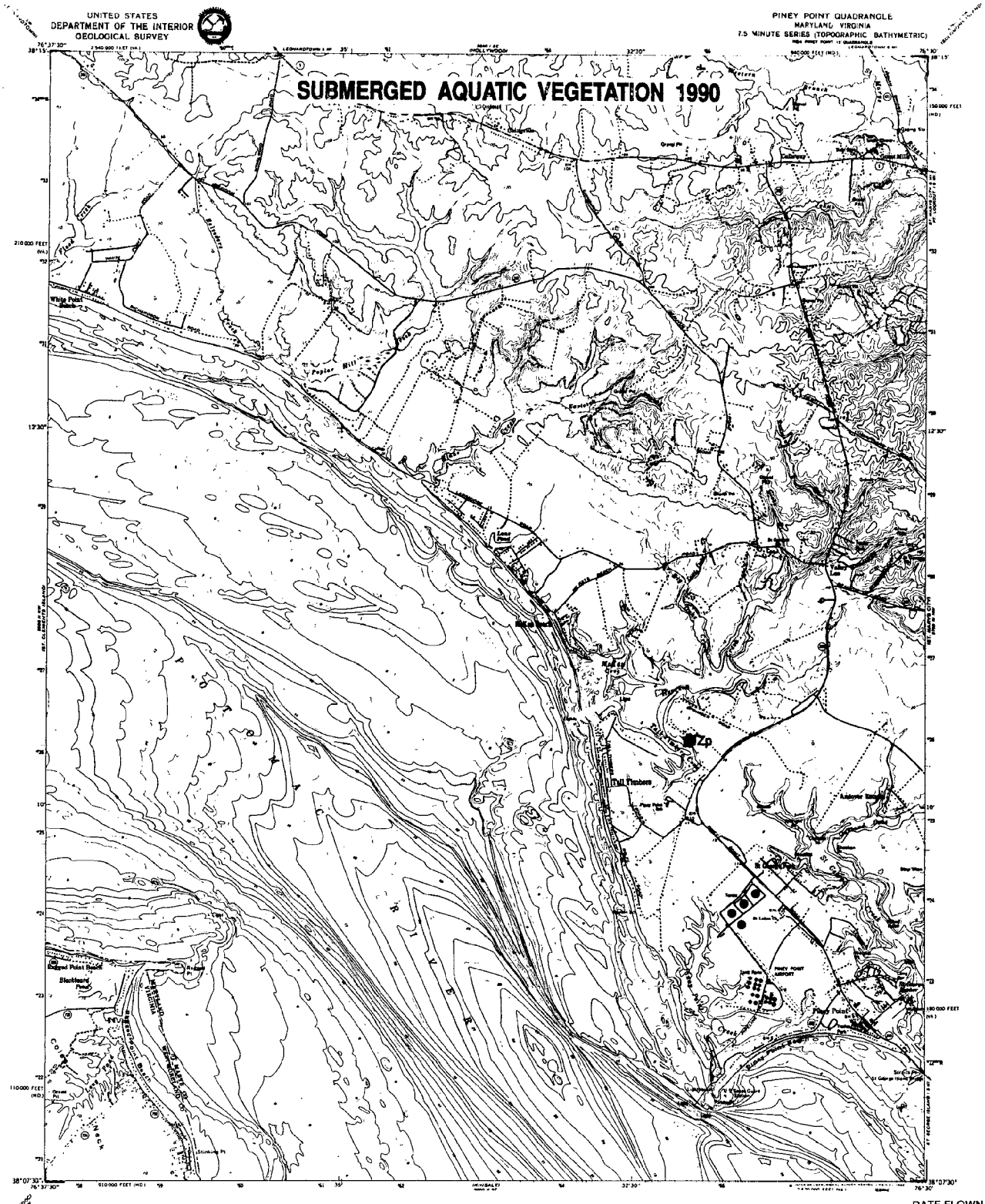
SCALE 1:24,000

SURVEY STATIONS
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ♥ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

WINGATE, MD
074



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllu m demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

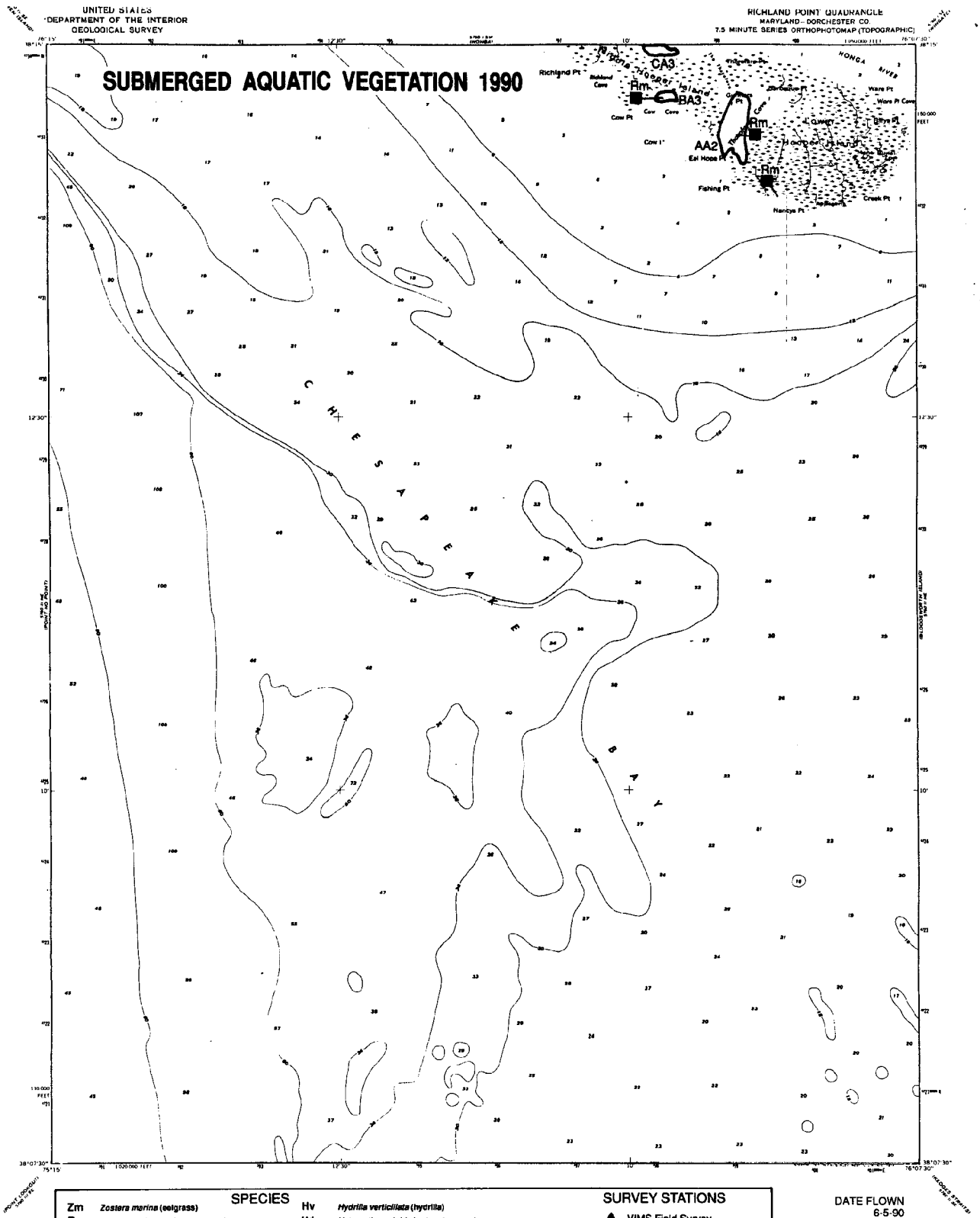
SURVEY STATIONS

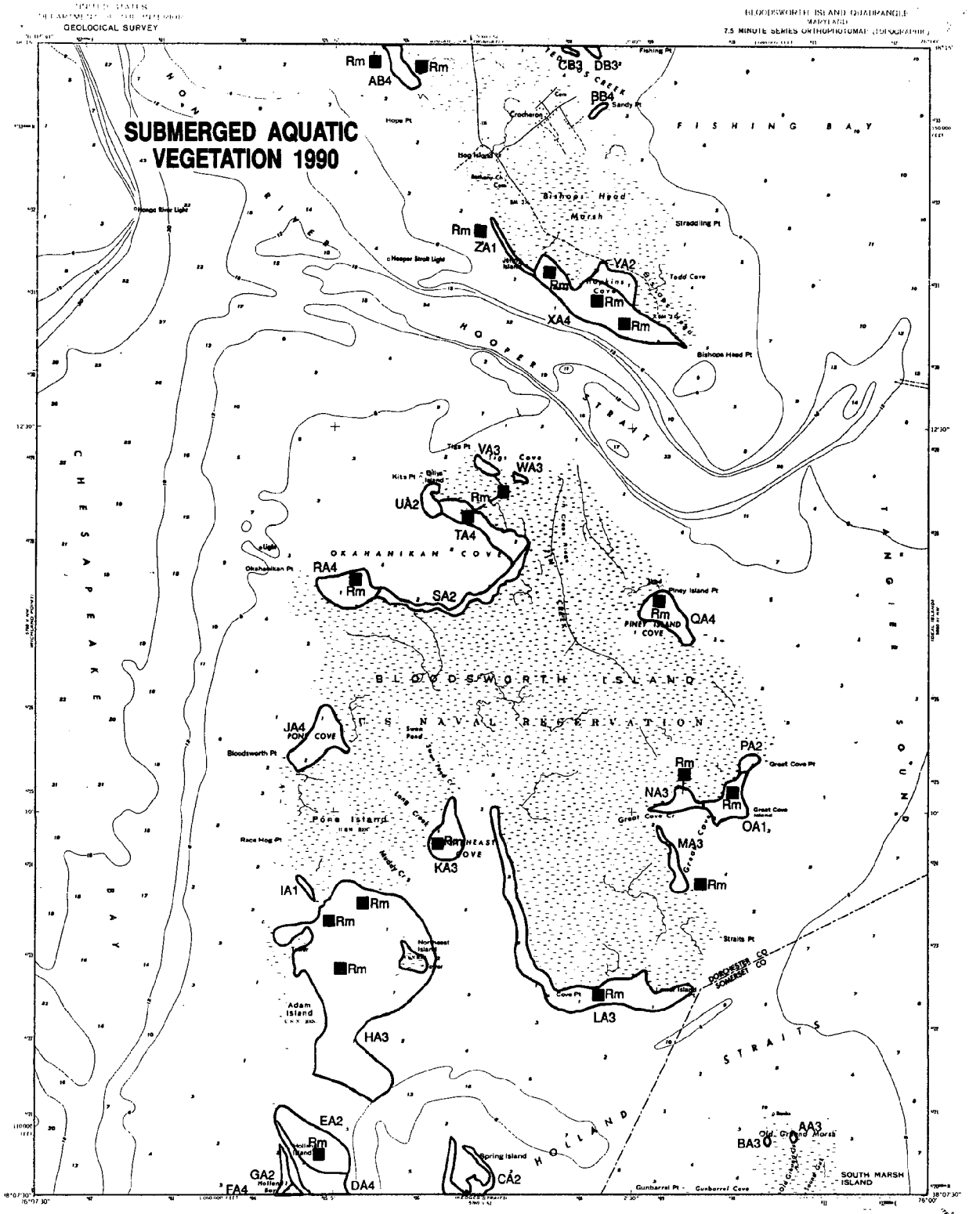
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
8-1-90

PINEY POINT,
MD-VA
079


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
RICHLAND POINT QUADRANGLE
MARYLAND - DORCHESTER CO.
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
CA3
BA3
AA2
Rm
Richland Pt
Cow Pt
Fishing Pt
Nanjee Pt
HONGA RIVER
CHESAPEAKE BAY
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
RICHLAND POINT, MD
082



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

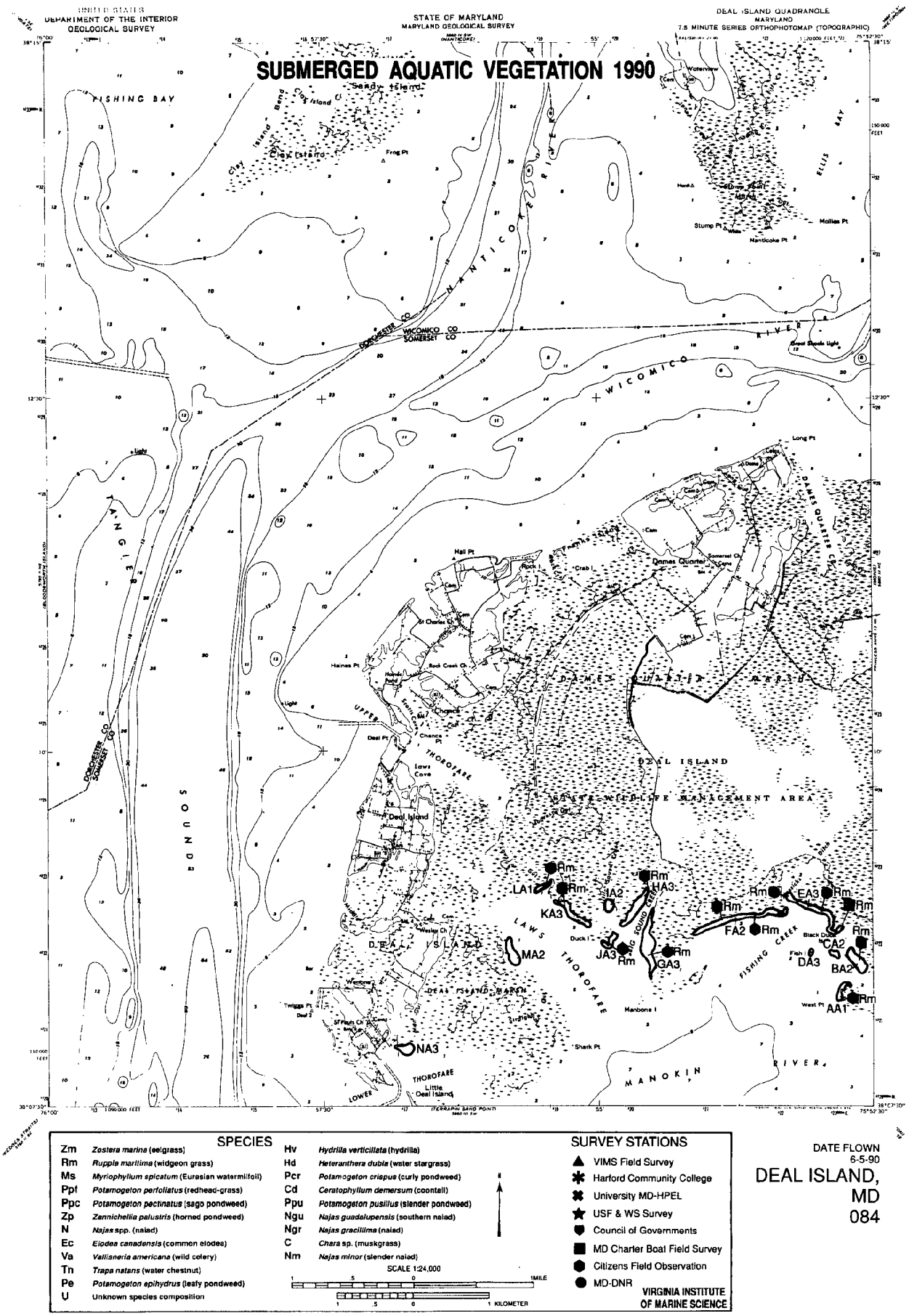
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

BLOODSWORTH ISLAND, MD
083

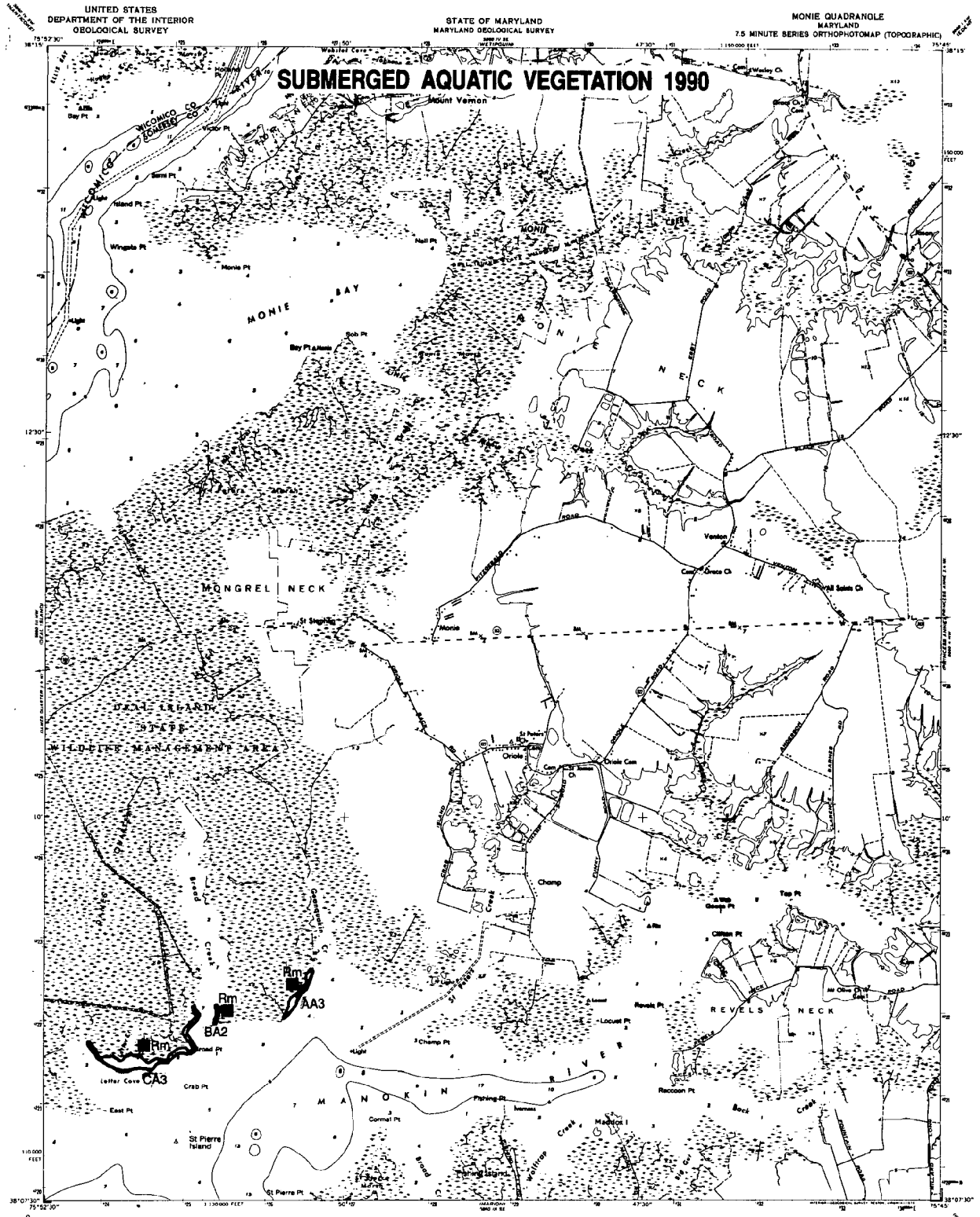

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF MARYLAND
MARYLAND GEOLOGICAL SURVEY
DEAL ISLAND QUADRANGLE
MARYLAND
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
FISHING BAY
Sandy Island
Clay Island
Frog Pt
NANTICOKE RIVER
WICOMICO RIVER
DORCHESTER CO
WICOMICO CO
SOMERSET CO
TANGIER SOUND
Hall Pt
Haines Pt
Deal Pt
Chance Pt
Laws Cove
Deal Island
UPPER THOROFARE
DEAL ISLAND
STATE WILDLIFE MANAGEMENT AREA
DAMES QUARTER MARSH
Dames Quarter
Long Pt
Stump Pt
Nanticoke Pt
Mollies Pt
ELLIS BAY
Waterview
Great Shoals Light
LAWS THOROFARE
DEAL ISLAND MARSH
Manbone I
Shark Pt
Little Deal Island
LOWER THOROFARE
MANOKIN RIVER
FISHING CREEK
Black Duck
West Pt
Rm
LA1
KA3
IA2
HA3
JA3
GA3
MA2
FA2
EA3
CA2
DA3
BA2
AA1
NA3
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
DEAL ISLAND, MD
084

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF MARYLAND
MARYLAND GEOLOGICAL SURVEY

MONIE QUADRANGLE
MARYLAND
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

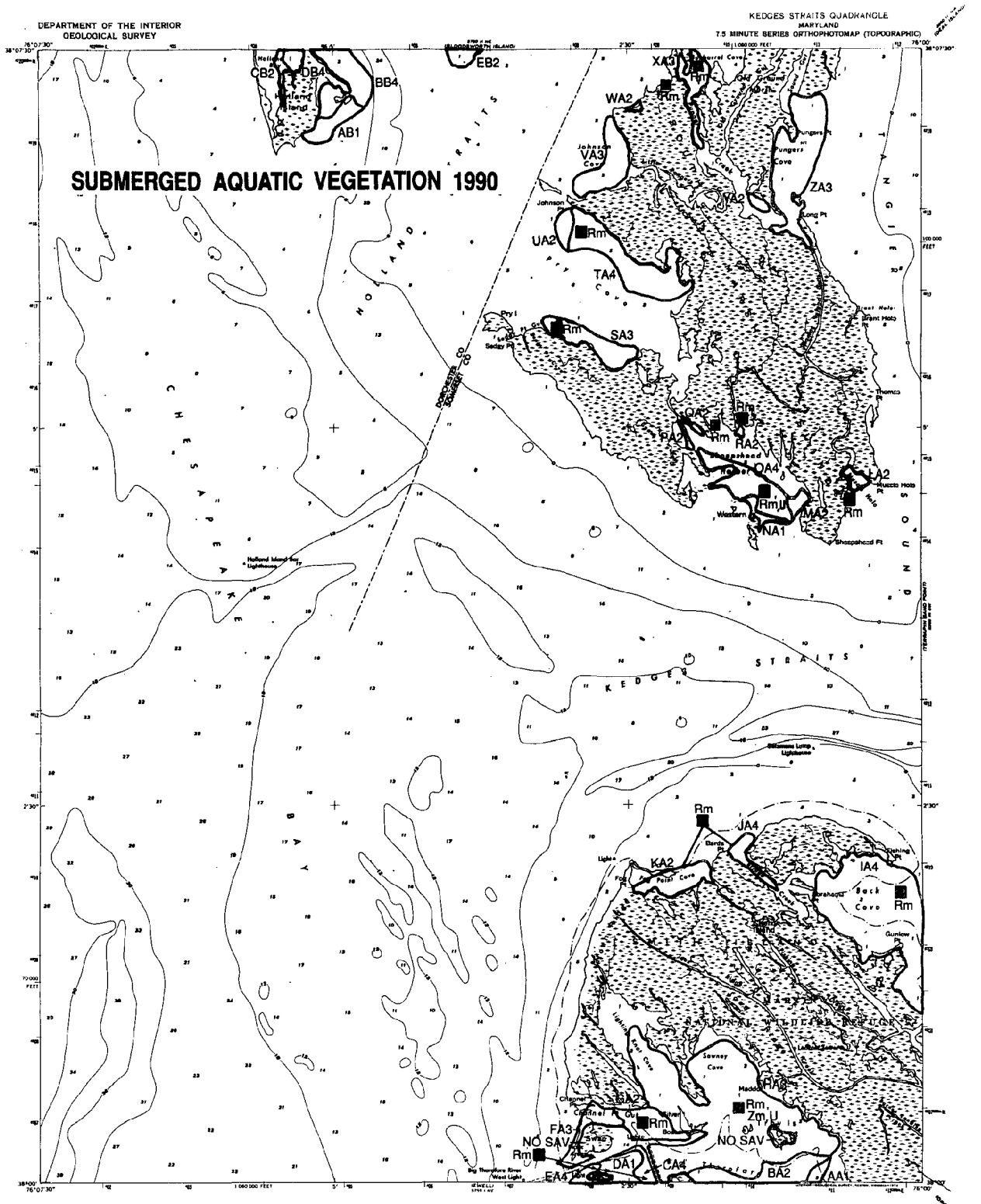
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ♥ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

MONIE,
MD
085



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophylium demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

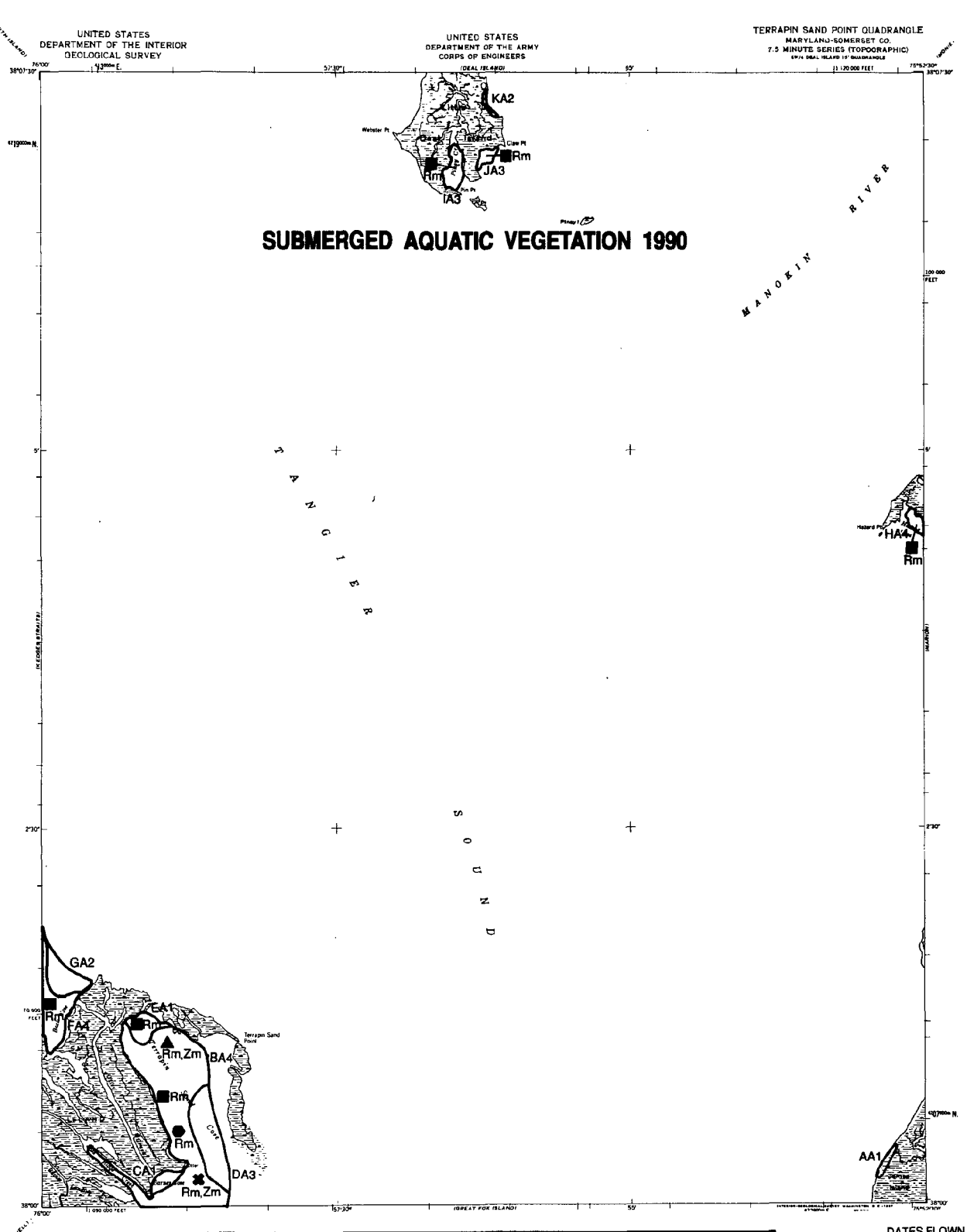
SURVEY STATIONS

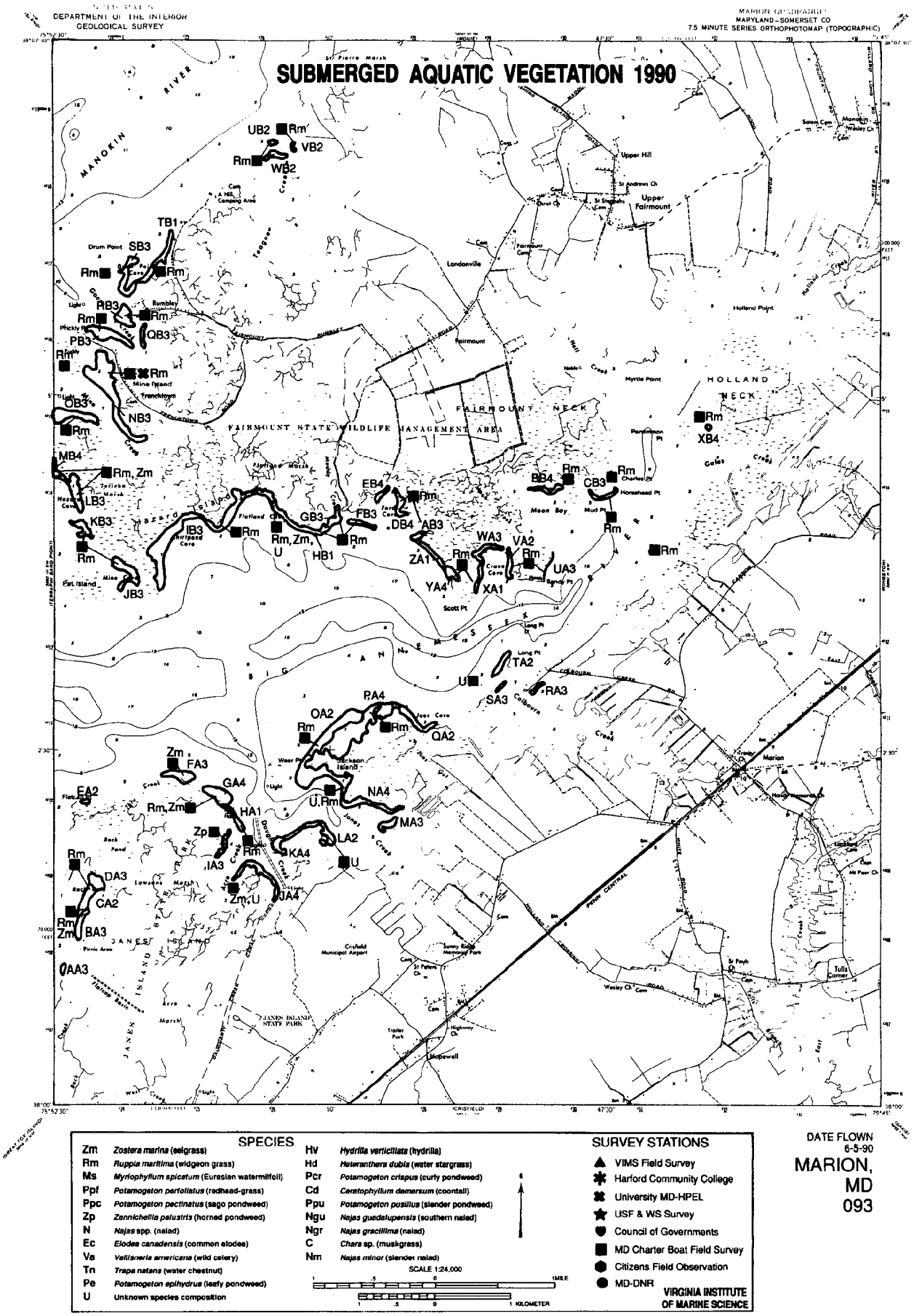
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

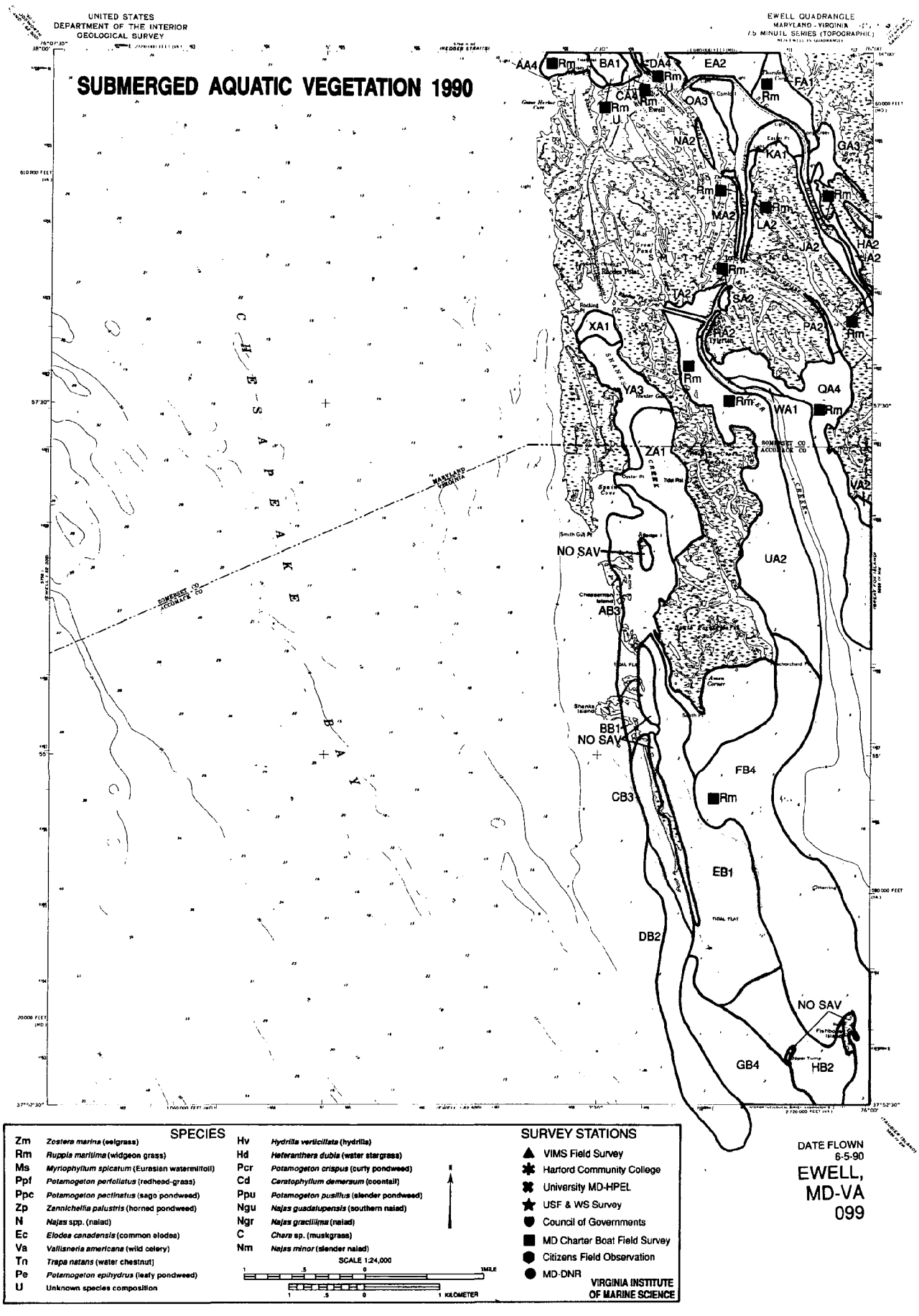
DATE FLOWN
6-5-90

KEDGES STRAITS, MD
091


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
UNITED STATES
DEPARTMENT OF THE army
CORPS OF ENGINEERS
TERRAPIN SAND POINT QUADRANGLE
MARYLAND-SOMERSET CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
TANGIER SOUND
MANOKIN RIVER
KA2
JA3
IA3
HA4
AA1
GA2
FA4
EA1
BA4
DA3
CA1
Rm
Rm,Zm
Terrapin Sand Point
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATES FLOWN
5-25-90 James & Smith Is.
6-5-90 Deal Is. & Hazard Pt.
TERRAPIN SAND POINT, MD
092



DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MARION QUADRANGLE
MARYLAND-SOMERSET CO
7.5 MINUTE SERIES ORTHOPHOTOMAP (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
MANOKIN RIVER
FAIRMOUNT STATE WILDLIFE MANAGEMENT AREA
FAIRMOUNT NECK
HOLLAND NECK
JANES ISLAND
JANES ISLAND STATE PARK
Upper Fairmount
Fairmount
Landonville
Hollend Point
Myrtle Point
Moon Bay
Scott Pt
Long Pt
Jackson Island
Marion
Crisfield Municipal Airport
Hopewell
Tulls Corner
Pat Island
Drum Point
Rumbley
Mine Island
Trenchtown
Flatland Cove
Hazard Island
Colbourn Creek
Jones Creek
Dougherty Creek
Pennsylvania Central
UB2
Rm
VB2
WB2
TB1
SB3
RB3
QB3
PB3
OB3
NB3
MB4
Rm, Zm
LB3
KB3
JB3
IB3
Rm, Zm, U
GB3
HB1
FB3
EB4
DB4
AB3
ZA1
YA4
WA3
VA2
XA1
UA3
BB4
CB3
XB4
TA2
U
SA3
RA3
PA4
OA2
QA2
Zm
FA3
GA4
EA2
Rm, Zm
HA1
Zp
IA3
KA4
LA2
U, Rm
NA4
MA3
DA3
CA2
BA3
AA3
Zm, U
JA4
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
MARION, MD
093



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

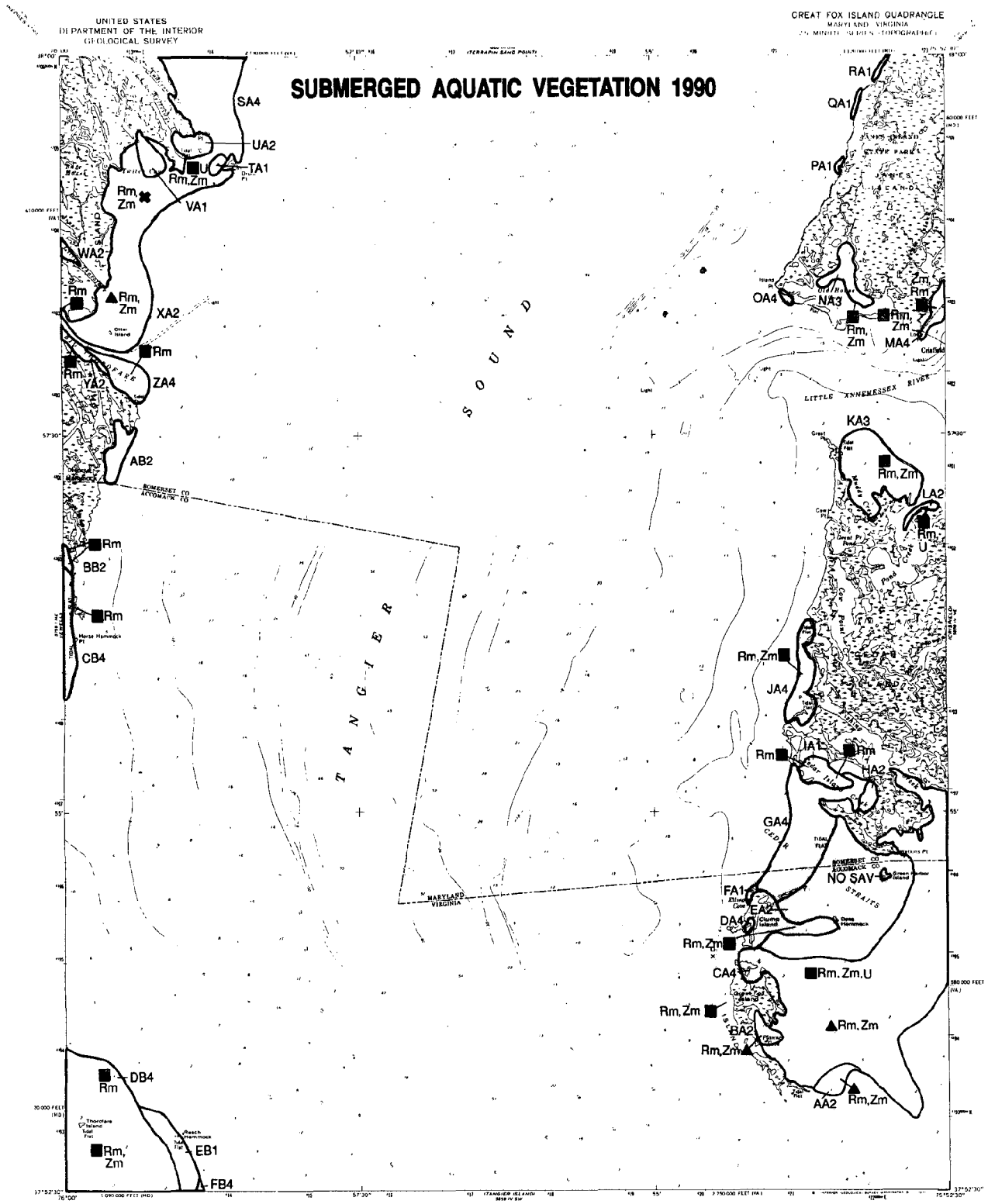
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

EWELL,
MD-VA
099



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

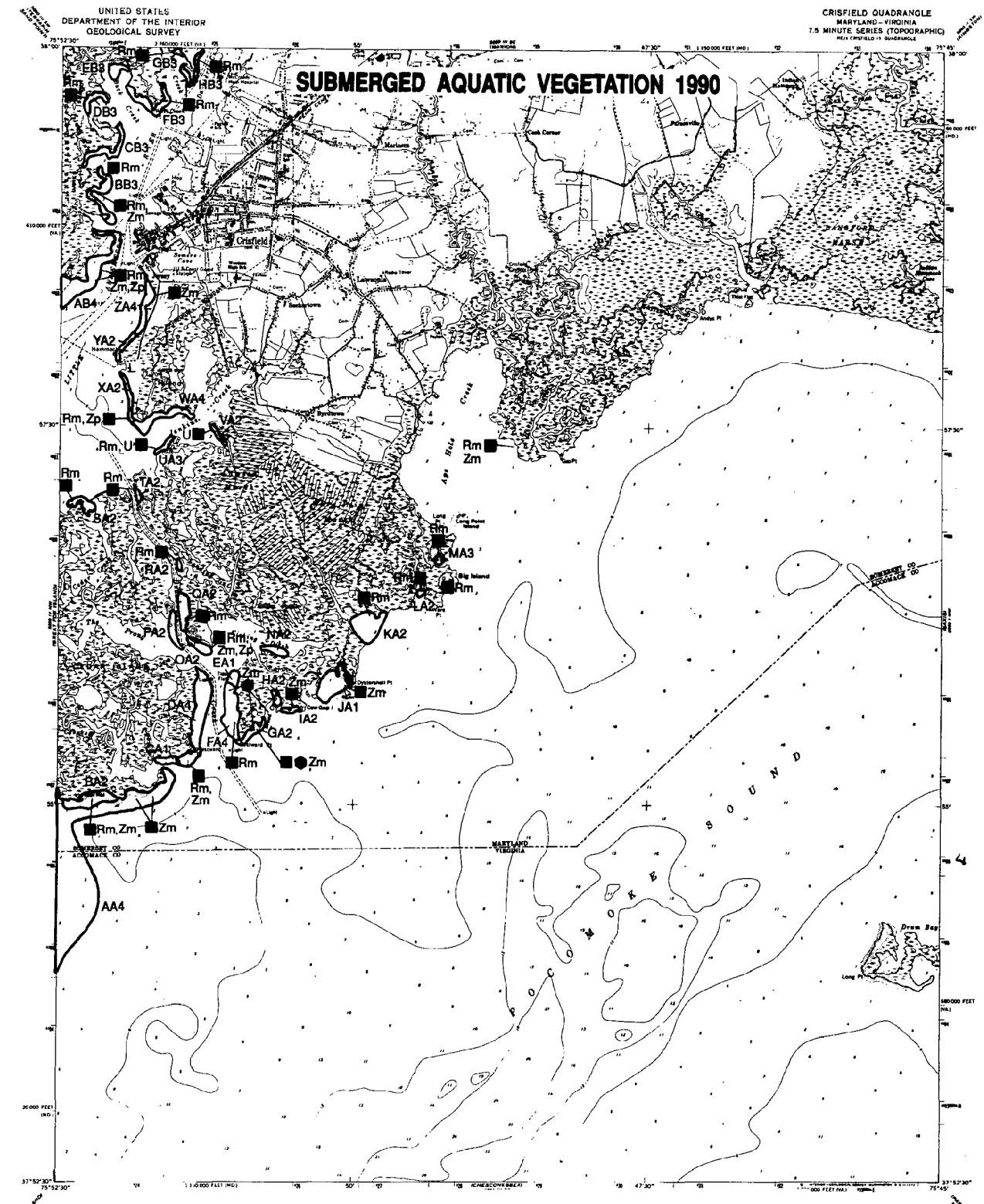
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATES FLOWN
6-5-90 Smith & Thorofare Is.
5-25-90 Cedar & Janes Is.

GREAT FOX ISLAND, MD-VA
100



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
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Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
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U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS	
▲	VIMS Field Survey
✱	Harford Community College
✖	University MD-HPEL
★	USF & WS Survey
●	Council of Governments
■	MD Charter Boat Field Survey
⬢	Citizens Field Observation
●	MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
5-25-90

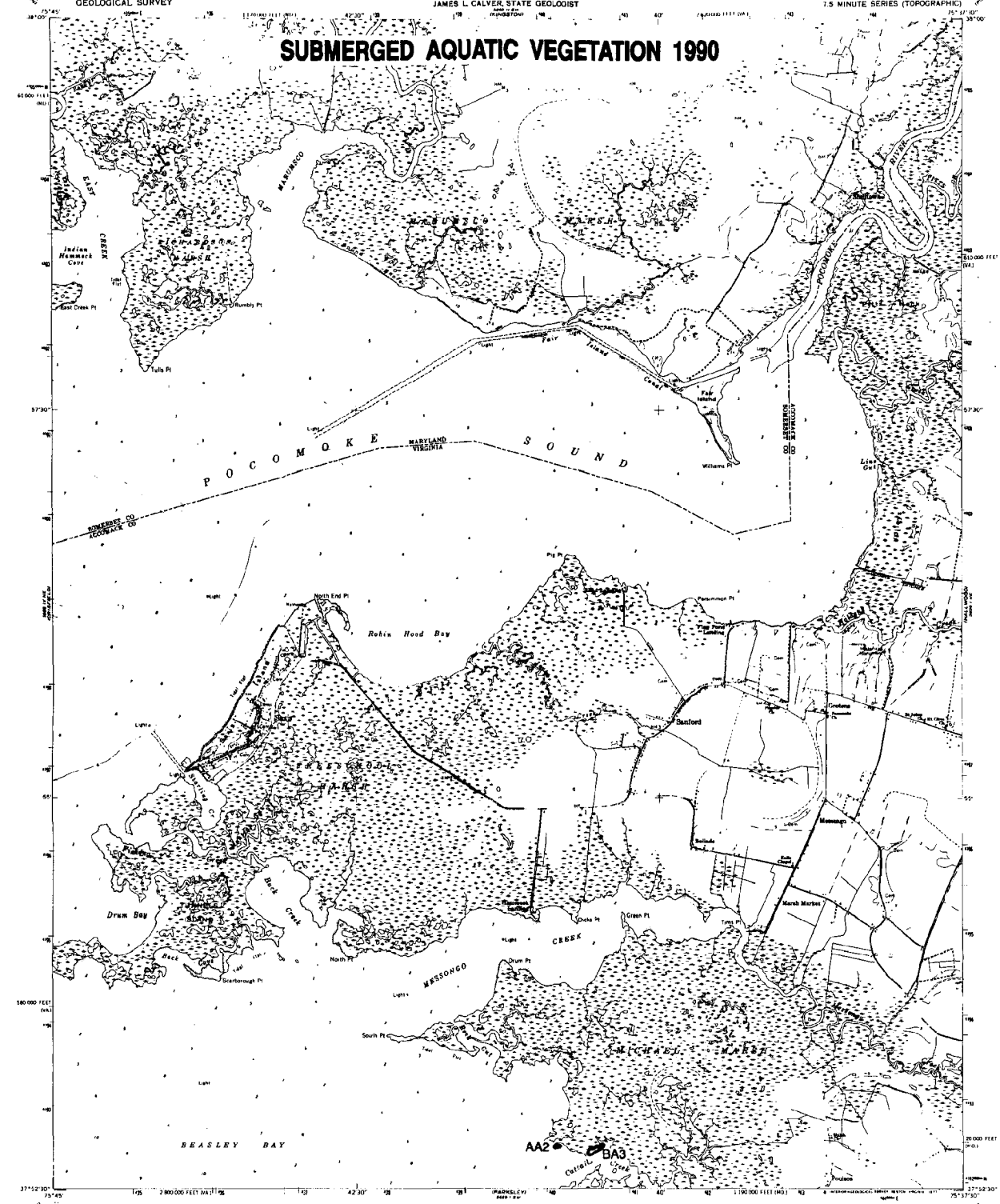
CRISFIELD,
MD-VA
101

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

SAXIS QUADRANGLE
VIRGINIA - MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
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Tn	*Trapa natans* (water chestnut)		
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U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

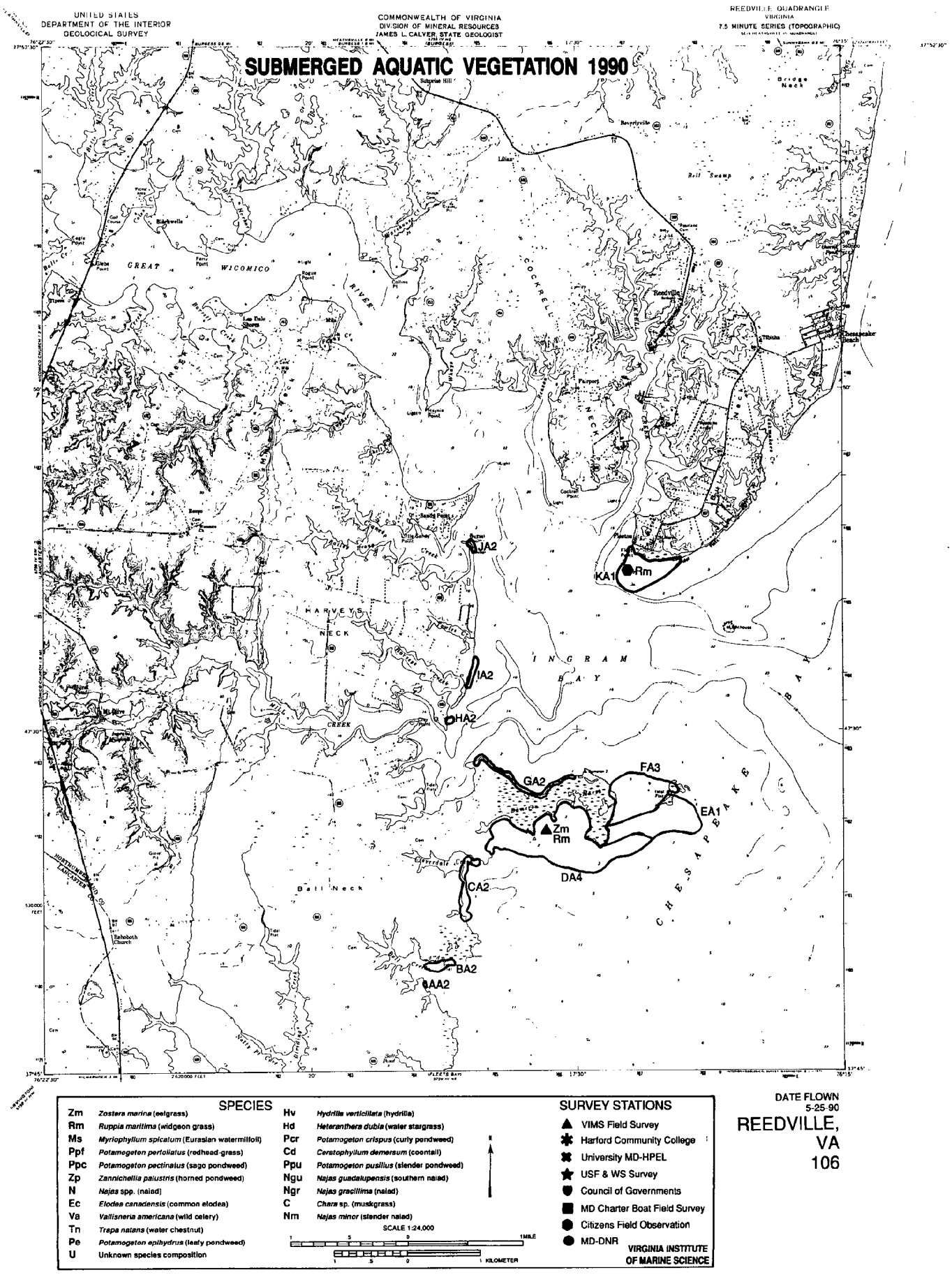
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ♥ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
5-25-90

SAXIS,
VA-MD
102

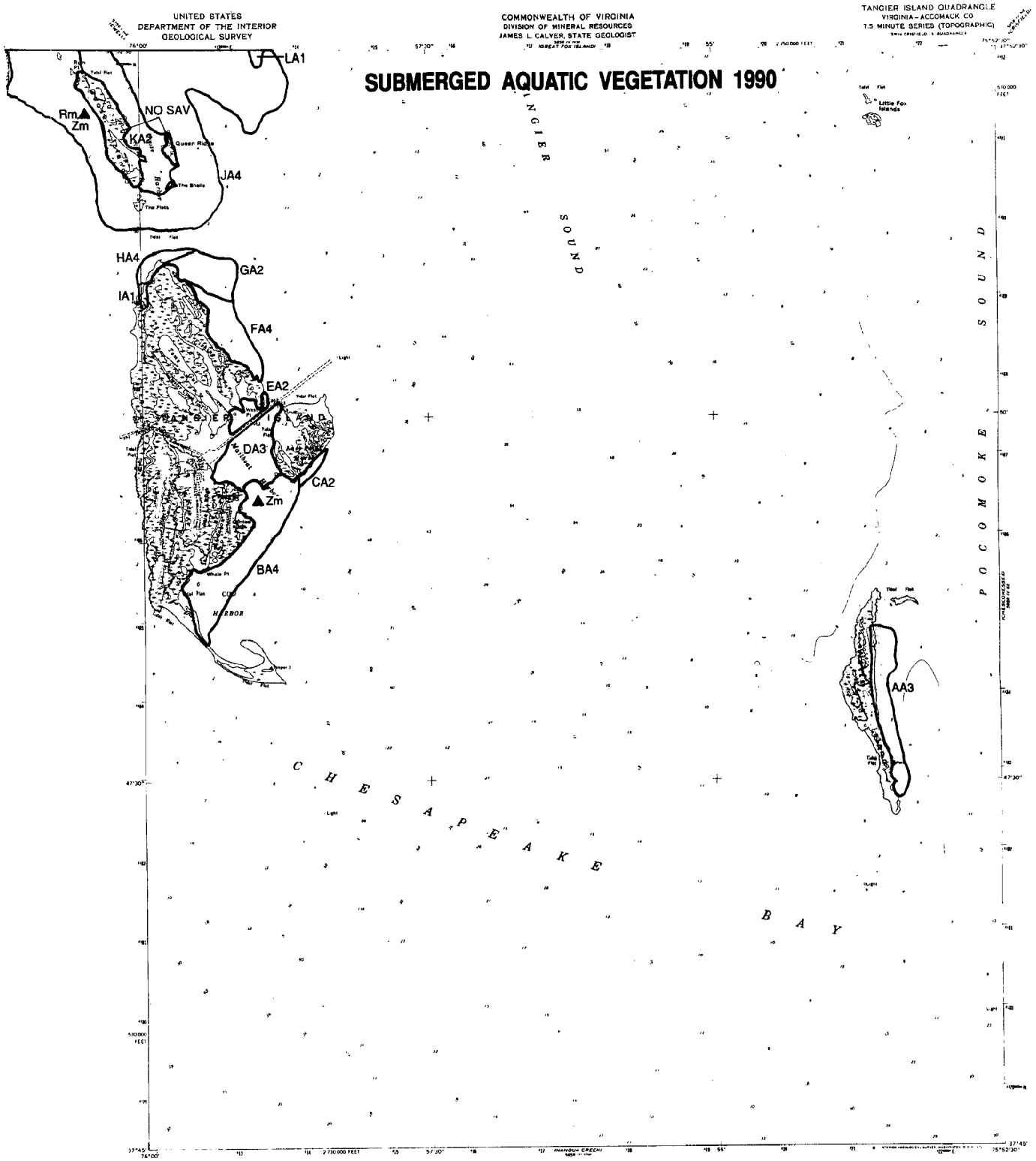

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
REEDVILLE QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
GREAT WICOMICO RIVER
COCKRELL CREEK
HARVEYS NECK
INGRAM BAY
CHESAPEAKE BAY
Bell Neck
JA2
KA1
Rm
IA2
HA2
GA2
FA3
EA1
Zm
Rm
DA4
CA2
BA2
AA2
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 0 1 MILE
1 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
5-25-90
REEDVILLE, VA
106

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

TANGIER ISLAND QUADRANGLE
VIRGINIA - ACCOMACK CO
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 0 1 KILOMETER

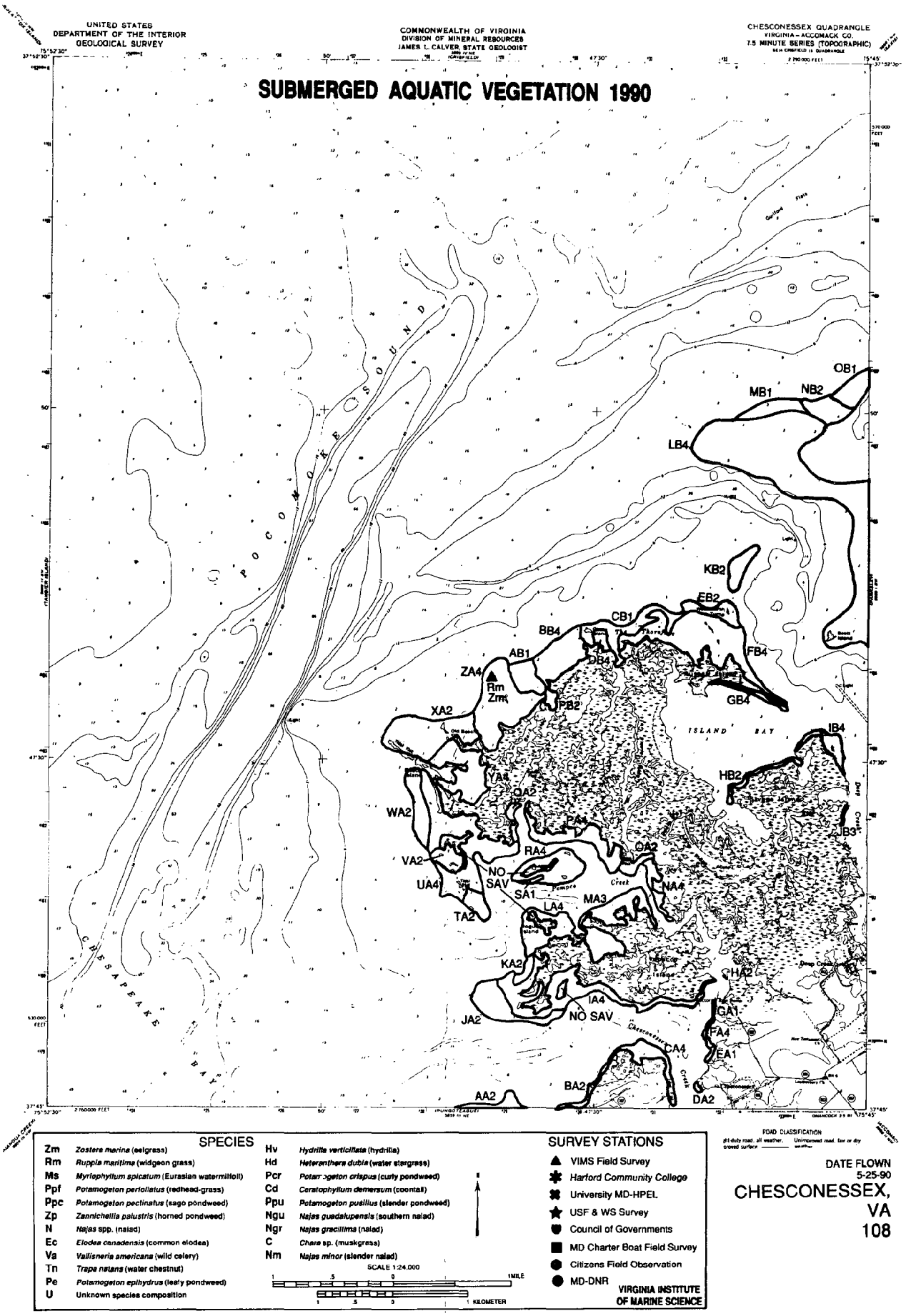
SURVEY STATIONS

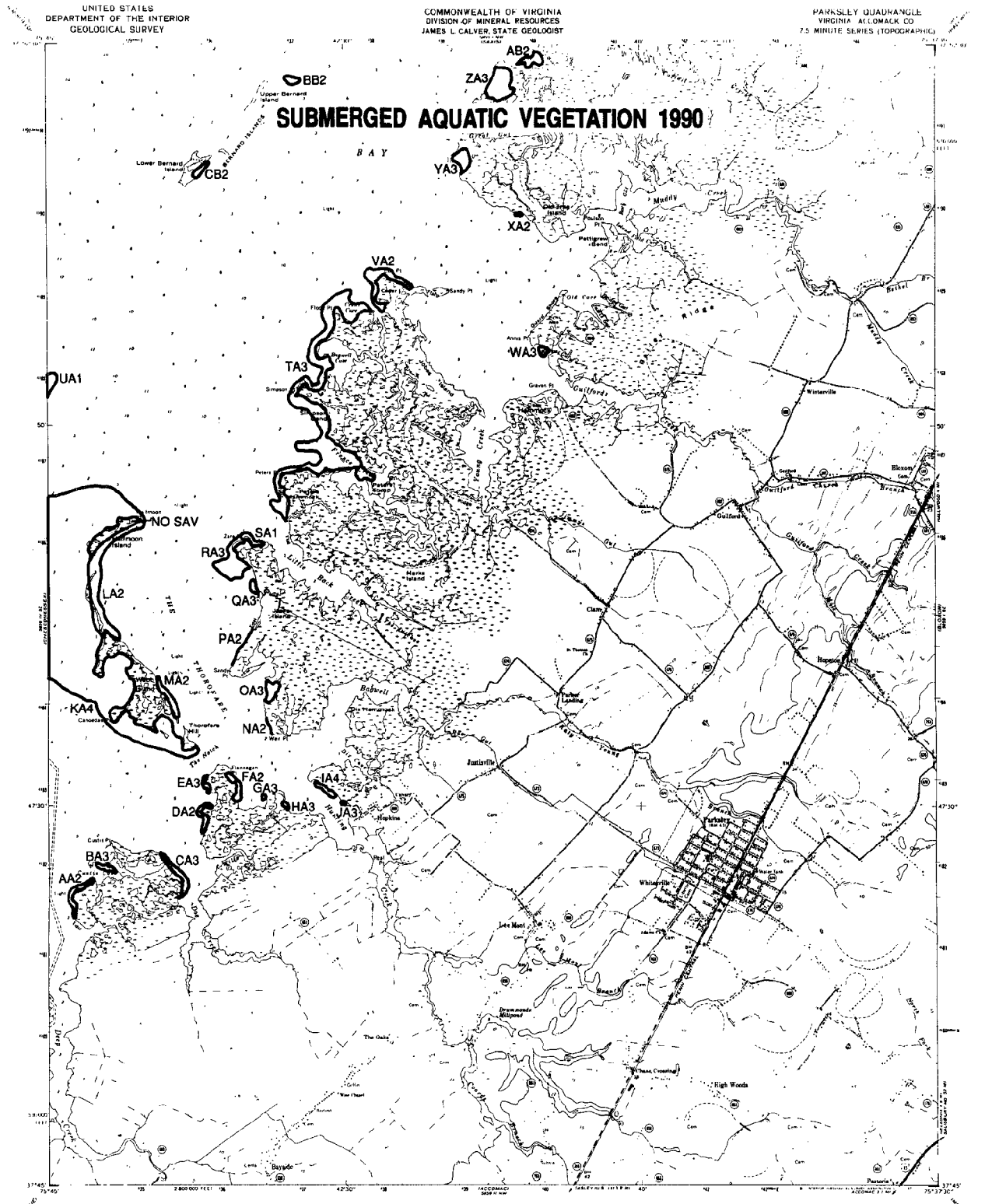
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

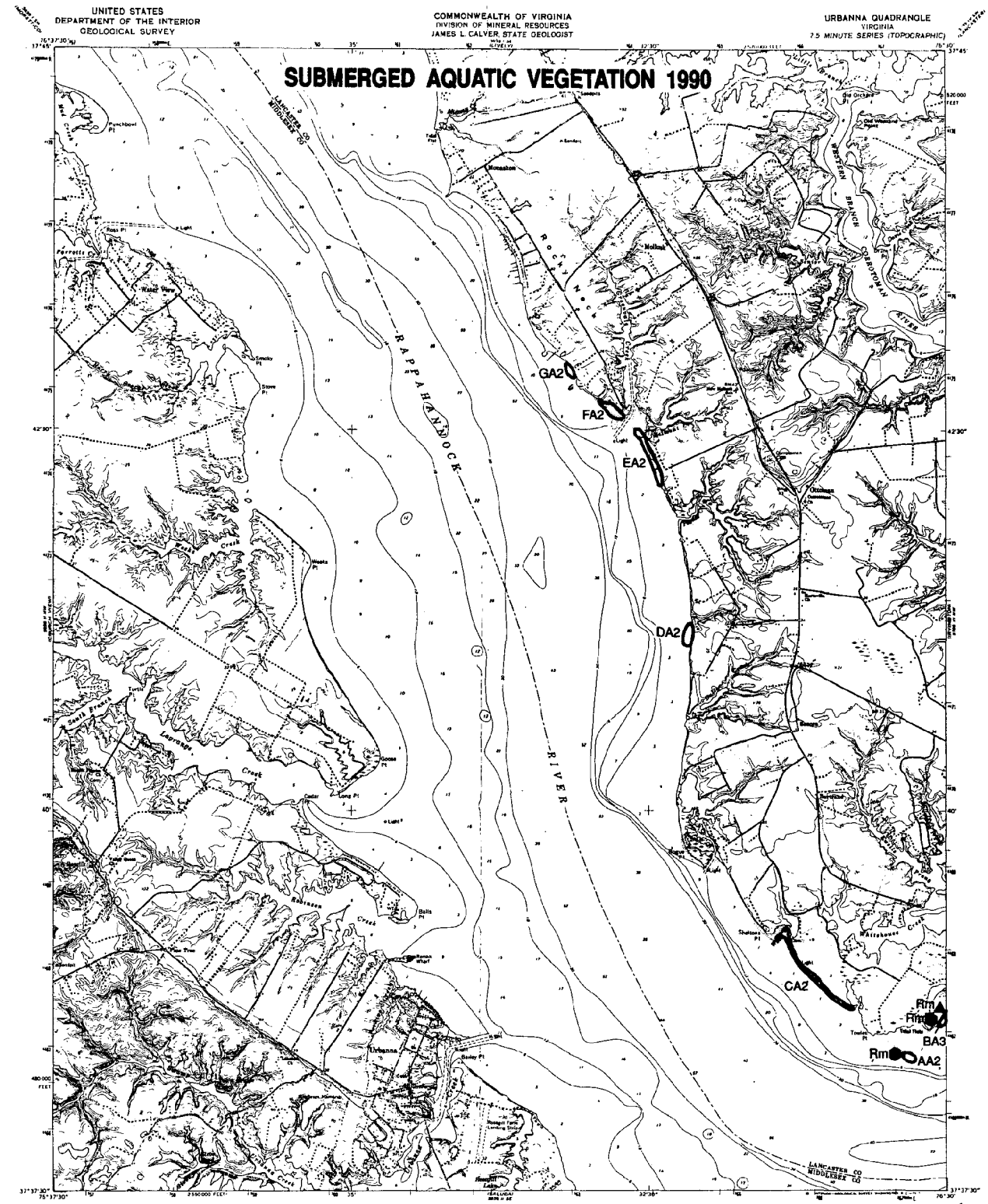
VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

TANGIER ISLAND, VA
107


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
CHESCONESSEX QUADRANGLE
VIRGINIA-ACCOMACK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
POCOMOKE SOUND
CHESAPEAKE BAY
ISLAND BAY
OB1
MB1
NB2
LB4
KB2
EB2
CB1
BB4
AB1
DB4
FB4
ZA4
Rm
Zm
PB2
GB4
XA2
IB4
HB2
YA4
OA2
WA2
FA4
JB3
RA4
OA2
VA2
NO SAV
UA4
SA1
MA3
NA4
LA4
TA2
KA2
HA2
IA4
NO SAV
GA1
JA2
FA4
CA4
EA1
BA2
DA2
AA2
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
ROAD CLASSIFICATION
DATE FLOWN
5-25-90
CHESCONESSEX, VA
108


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
PARKSLEY QUADRANGLE
VIRGINIA ACCOMACK CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
AB2
ZA3
BB2
CB2
YA3
XA2
VA2
WA3
TA3
UA1
NO SAV
SA1
RA3
QA3
LA2
PA2
MA2
OA3
KA4
NA2
EA3
FA2
GA3
IA4
HA3
JA3
DA2
BA3
CA3
AA2
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppl Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
5-25-90
PARKSLEY, VA
109



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

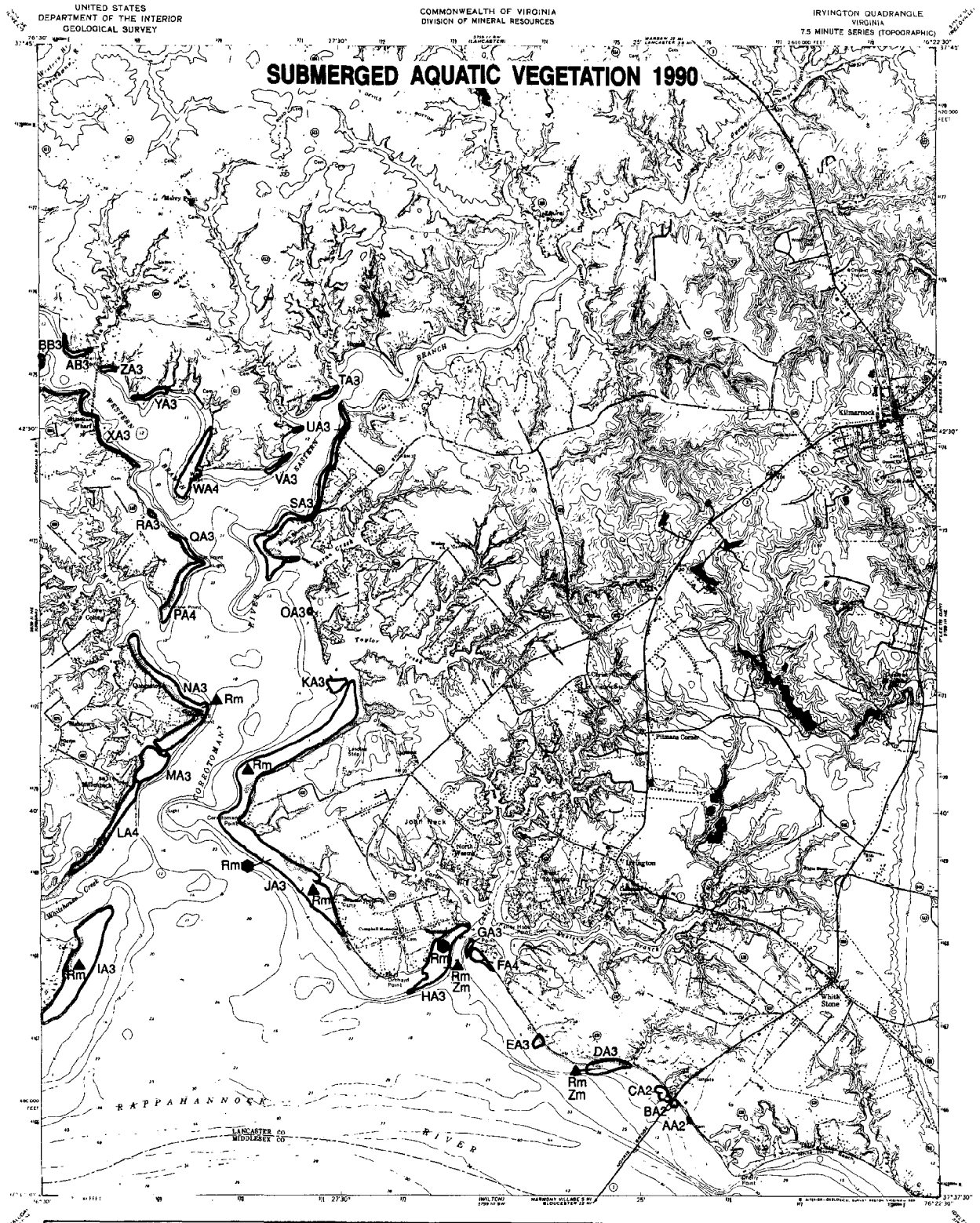
SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

URBANNA, VA
110



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Per	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 .5 1 MILE

1 0 .5 1 KILOMETER

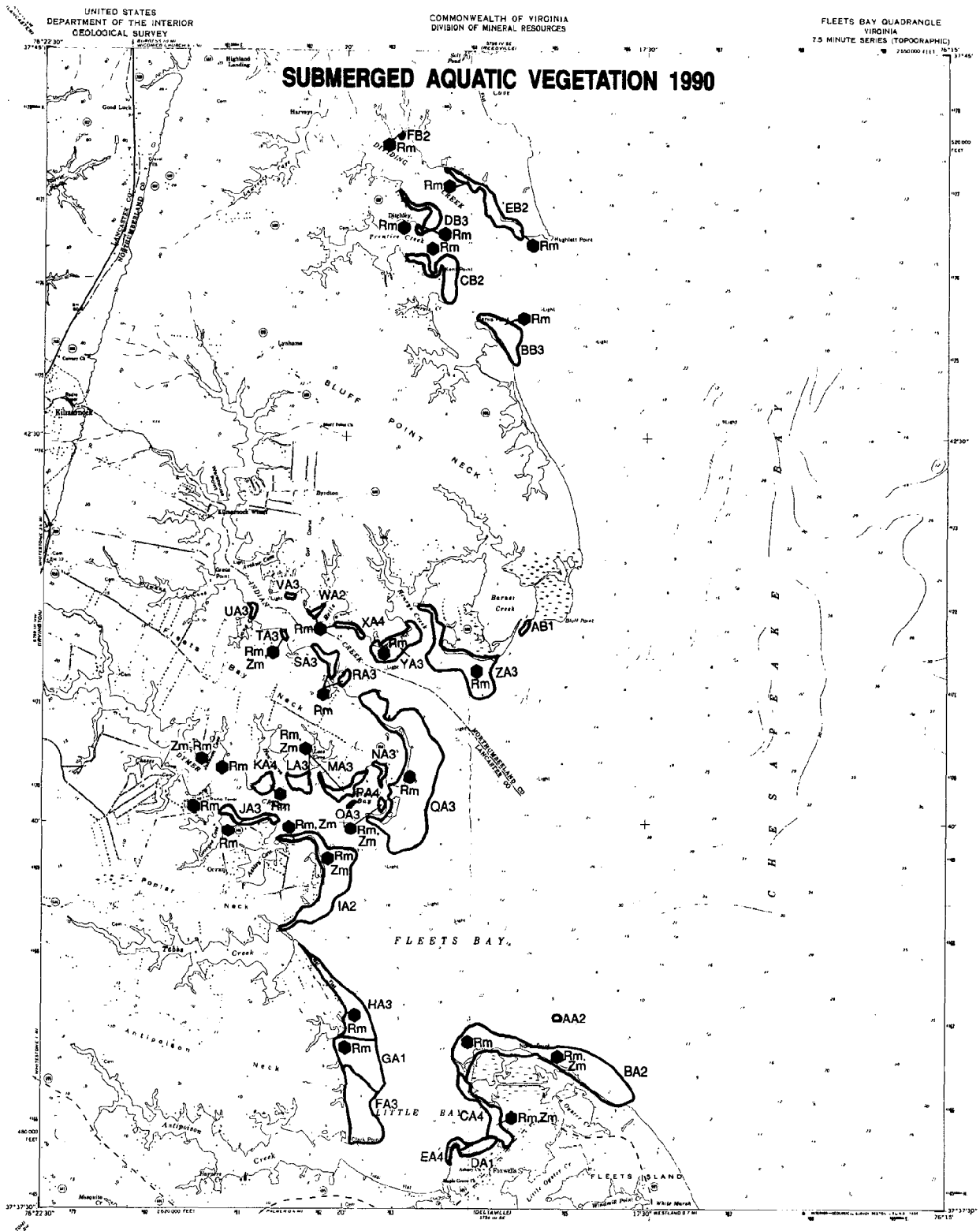
SURVEY STATIONS

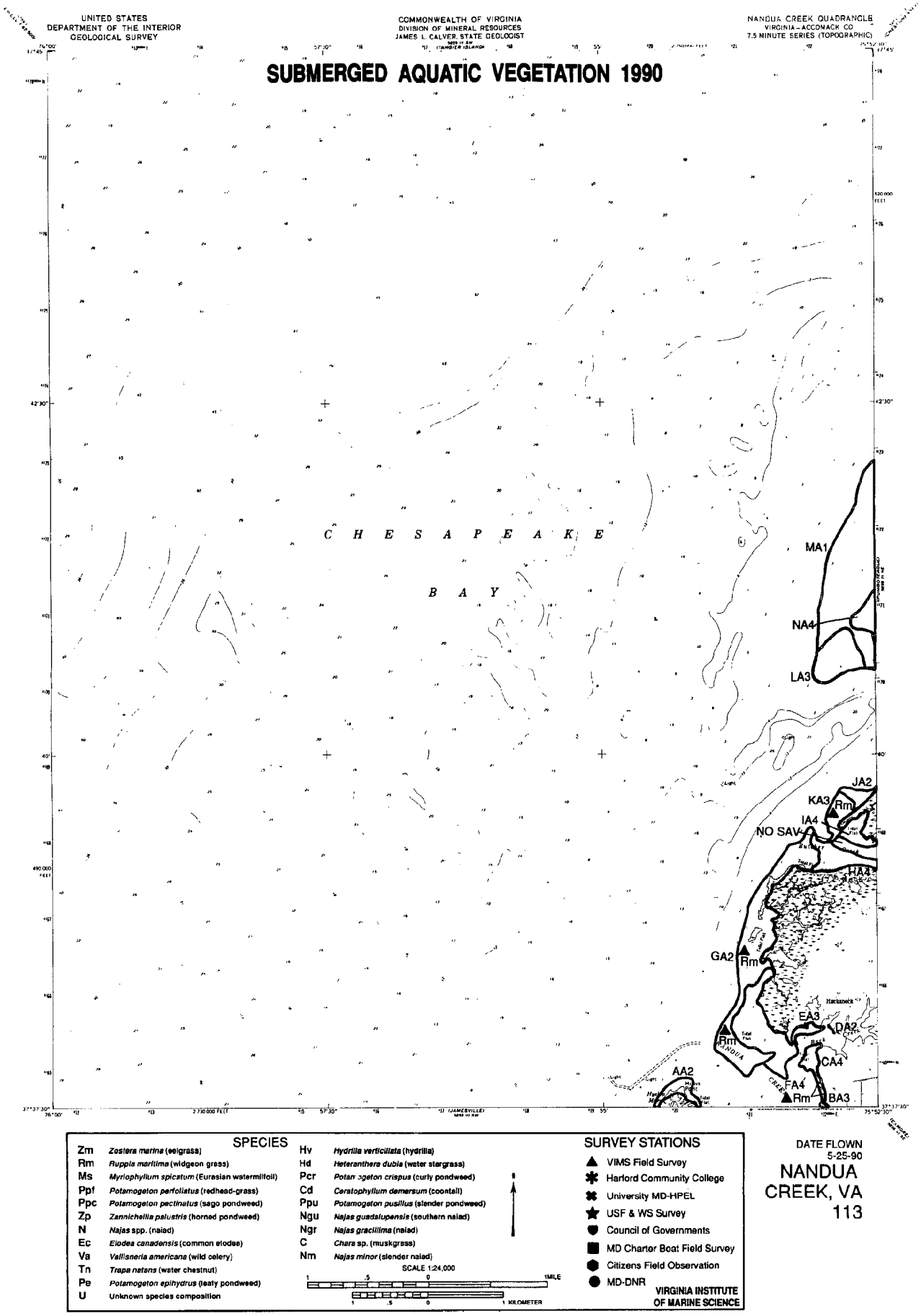
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

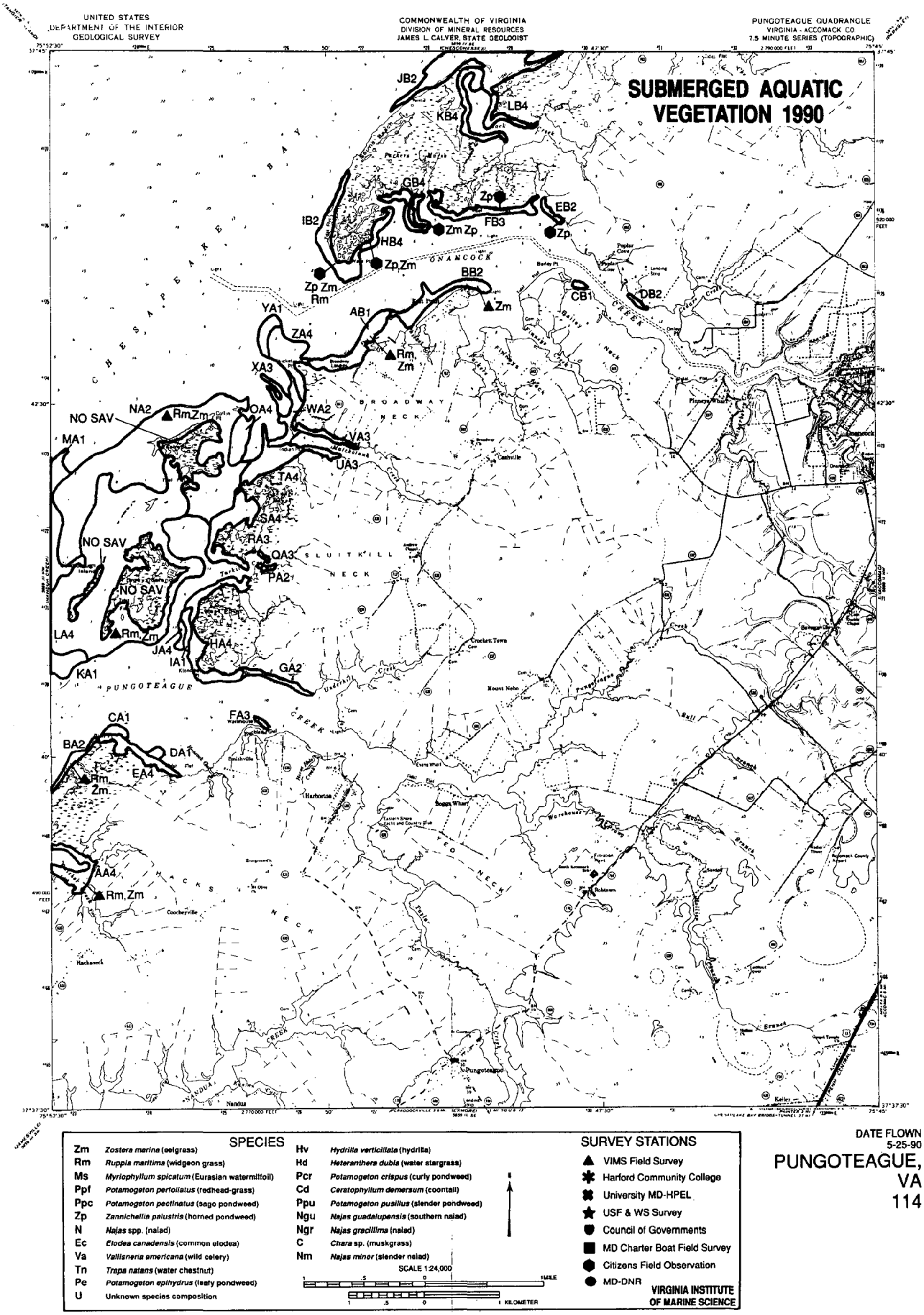
VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

IRVINGTON,
VA
111


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
FLEETS BAY QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
FB2
EB2
DB3
CB2
BB3
AB1
ZA3
YA3
XA4
WA2
VA3
UA3
TA3
SA3
RA3
QA3
PA4
OA3
NA3
MA3
LA3
KA4
JA3
IA2
HA3
GA1
FA3
EA4
DA1
AA2
BA2
CA4
Rm
Zm
BLUFF POINT NECK
FLEETS BAY
CHESAPEAKE BAY
LITTLE BAY
FLEETS ISLAND
Poplar Neck
Antipoison Neck
Fleets Bay
Barnes Creek
Dividing Creek
Prentice Creek
Hughlett Point
Bluff Point
Deep Point
Windmill Point
Kilmarnock
Lynhaven
Byrdton
Harvey
Good Luck
Highland Landing
Mosquito Cr.
Little Oyster Cr.
Pinnells
Ocran
Dymer
Ditch Point
Maple Grove Pt.
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadelupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
5-25-90
FLEETS BAY, VA
112


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
NANDUA CREEK QUADRANGLE
VIRGINIA-ACCOMACK CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
C H E S A P E A K E
B A Y
MA1
NA4
LA3
JA2
KA3
Rm
IA4
NO SAV
HA4
GA2
Rm
EA3
DA2
Rm
CA4
AA2
FA4
Rm
BA3
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
5-25-90
NANDUA
CREEK, VA
113


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
PUNGOTEAGUE QUADRANGLE
VIRGINIA - ACCOMACK CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
CHESAPEAKE BAY
ONANCOCK
BROADWAY NECK
SLUITKILL NECK
PUNGOTEAGUE CREEK
HACKS NECK
JB2
KB4
LB4
GB4
Zp
IB2
FB3
EB2
Zm Zp
HB4
Zp,Zm
Zp Zm Rm
BB2
Zm
CB1
DB2
YA1
AB1
ZA4
Rm, Zm
XA3
NA2
RmZm
OA4
WA2
NO SAV
MA1
VA3
UA3
TA4
SA4
RA3
QA3
PA2
LA4
JA4
HA4
IA1
GA2
KA1
CA1
FA3
BA2
DA1
EA4
AA4
Harborton
Cheriton
Pungoteague
Nandua
Onancock
Crocket Town
Mount Nebo
Robbins
Keller
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
5-25-90
PUNGOTEAGUE, VA
114

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990

SPECIES

Zm	*Zostera marina* (eelgrass)
Rm	*Ruppia maritima* (widgeon grass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)
Ppf	*Potamogeton perfoliatus* (redhead-grass)
Ppc	*Potamogeton pectinatus* (sago pondweed)
Zp	*Zannichellia palustris* (horned pondweed)
N	*Najas* spp. (naiad)
Ec	*Elodea canadensis* (common elodea)
Va	*Vallisneria americana* (wild celery)
Tn	*Trapa natans* (water chestnut)
Pe	*Potamogeton epihydrus* (leafy pondweed)
U	Unknown species composition
Hv	*Hydrilla verticillata* (hydrilla)
Hd	*Heteranthera dubia* (water stargrass)
Pcr	*Potamogeton crispus* (curly pondweed)
Cd	*Ceratophyllum demersum* (coontail)
Ppu	*Potamogeton pusillus* (slender pondweed)
Ngu	*Najas guadalupensis* (southern naiad)
Ngr	*Najas gracillima* (naiad)
C	*Chara* sp. (muskgrass)
Nm	*Najas minor* (slender naiad)

N

SCALE 1:24,000

1 0 1 MILE

1 .5 0 1 KILOMETER

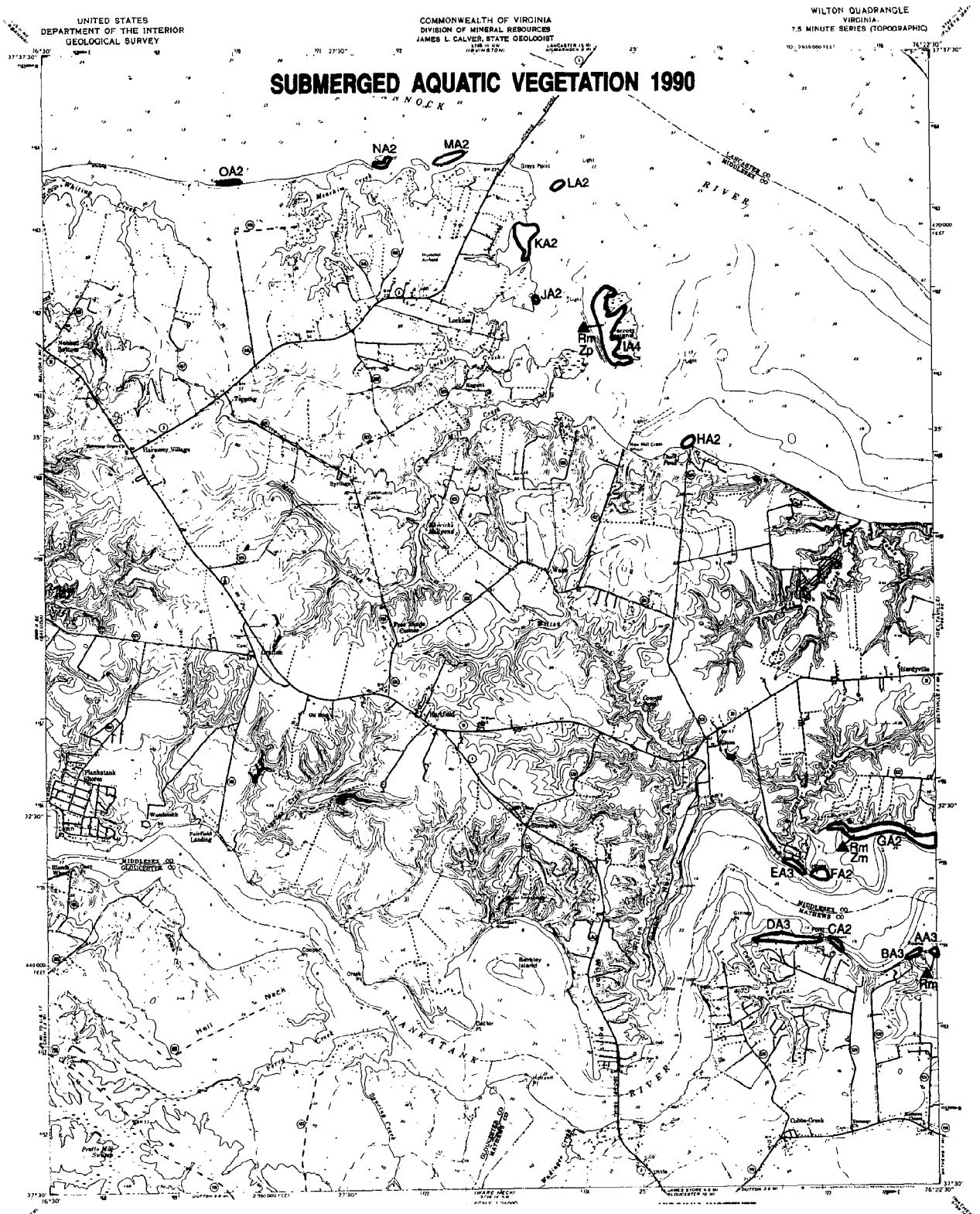
SURVEY STATIONS

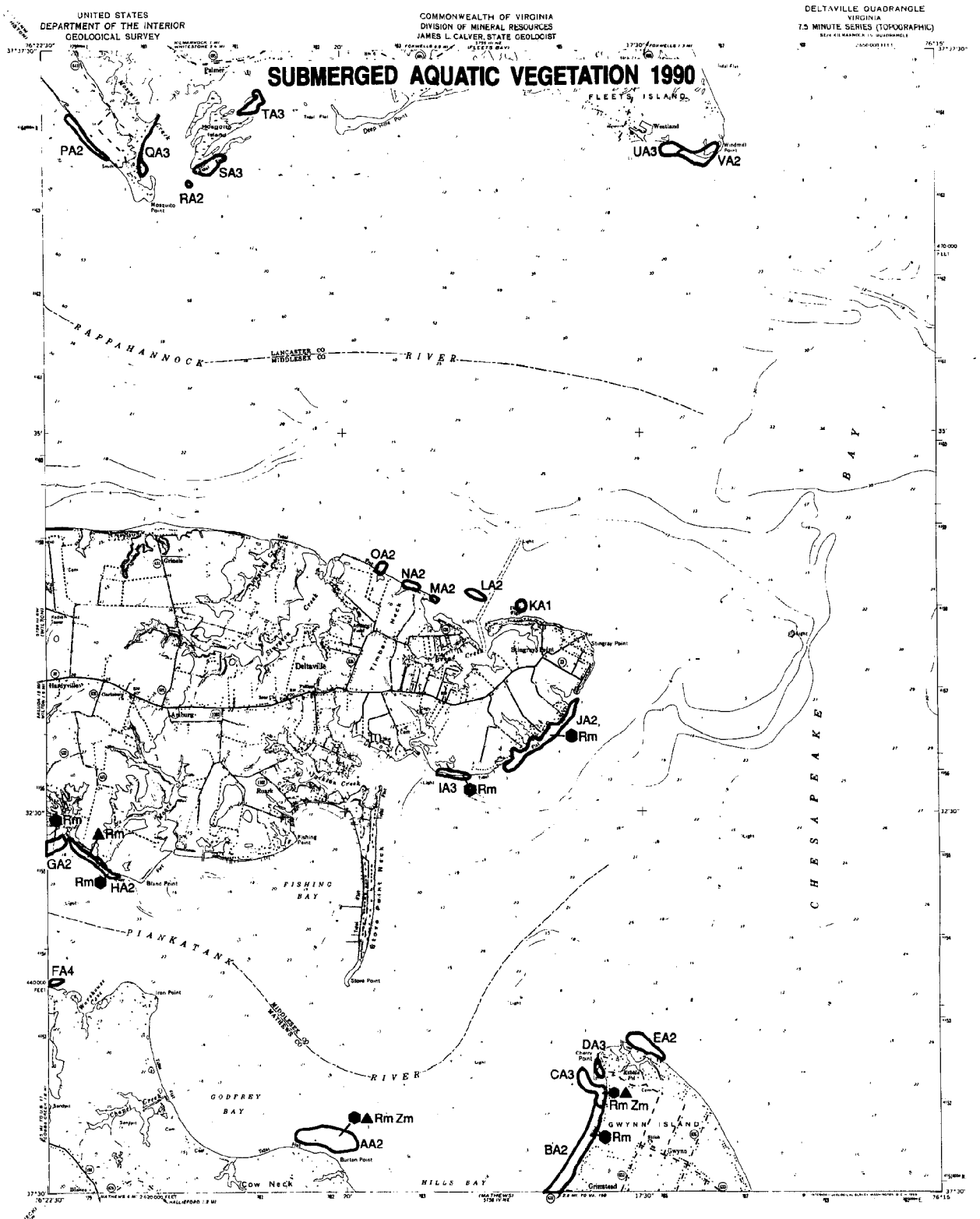
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-5-90

SALUDA, VA
116


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
WILTON QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
NA2
MA2
OA2
LA2
KA2
JA2
Rm
Zp
IA4
HA2
GA2
Rm
Zm
EA3
FA2
DA3
CA2
AA3
BA3
Rm
PLANKATANK RIVER
RIVER
Hall
Neck
Creek
Barclay Island
Dutton
Cubbs Creek
Guinea
Haywood
Handyville
Fairfield Landing
Weeksbeck
Plankatank Shores
Prattsville
Bethel
Hayland
Tipping
Locklies
Hallowing Village
Middlesex Co.
Gloucester Co.
Mathews Co.
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
WILTON, VA
117



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 0 1 KILOMETER

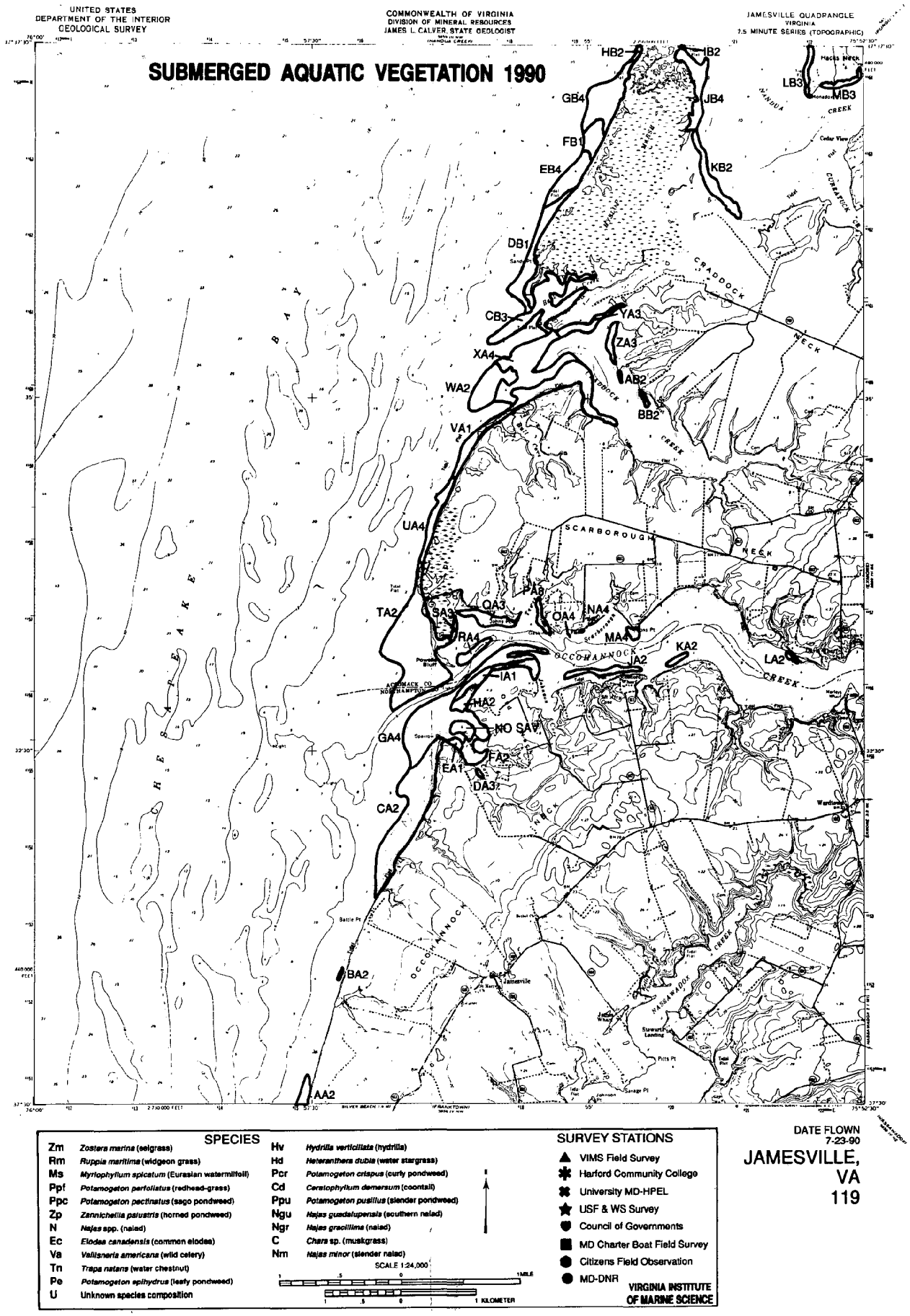
SURVEY STATIONS

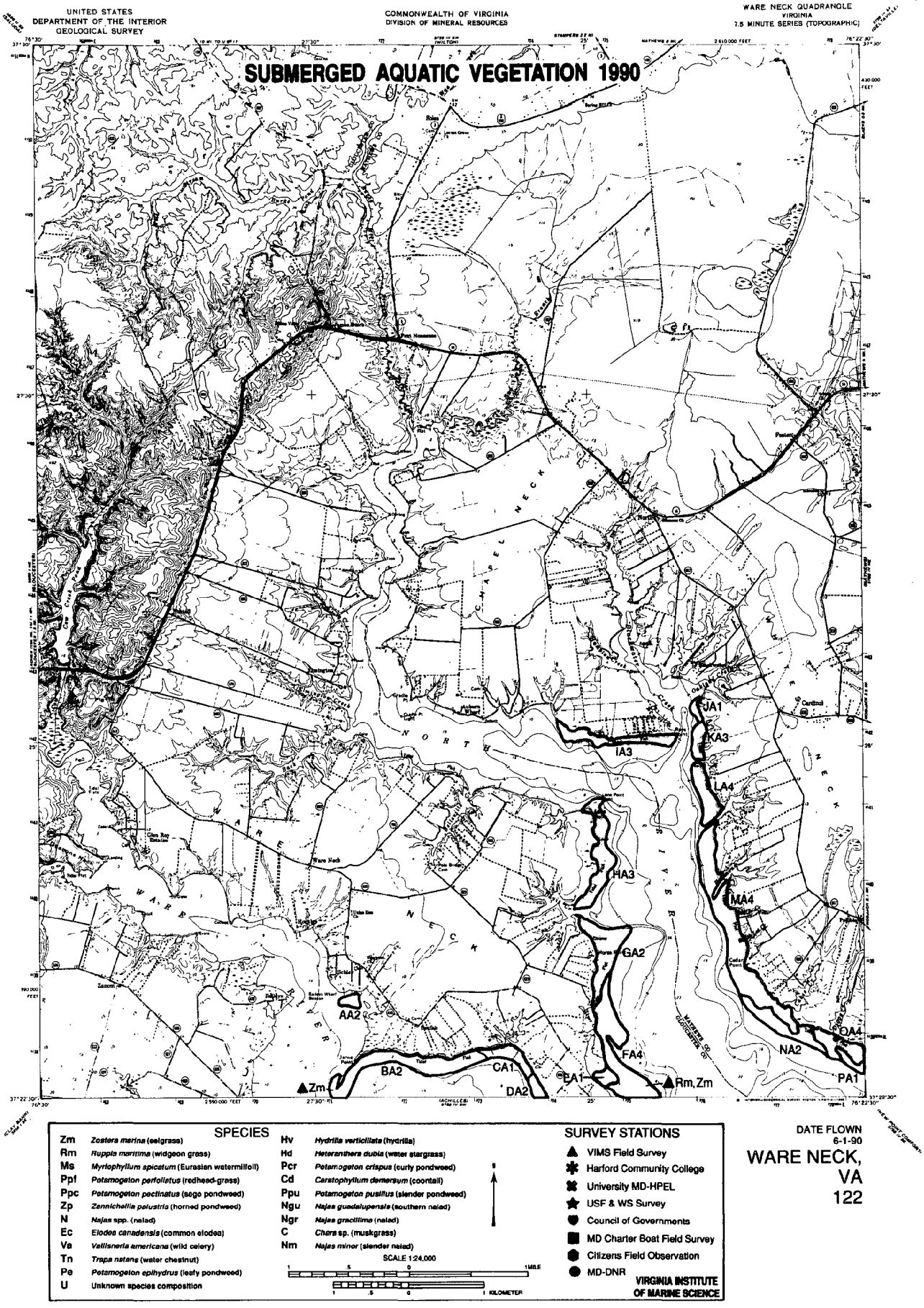
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⛊ Council of Governments
- ■ MD Charter Boat Field Survey
- ● Citizens Field Observation
- ● MD-DNR

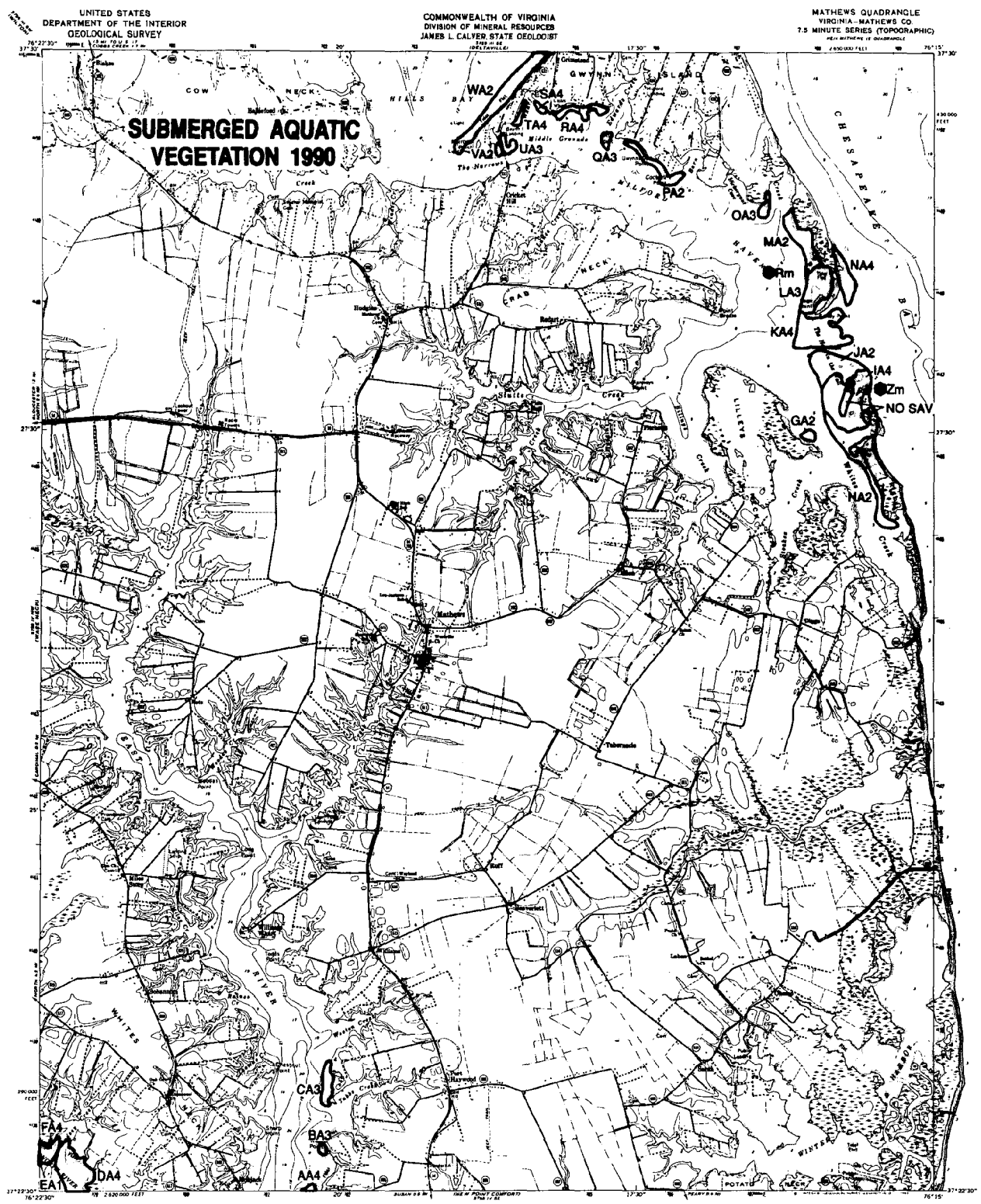
VIRGINIA INSTITUTE OF MARINE SCIENCE

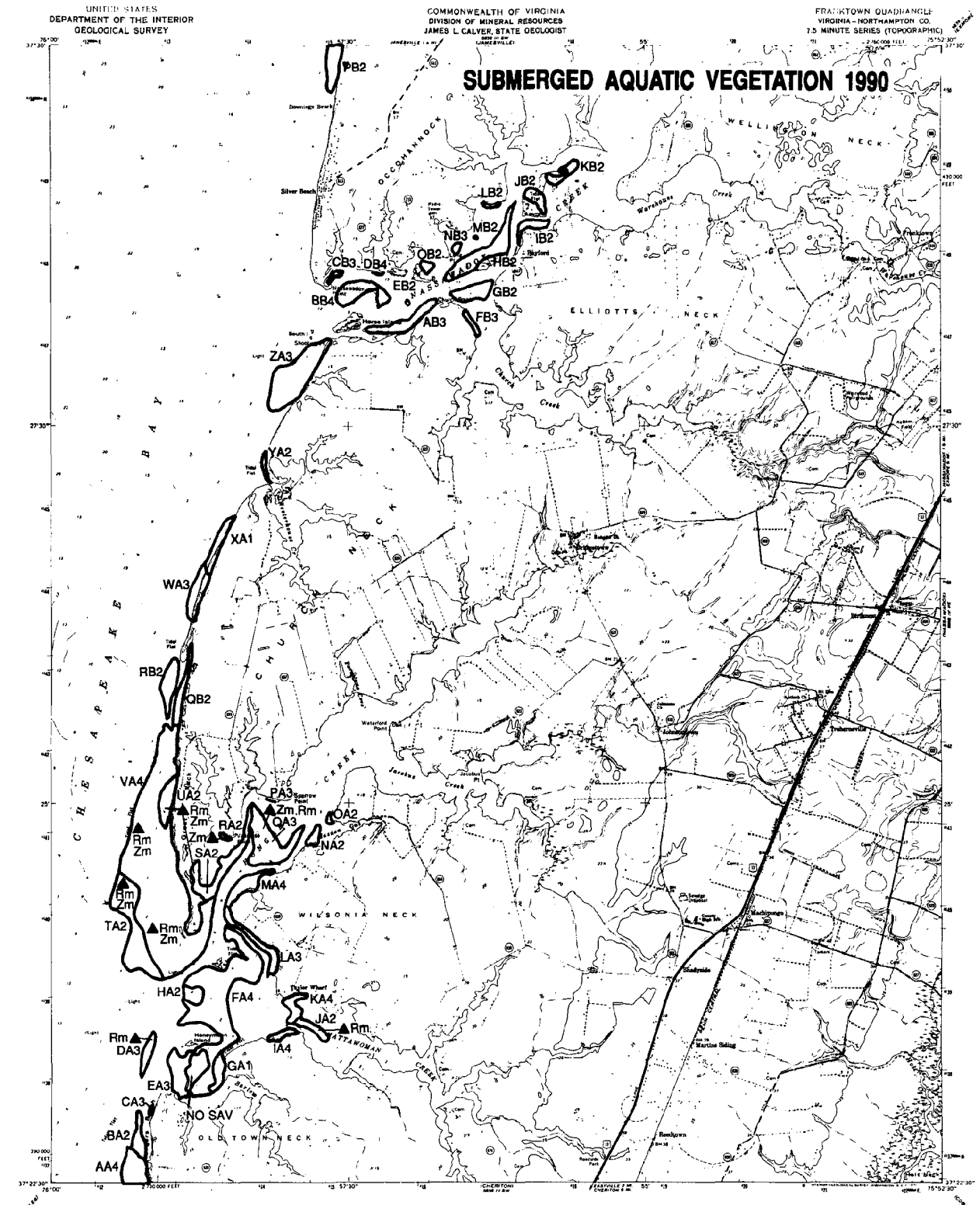
DATE FLOWN
6-5-90

DELTAVILLE, VA
118


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
JAMESVILLE QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
HB2
IB2
LB3
MB3
GB4
JB4
FB1
EB4
KB2
DB1
CB3
YA3
ZA3
XA4
AB2
WA2
BB2
VA1
UA4
TA2
SA3
QA3
PA3
OA4
NA4
MA4
RA4
KA2
JA2
LA2
IA1
HA2
NO SAV
GA4
FA2
EA1
DA3
CA2
BA2
AA2
CRADDOCK NECK
SCARBOROUGH NECK
OCCOHANNOCK CREEK
NASSAWADOX CREEK
CHESAPEAKE BAY
Jamesville
Wardtown
Stewart Landing
Battle Pt
Savage Pt
Pitts Pt
Cedar View
Hacks Neck
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
7-23-90
JAMESVILLE, VA
119


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
WARE NECK QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
JA1
KA3
IA3
LA4
HA3
MA4
GA2
AA2
BA2
CA1
DA2
EA1
FA4
NA2
DA4
PA1
Zm
Rm,Zm
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-1-90
WARE NECK, VA
122


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
MATHEWS QUADRANGLE
VIRGINIA - MATHEWS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
WA2
SA4
TA4
RA4
VA2
UA3
QA3
PA2
OA3
MA2
NA4
Rm
LA3
KA4
JA2
IA4
Zm
NO SAV
GA2
NA2
CA3
FA4
BA3
AA4
EA
DA4
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton spihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
MATHEWS, VA
123

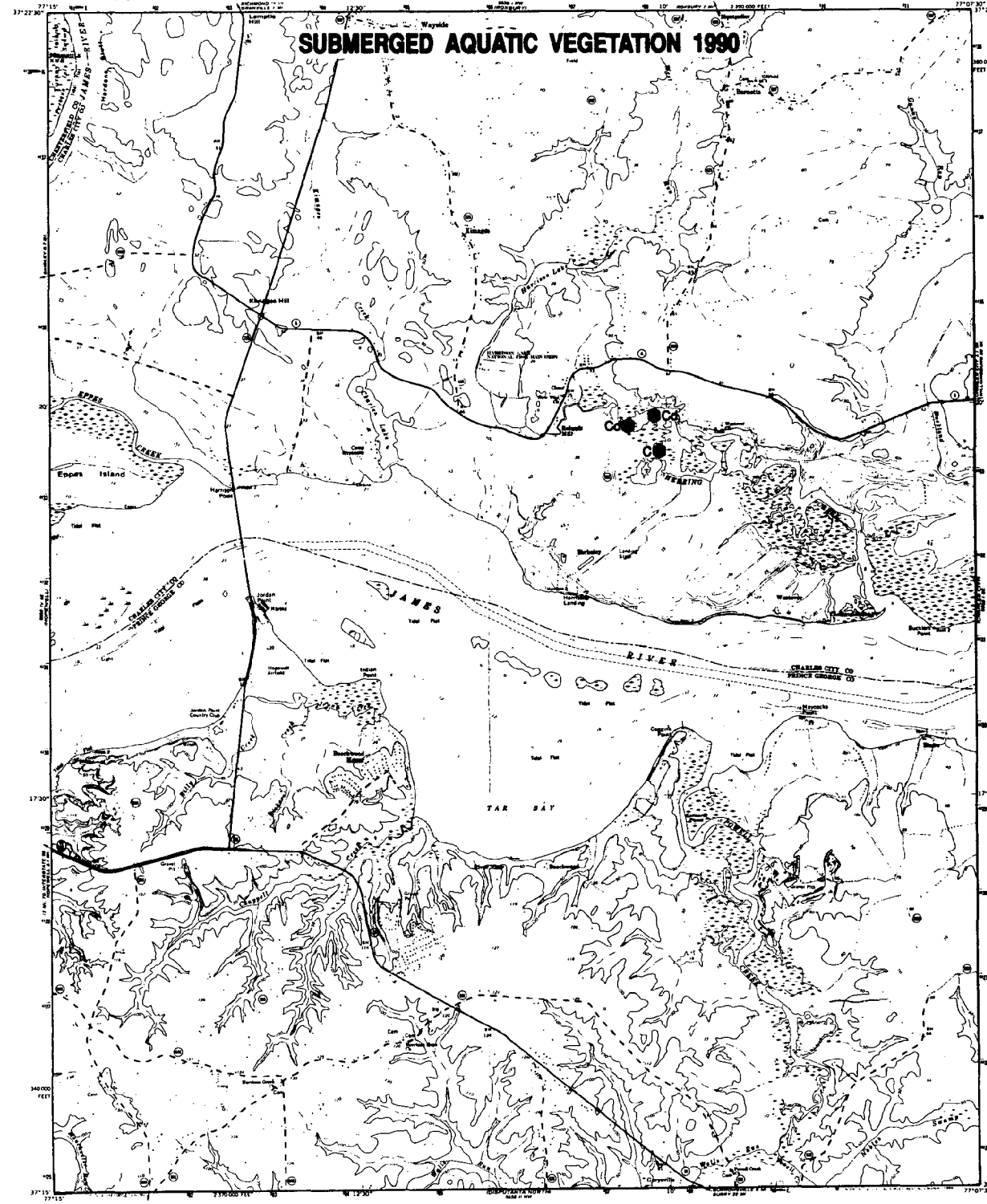

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
FRANKTOWN QUADRANGLE
VIRGINIA - NORTHAMPTON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
PB2
KB2
JB2
LB2
NB3
MB2
IB2
OB2
CB3
DB4
HB2
EB2
GB2
BB4
AB3
FB3
ZA3
YA2
XA1
WA3
RB2
QB2
VA4
UA2
PA3
OA2
QA3
RA2
NA2
SA2
MA4
TA2
LA3
HA2
FA4
KA4
JA2
IA4
DA3
GA1
EA3
CA3
NO SAV
BA2
AA4
Rm
Zm
CHESAPEAKE BAY
WILSONIA NECK
OLD TOWN NECK
WELLINGTON NECK
ELLIOTTS NECK
OCCOHANNOCK CREEK
CHUCKATUCK CREEK
NASSAWADOX CREEK
Silver Beach
Downings Beach
Franktown
Machipongo
Nassawadox
Bayford
Reedtown
Marlins Siding
Cheriton
Eastville
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
5-23-90
FRANKTOWN, VA
124

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

WESTOVER QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 5 0 1 MILE

1 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

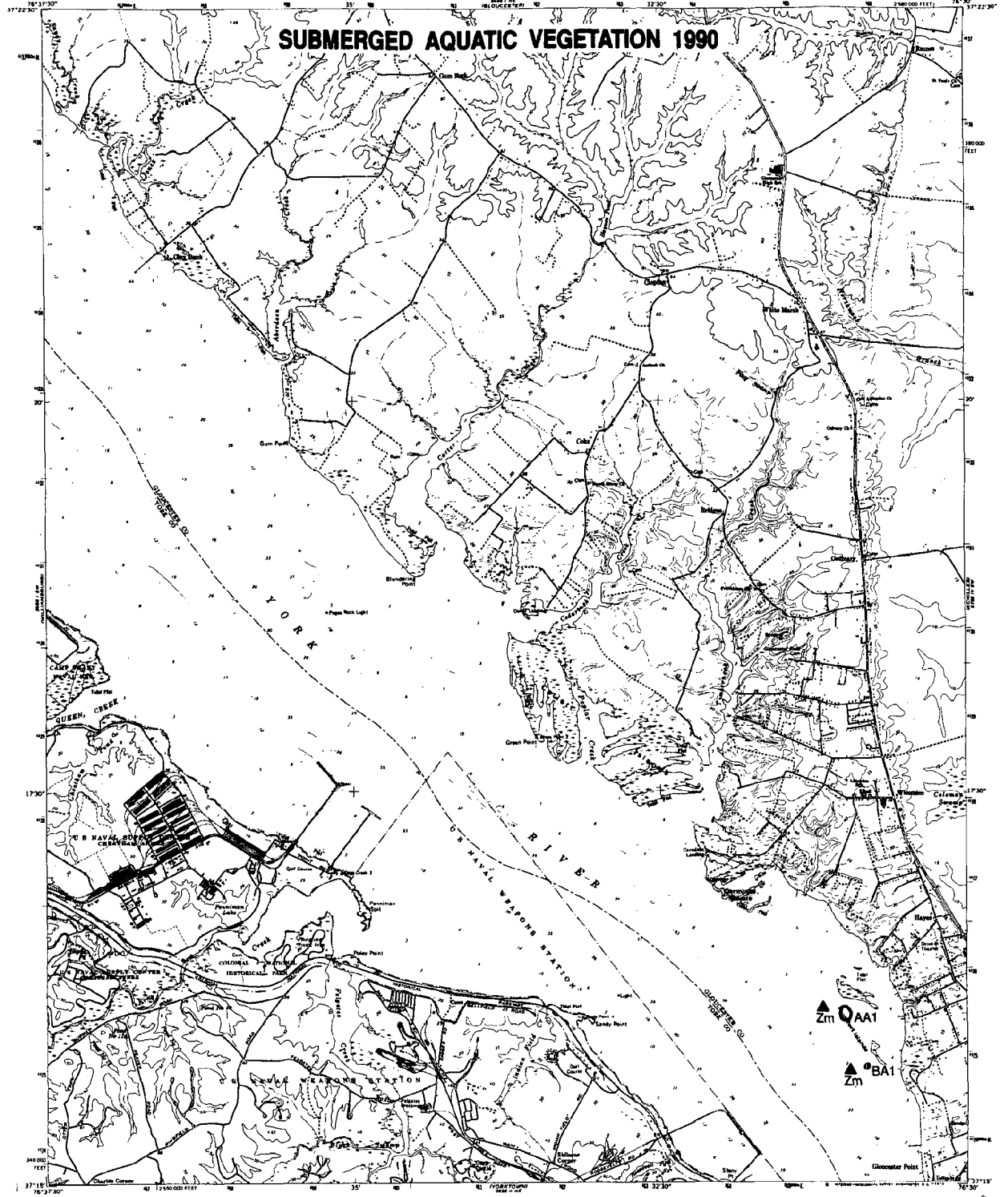
NOT FLOWN
WESTOVER, VA
125

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

CLAY BANK QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

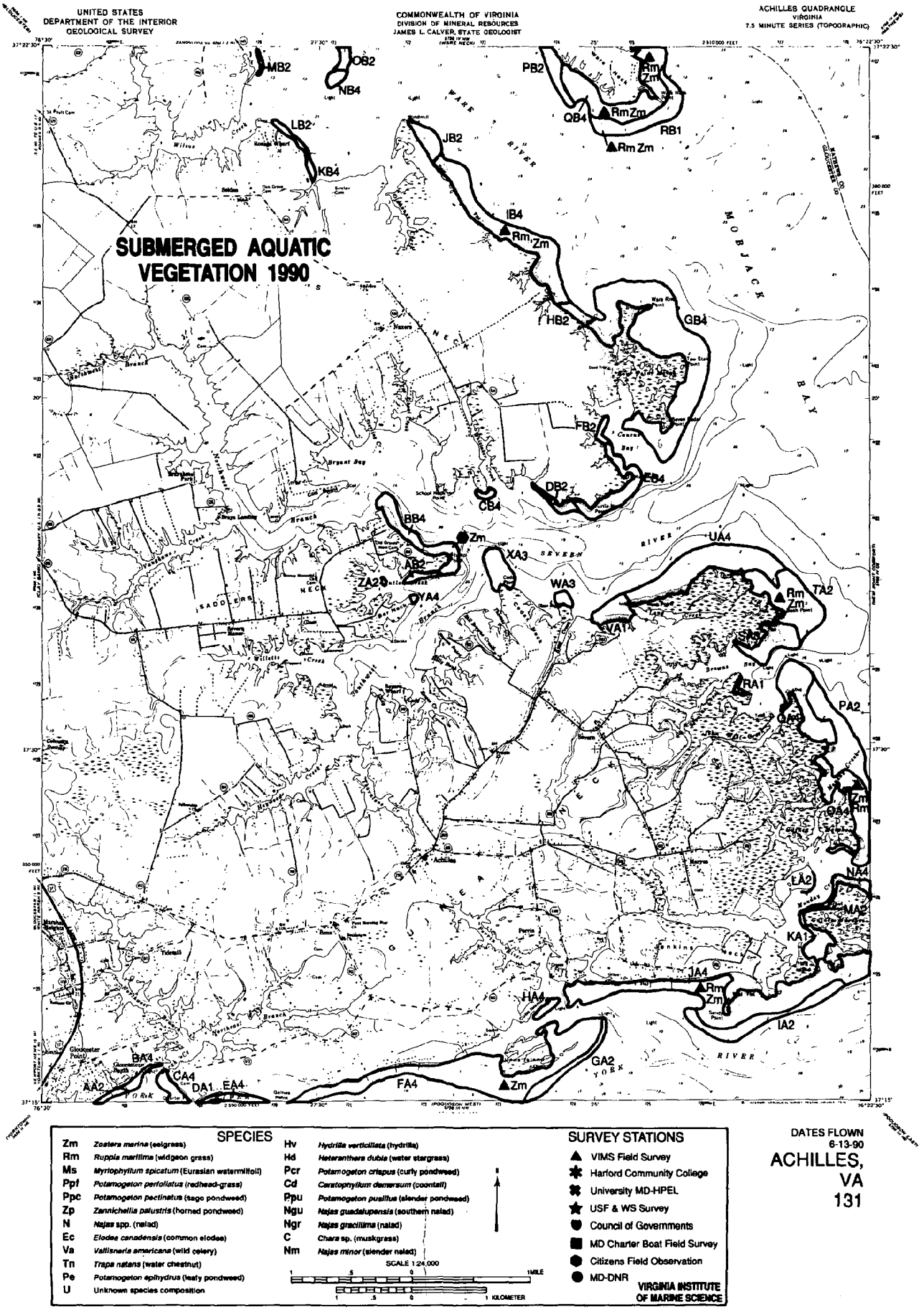
SURVEY STATIONS

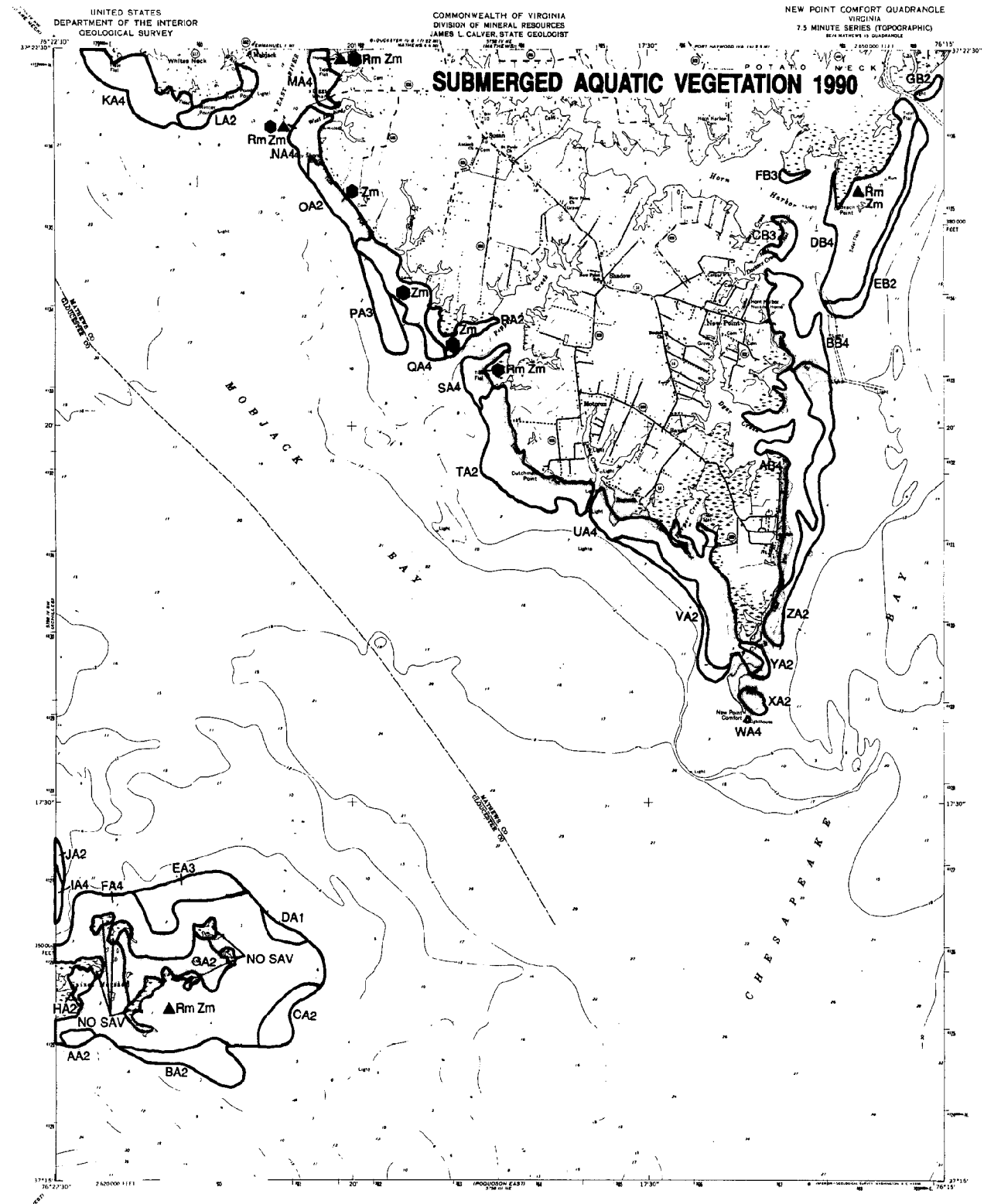
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-1-90

CLAY BANK,
VA
130


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
ACHILLES QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
MB2
OB2
NB4
LB2
KB4
PB2
QB4
RB1
JB2
IB4
HB2
GB4
FB2
EB4
DB2
CB4
BB4
AB2
ZA2
DYA4
XA3
WA3
UA4
TA2
VA1
SA2
RA1
PA2
QA3
QA4
NA4
LA2
MA2
KA1
JA4
IA2
HA4
GA2
FA4
BA4
CA4
DA1
EA4
AA2
Zm
Rm
Rm Zm
WARE RIVER
MOBJACK BAY
SEVERN RIVER
YORK RIVER
NECK
SADDLERS
Achilles
Tidewill
Gloucester Point
Yorktown
Gwynn's Island
Mathews
Gloucester Co.
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATES FLOWN
6-13-90
ACHILLES, VA
131


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST
NEW POINT COMFORT QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
MOBJACK BAY
CHESAPEAKE BAY
POTATO NECK
KA4
LA2
MA4
NA4
OA2
PA3
QA4
RA2
SA4
TA2
UA4
VA2
WA4
XA2
YA2
ZA2
AB4
BB4
CB3
DB4
EB2
FB3
GB2
JA2
IA4
FA4
EA3
DA1
GA2
HA2
CA2
AA2
BA2
NO SAV
Rm Zm
Zm
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
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Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
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Cd Ceratophyllum demersum (coontail)
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Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-5-90
NEW POINT COMFORT, VA
132

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, STATE GEOLOGIST

CAPE CHARLES QUADRANGLE
VIRGINIA - NORTHAMPTON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppl	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

.5 0 1 KILOMETER

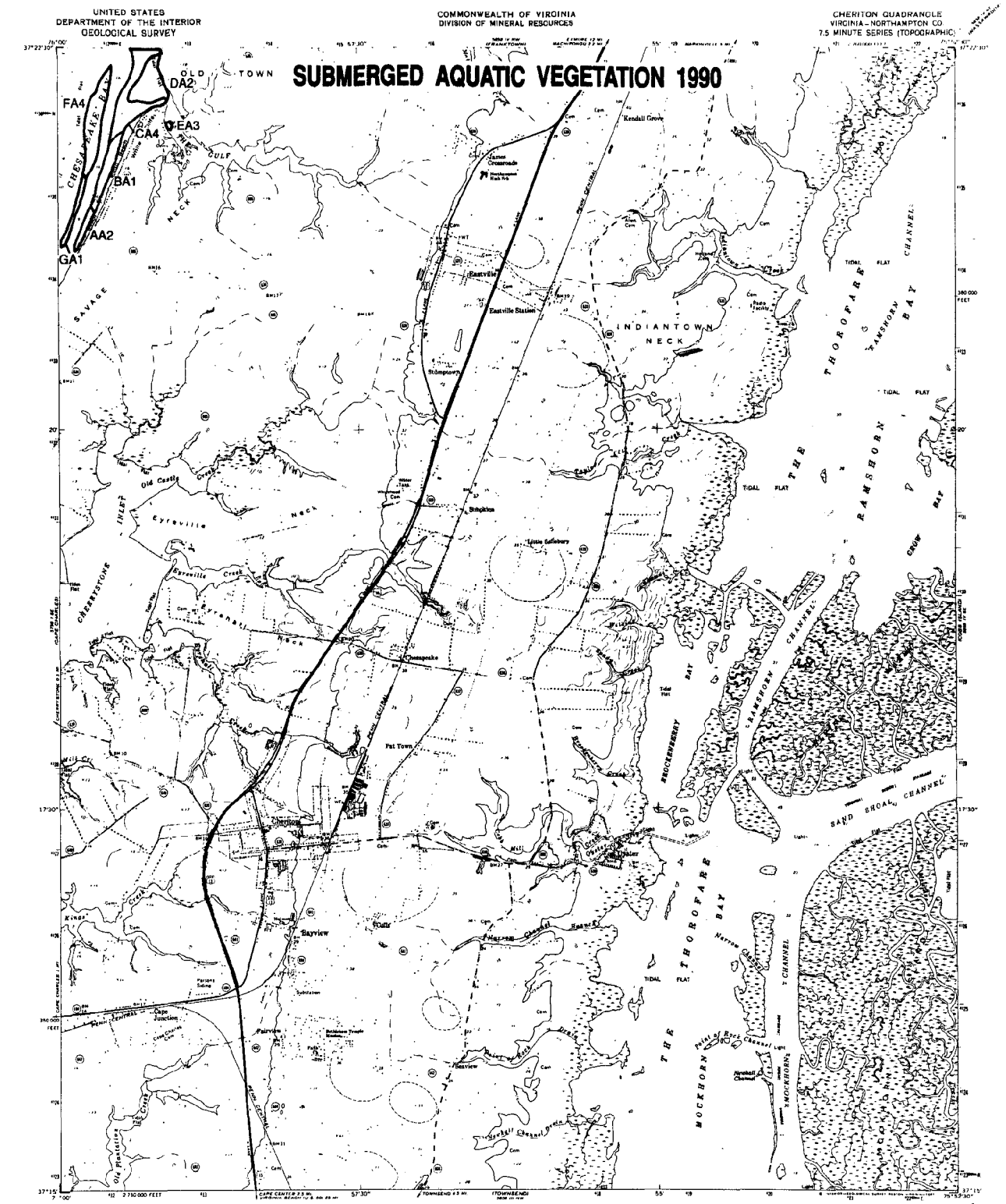
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ● Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
5-23-90

CAPE CHARLES, VA
133



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

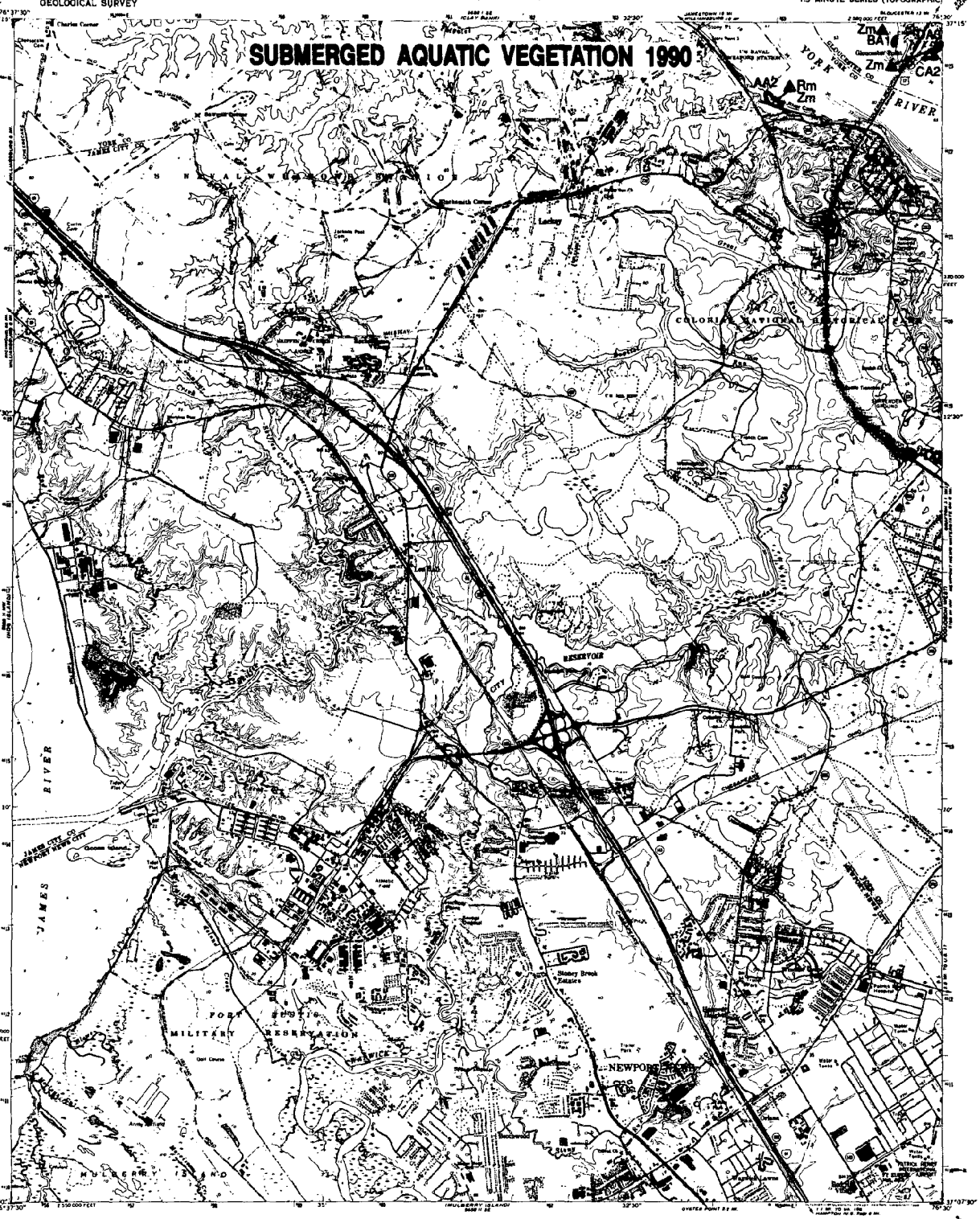
DATE FLOWN
5-23-90

CHERITON, VA
134

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

YORKTOWN QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ● Citizens Field Observation
- ⊕ MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-1-90

YORKTOWN,
VA
139

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

POQUOSON WEST QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracilima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-1-90

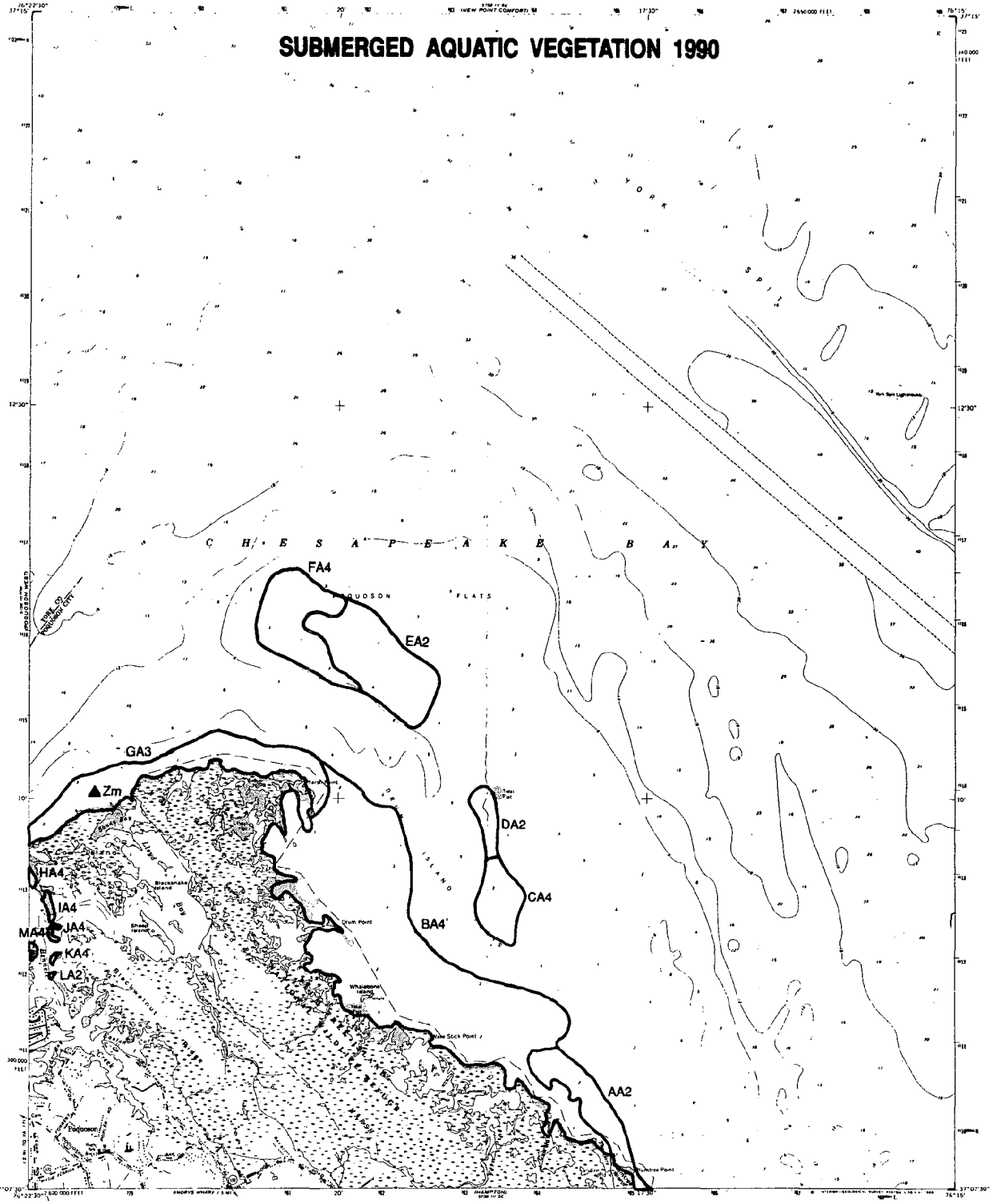
POQUOSON
WEST, VA
140

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

POQUOSON EAST QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadelupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

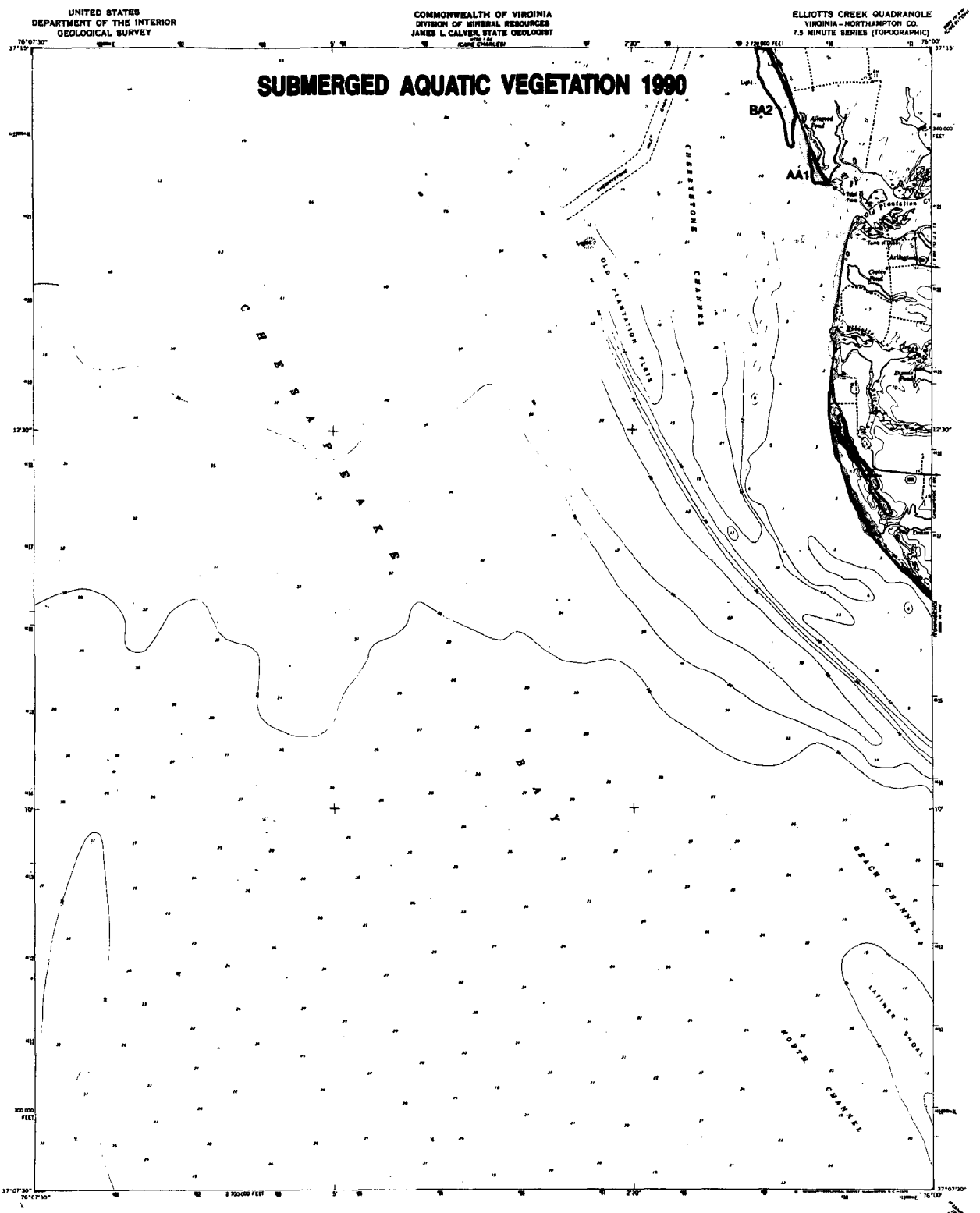
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER

SURVEY STATIONS
- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-1-90

POQUOSON
EAST, VA
141



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

1 0 1 KILOMETER

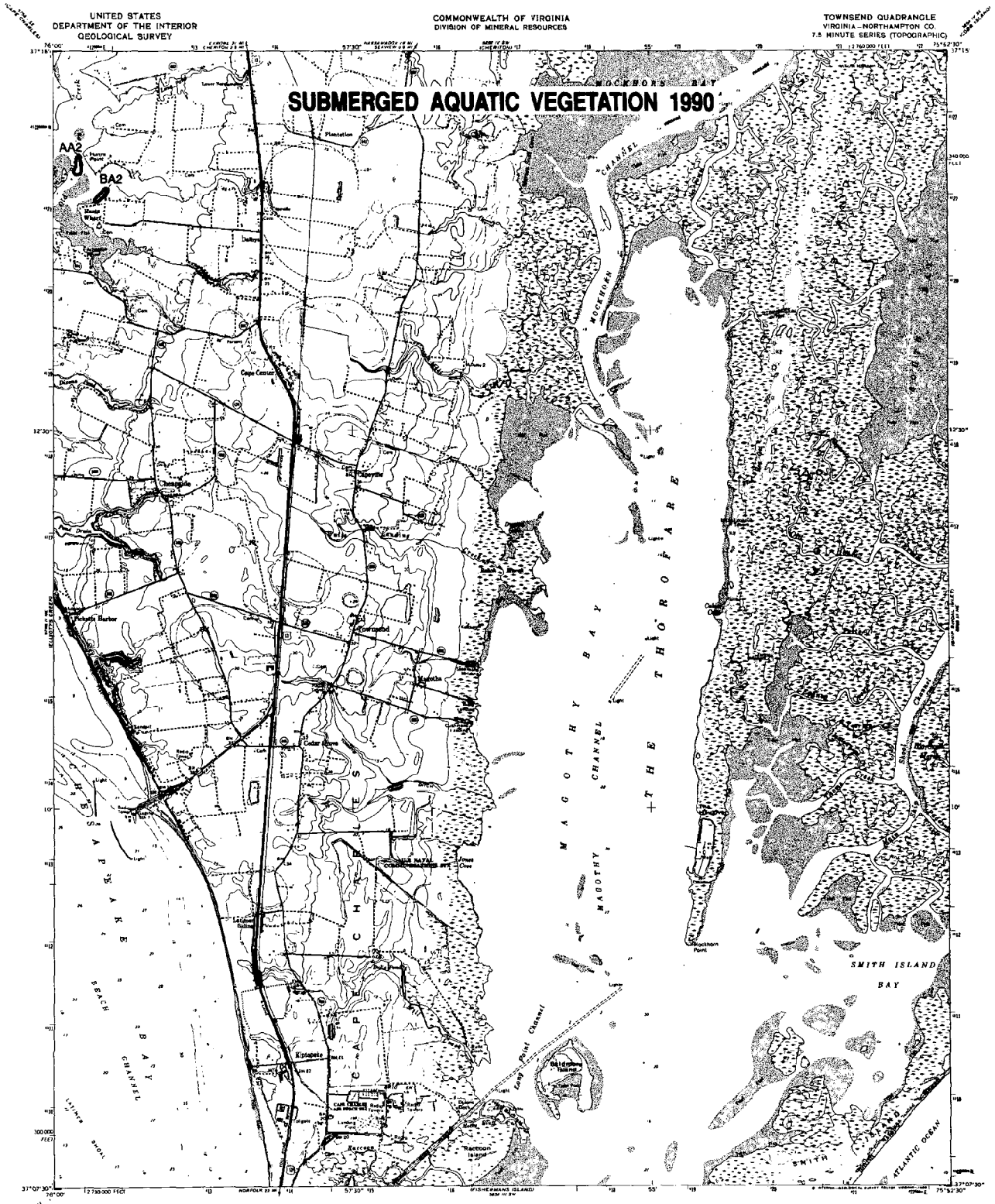
SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
5-23-90

ELLIOTTS CREEK, VA
142



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

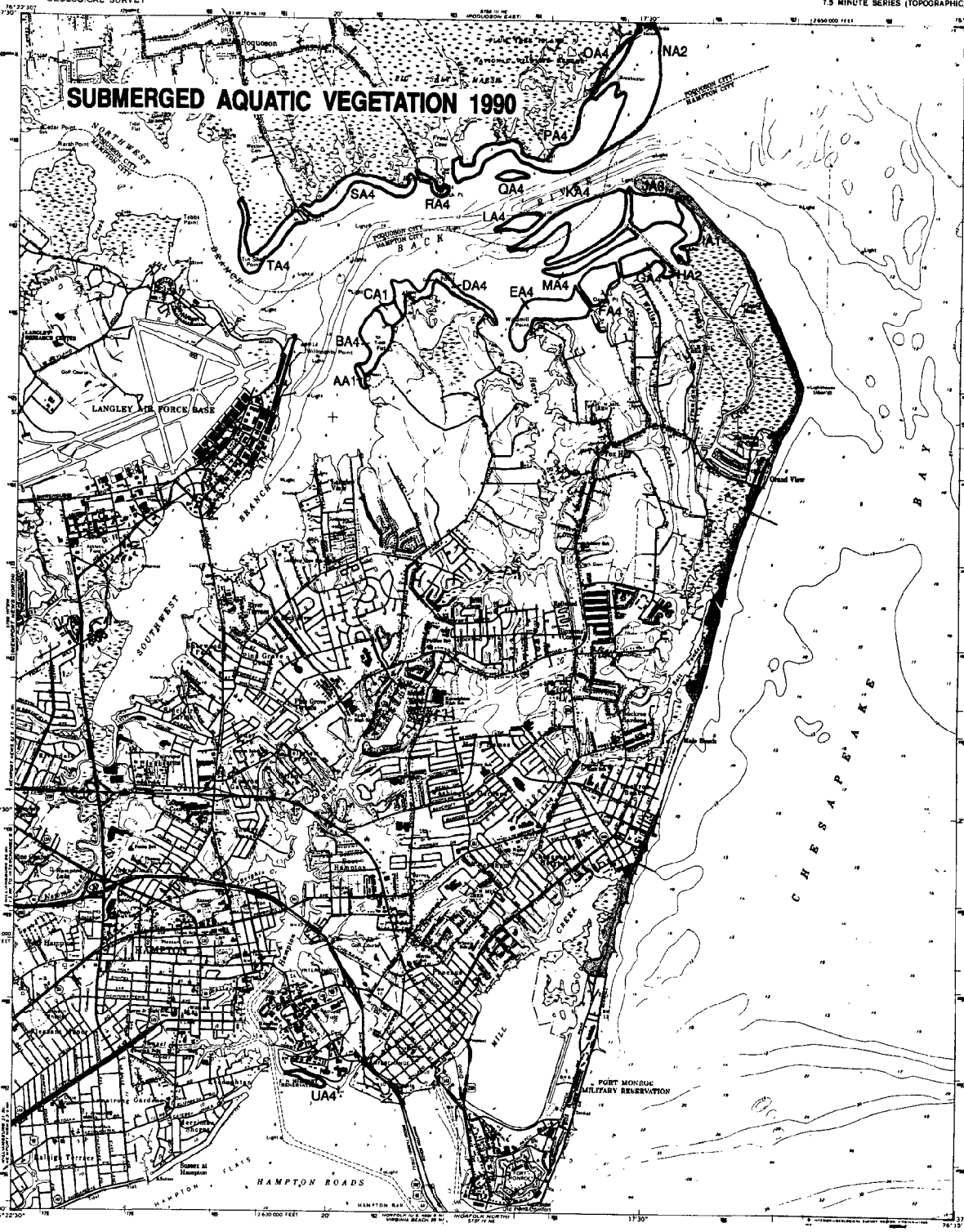
DATE FLOWN
5-23-90

TOWNSEND, VA
143

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

HAMPTON QUADRANGLE
VIRGINIA
7.5 MINUTE SERIES (TOPOGRAPHIC)


SUBMERGED AQUATIC VEGETATION 1990

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

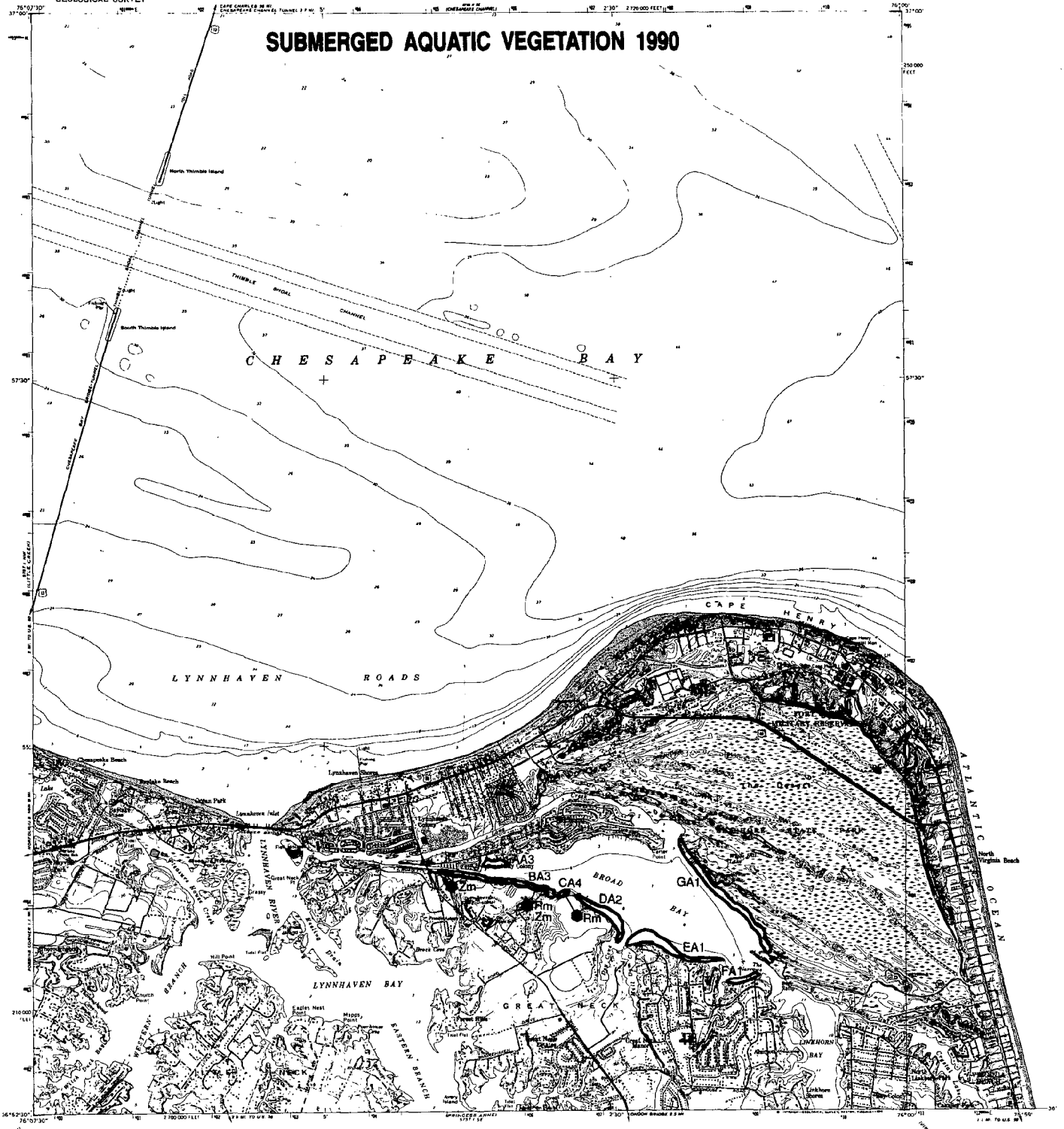
DATES FLOWN
6-1-90
HAMPTON,
VA
147

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

CAPE HENRY QUADRANGLE
VIRGINIA–VIRGINIA BEACH CITY
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000
1 MILE
1 KILOMETER

SURVEY STATIONS
- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-13-90

CAPE HENRY,
VA
152

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

COMMONWEALTH OF VIRGINIA
DIVISION OF MINERAL RESOURCES

PRINCESS ANNE QUADRANGLE
VIRGINIA-VIRGINIA BEACH CITY
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990

Mapped, edited, and published by the Geological Survey

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sage pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

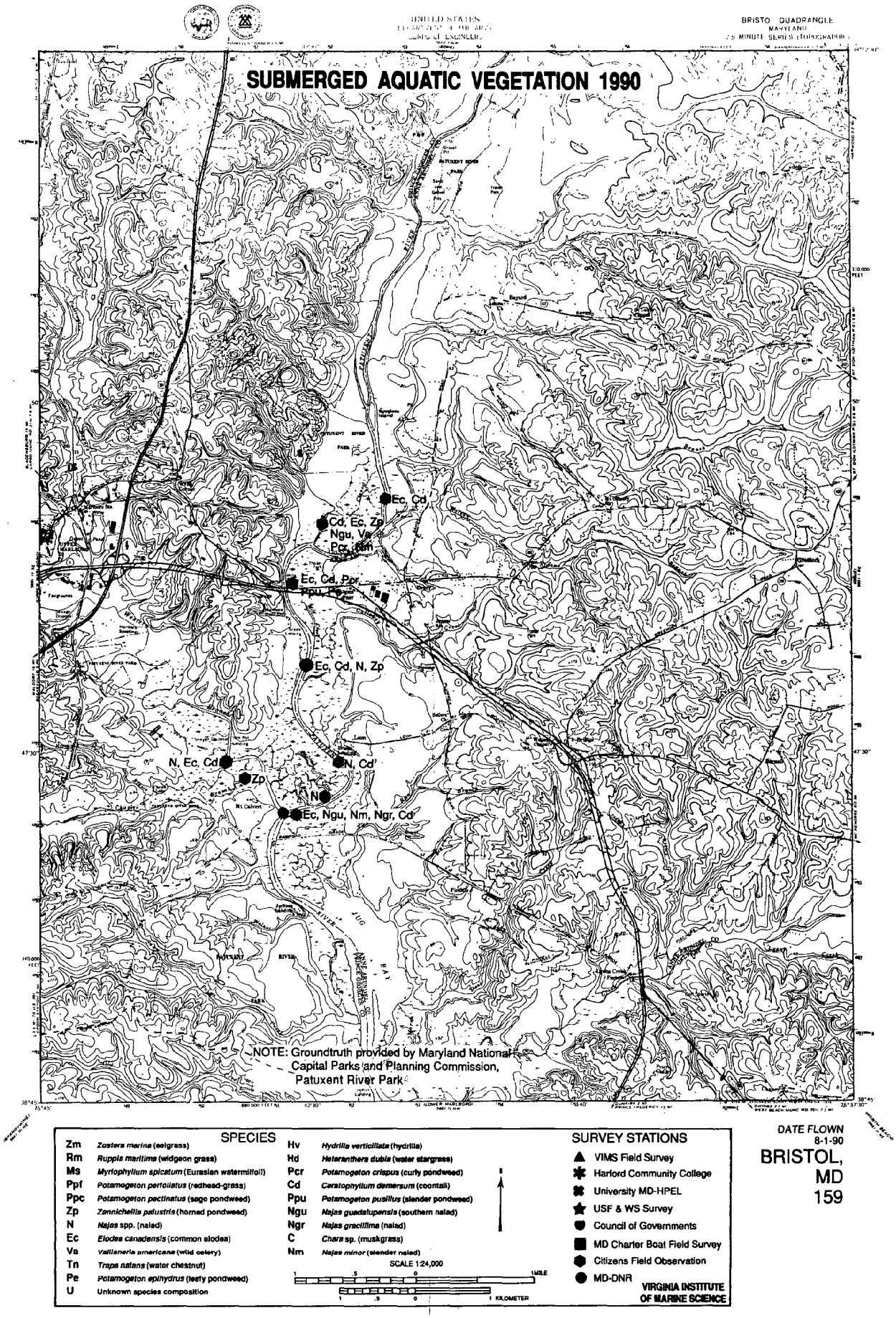
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬢ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-13-90

PRINCESS ANNE, VA
157


SUBMERGED AQUATIC VEGETATION 1990
BRISTO QUADRANGLE
MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)
Ec, Cd
Cd, Ec, Zp
Ngu, Va
Pcr, Hdh
Ec, Cd, Pcr
Ppu, Zp
Ec, Cd, N, Zp
N, Ec, Cd
Zp
N, Cd
N
Ec, Ngu, Nm, Ngr, Cd
NOTE: Groundtruth provided by Maryland National Capital Parks and Planning Commission, Patuxent River Park
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sage pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
Hd Heteranthera dubia (water stargrass)
Pcr Potamogeton crispus (curly pondweed)
Cd Ceratophyllum demersum (coontail)
Ppu Potamogeton pusillus (slender pondweed)
Ngu Najas guadalupensis (southern naiad)
Ngr Najas gracillima (naiad)
C Chara sp. (muskgrass)
Nm Najas minor (slender naiad)
SCALE 1:24,000
1 .5 0 1 MILE
1 .5 0 1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
8-1-90
BRISTOL, MD
159

SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 MILE

1 KILOMETER

SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATES FLOWN
8-13-90

PORT TOBACCO, MD
161

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ASSAWOMAN BAY QUADRANGLE
MARYLAND–DELAWARE
7.5 MINUTE SERIES (TOPOGRAPHIC)

SUBMERGED AQUATIC VEGETATION 1990

SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

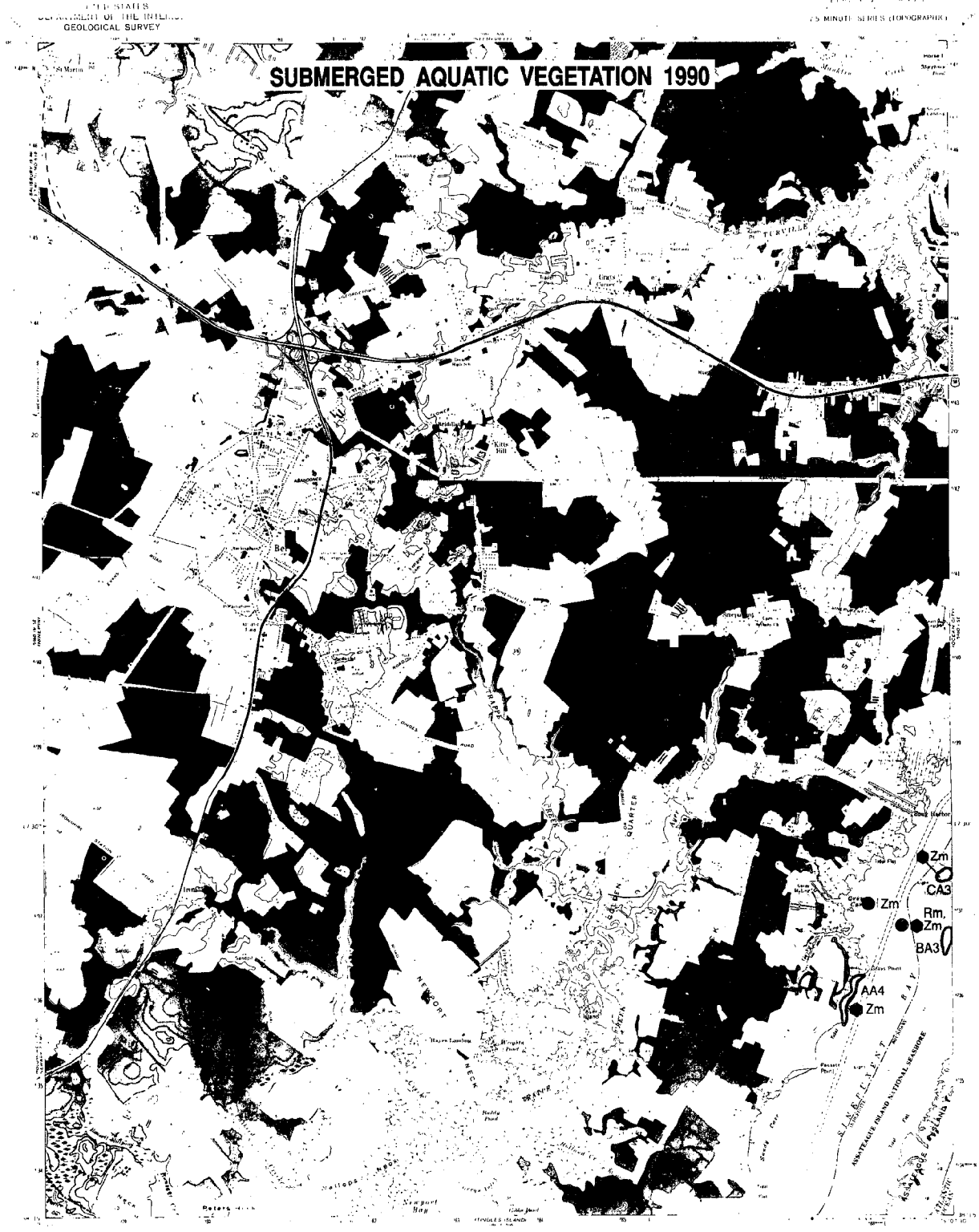
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-13-90

ASSAWOMAN BAY, MD
166



SPECIES

Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
Zp	*Zannichellia palustris* (horned pondweed)	Ngu	*Najas guadalupensis* (southern naiad)
N	*Najas* spp. (naiad)	Ngr	*Najas gracillima* (naiad)
Ec	*Elodea canadensis* (common elodea)	C	*Chara* sp. (muskgrass)
Va	*Vallisneria americana* (wild celery)	Nm	*Najas minor* (slender naiad)
Tn	*Trapa natans* (water chestnut)		
Pe	*Potamogeton epihydrus* (leafy pondweed)		
U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- VIMS Field Survey
- Harford Community College
- University MD-HPEL
- USF & WS Survey
- Council of Governments
- MD Charter Boat Field Survey
- Citizens Field Observation
- MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-13-90

BERLIN, MD
167

SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
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U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ⬟ Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

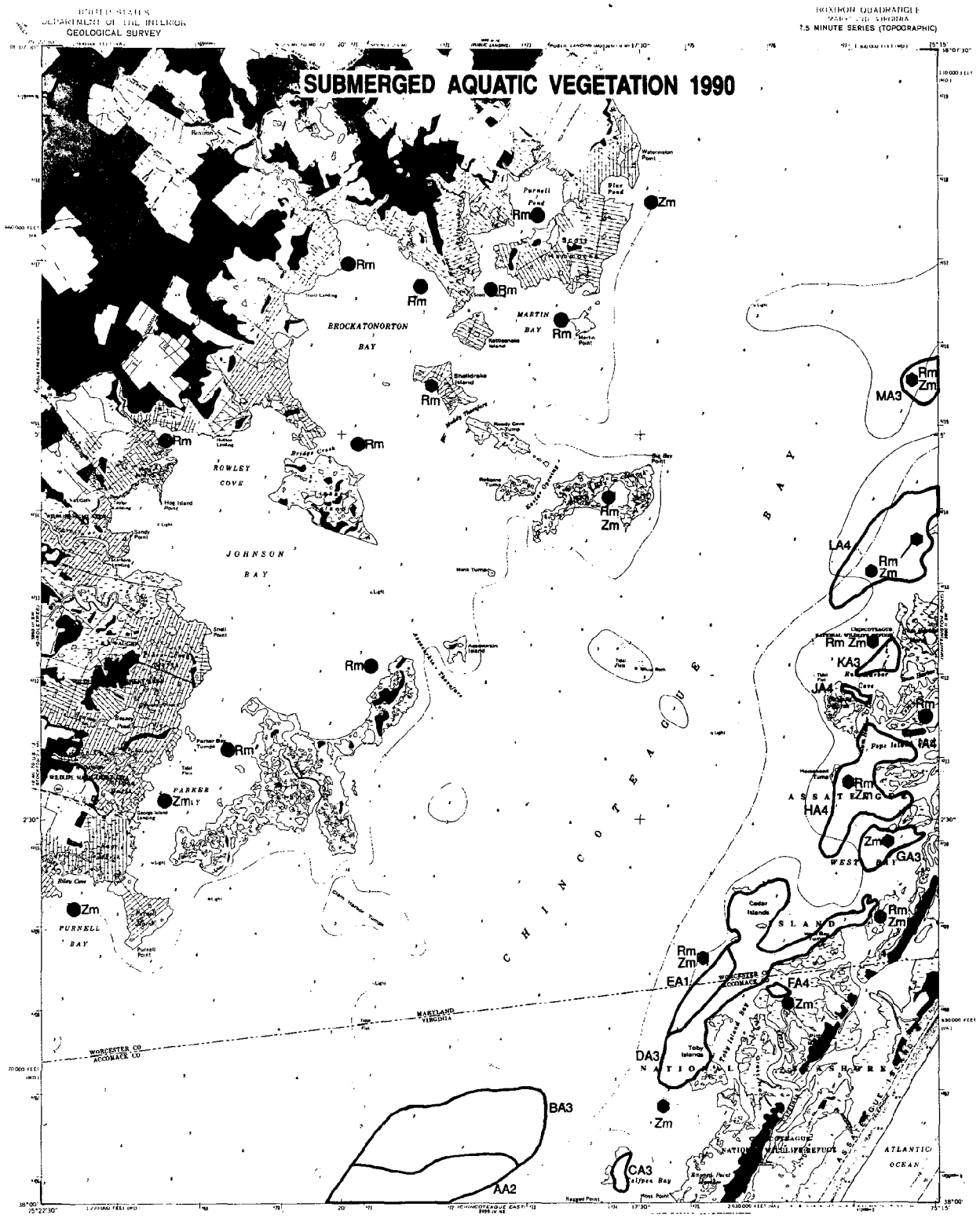
VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-13-90

OCEAN CITY, MD
168

DATE FLOWN
6-13-90

TINGLES ISLAND, MD
170



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
Ppf	*Potamogeton perfoliatus* (redhead-grass)	Cd	*Ceratophyllum demersum* (coontail)
Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
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U	Unknown species composition		

SCALE 1:24,000

1 .5 0 1 MILE

1 .5 0 1 KILOMETER

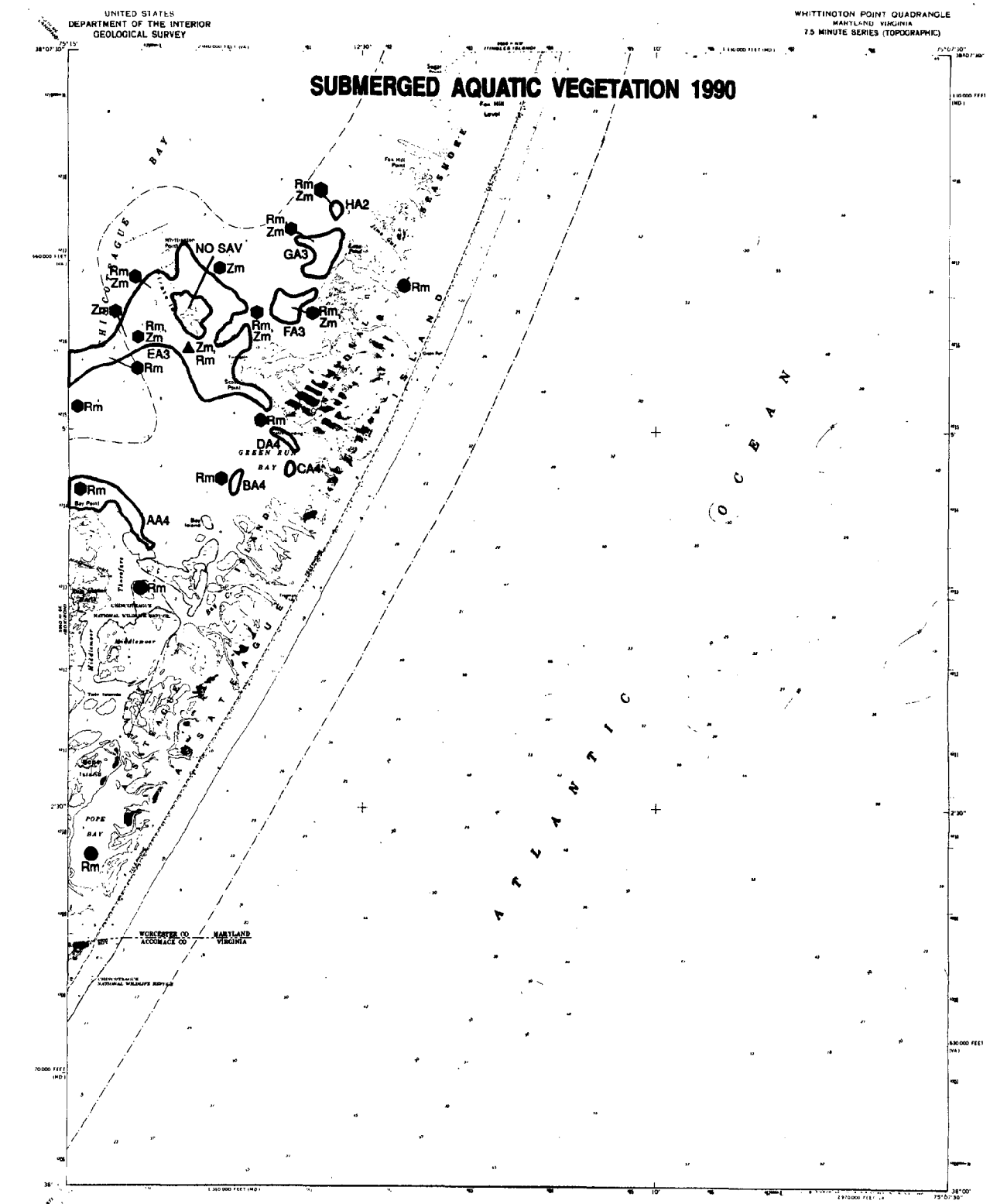
SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATE FLOWN
6-13-90

BOXIRON, MD-VA
172



SPECIES			
Zm	*Zostera marina* (eelgrass)	Hv	*Hydrilla verticillata* (hydrilla)
Rm	*Ruppia maritima* (widgeon grass)	Hd	*Heteranthera dubia* (water stargrass)
Ms	*Myriophyllum spicatum* (Eurasian watermilfoil)	Pcr	*Potamogeton crispus* (curly pondweed)
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Ppc	*Potamogeton pectinatus* (sago pondweed)	Ppu	*Potamogeton pusillus* (slender pondweed)
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U	Unknown species composition		

SCALE 1:24,000

1 0 1 MILE

.5 0 1 KILOMETER

SURVEY STATIONS

- ▲ VIMS Field Survey
- ✱ Harford Community College
- ✖ University MD-HPEL
- ★ USF & WS Survey
- ● Council of Governments
- ■ MD Charter Boat Field Survey
- ⬢ Citizens Field Observation
- ● MD-DNR

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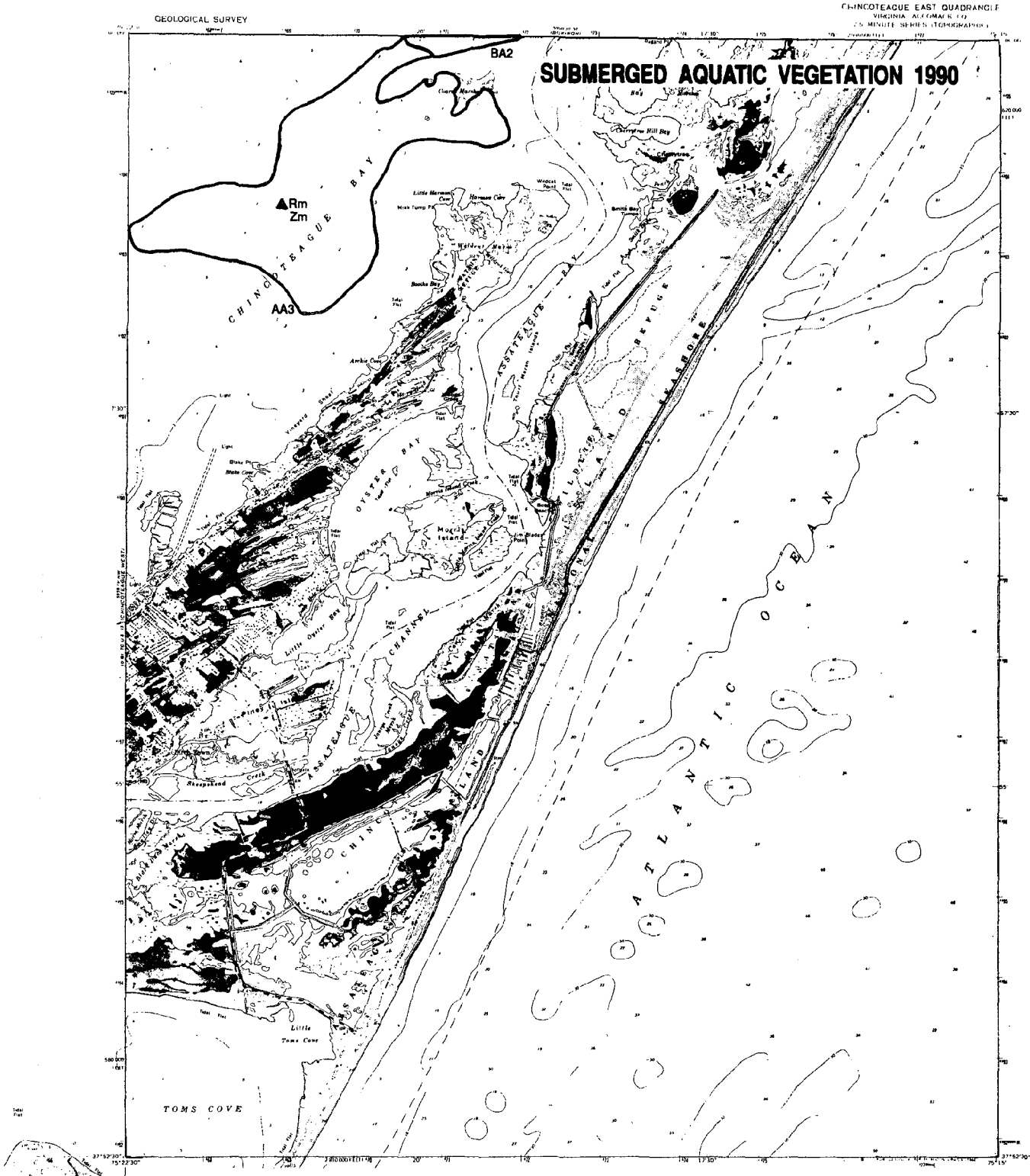
6-13-90

WHITTINGTON POINT, MD-VA
173


GEOLOGICAL SURVEY
CHINCOTEAGUE EAST QUADRANGLE
VIRGINIA ACCOMACK CO
7.5 MINUTE SERIES (TOPOGRAPHIC)
SUBMERGED AQUATIC VEGETATION 1990
BA2
AA3
Rm
Zm
CHINCOTEAGUE BAY
ASSATEAGUE ISLAND
ATLANTIC OCEAN
OYSTER BAY
TOMS COVE
SPECIES
Zm Zostera marina (eelgrass)
Rm Ruppia maritima (widgeon grass)
Ms Myriophyllum spicatum (Eurasian watermilfoil)
Ppf Potamogeton perfoliatus (redhead-grass)
Ppc Potamogeton pectinatus (sago pondweed)
Zp Zannichellia palustris (horned pondweed)
N Najas spp. (naiad)
Ec Elodea canadensis (common elodea)
Va Vallisneria americana (wild celery)
Tn Trapa natans (water chestnut)
Pe Potamogeton epihydrus (leafy pondweed)
U Unknown species composition
Hv Hydrilla verticillata (hydrilla)
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Pcr Potamogeton crispus (curly pondweed)
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SCALE 1:24,000
1 MILE
1 KILOMETER
SURVEY STATIONS
VIMS Field Survey
Harford Community College
University MD-HPEL
USF & WS Survey
Council of Governments
MD Charter Boat Field Survey
Citizens Field Observation
MD-DNR
VIRGINIA INSTITUTE OF MARINE SCIENCE
DATE FLOWN
6-13-90
CHINCOTEAGUE
EAST, VA
175

APPENDIX D

1990 SAV Bed Areas And Density Totals For Each Topographic Quadrangle.

APPENDIX D

Number Of Square Meters Of SAV In 1990 For Individual Beds And Totals For Density Categories By Topographic Quadrangle. (See Maps In Appendix C For Location Of Each Bed. Quadrangles Are Listed Numerically By VIMS Map Number. Slight Differences In Totals From Tables 4, 5, and 6 Are Due To Rounding.)

ABERDEEN, MD.
VIMS MAP # 002

AA3	5417
BA3	1961
CA3	742
DA3	1953
EA3	3676
FA3	7492

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	21241
DENSITY 4 =	0
TOTAL =	21241

HAVRE DE GRACE, MD.
VIMS MAP # 003

AA2	5845
BA2	29621
CA1	17996
DA2	314623
EA1	14962508
FA1	1557
GA2	3709
HA2	41436
IA3	2048
JA4	44308
KA2	2984
LA4	79217
MA4	160848
NA3	45773
OA2	116034
PA1	953472
QA4	9530
RA1	193657
SA4	222949
TA3	2882
UA4	9866
VA4	8999
WA4	5523
XA4	3540
YA3	937
ZA3	2657
AB2	16819
BB3	50806
CB4	11395
DB4	29607
EB4	5657
FB4	16800
GB4	2156
HB4	3161
IB4	169279
JB4	2682
KB4	7559
LB4	4054
MB3	77917
NB4	4987
OB4	3176
PB3	9119
QB3	3682
RB3	9813
SB2	1177
TB4	27927

TOTAL AREA

DENSITY 1 =	16129190
DENSITY 2 =	532248
DENSITY 3 =	205634
DENSITY 4 =	833220
TOTAL =	17700292

NORTH EAST, MD.
VIMS MAP # 004

AA2	45001
BA2	100212
CA2	80480
DA2	838265
EA1	45899
FA2	34310
GA2	159443
HA2	163284

TOTAL AREA

DENSITY 1 =	45899
DENSITY 2 =	1420995
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	1466894

ELKTON, MD.-DEL.
VIMS MAP # 005

AA2	384482
BA2	11417

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	395899
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	395899

SPESUTIE, MD.
VIMS MAP # 009

AA2	27581
BA2	189570
CA2	108398
DA1	166198
EA2	13285
FA2	4442

TOTAL AREA

DENSITY 1 =	166198
DENSITY 2 =	343276
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	509474

EARLEVILLE, MD.
VIMS MAP # 010

AA2	55211
BA2	30277
CA2	5231
DA1	22433
EA2	12051
FA2	18184
GA1	126865
HA2	278450
IA2	1051871
JA1	68604

TOTAL AREA

DENSITY 1 =	217902
DENSITY 2 =	1451275
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	1669177

MIDDLE RIVER, MD.
VIMS MAP # 013

AA3	6933

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	6933
DENSITY 4 =	0
TOTAL =	6933

GUNPOWDER NECK, MD.
VIMS MAP # 014

AA2	4523
BA2	4884
CA2	4378
DA2	10807
EA2	7787
FA3	29324
GA2	19262
HA3	194422
IA1	10345
JA3	941
KA3	77083
LA3	61203
MA3	10017
NA3	3471
OA3	187544
PA4	271498

TOTAL AREA

DENSITY 1 =	10345
DENSITY 2 =	51641
DENSITY 3 =	564005
DENSITY 4 =	271498
TOTAL =	897489

HANESVILLE, MD.
VIMS MAP # 015

AA2	11467
BA3	5536
CA2	46323

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	57790
DENSITY 3 =	5536
DENSITY 4 =	0
TOTAL =	63326

BETTERTON, MD.
VIMS MAP # 016

AA2	30264
BA2	2105
CA2	9934

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	42303
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	42303

GALENA, MD.
VIMS MAP # 017

AA2	74175
BA1	5178

TOTAL AREA

DENSITY 1 =	5178
DENSITY 2 =	74175
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	79353

SWAN POINT, MD.
VIMS MAP # 020

AA2	28482
BA2	14435
CA1	7652
DA2	3610
EA2	3519
FA1	6960

TOTAL AREA

DENSITY 1 =	14612
DENSITY 2 =	50046

DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	64658

ROCK HALL, MD.
VIMS MAP # 021

BA3	7156
CA3	28644
DA3	9206
EA3	23929
FA4	4354
GA2	42517
AA2	4197

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	46714
DENSITY 3 =	68935
DENSITY 4 =	4354
TOTAL =	120003

LANGFORD CREEK, MD.
VIMS MAP # 026

AA2	23829
BA3	1009
CA1	3052
DA3	116525
EA1	2248
FA1	8719
GA3	47056
HA1	31841
IA2	2545
JA4	14261
KA2	2931
LA3	89791
MA1	13168
NA2	2799
OA2	7562
PA1	10637
QA1	44485
RA3	55435

TOTAL AREA

DENSITY 1 =	114150
DENSITY 2 =	39666
DENSITY 3 =	309816
DENSITY 4 =	14261
TOTAL =	477893

KENT ISLAND, MD.
VIMS MAP # 032

AA2	198425
BA4	24113
CA1	242991
DA1	65018
EA4	23411
FA2	195611
GA1	16132
HA1	65399
IA2	13374
JA2	26198
KA1	18971
LA2	19673
MA2	7946
NA2	236690
OA2	13150
PA2	41358
QA1	121448

TOTAL AREA

DENSITY 1 =	529959
DENSITY 2 =	752425
DENSITY 3 =	0
DENSITY 4 =	47524
TOTAL =	1329908

QUEENSTOWN, MD.
VIMS MAP # 033

AA2	28594
BA2	290558
CA1	52783
DA1	35301
EA2	127648

FA2	6421
GA2	9551
HA2	5770

TOTAL AREA

DENSITY 1 =	88084
DENSITY 2 =	468542
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	556626

ALEXANDRIA, VA.-D.C.-MD.
VIMS MAP # 034

AA3	51534
BA3	4720
FA2	1192028
GA4	128434
HA2	5785
IA2	18455
JA2	4437
KA4	11462
LA3	34200
MA2	3603
NA3	10042
OA2	21854
PA2	5745
QA2	9209
RA3	16163
SA1	176193
TA3	99115
UA4	30293
VA2	3530
WA2	5823
XA3	24024
YA2	17006
ZA4	25925
AB4	32812
BB4	976595
CB4	36462
DB4	4200
EB4	5194
FB2	5707
GB3	168453
HB4	521114
IB4	49705
JB2	54935
KB4	44352
LB3	157204
CA3	4392
DA3	8879
EA2	25800

TOTAL AREA

DENSITY 1 =	176193
DENSITY 2 =	1373917
DENSITY 3 =	578726
DENSITY 4 =	1866548
TOTAL =	3995384

CLAIBORNE, MD.
VIMS MAP # 036

AA3	447400
BA1	50674
CA3	319089
DA2	5938
EA2	169332
FA3	10967
GA2	17267
HA2	122958
IA3	111437
JA1	77686
KA2	4287
LA2	20766
MA2	32654

TOTAL AREA

DENSITY 1 =	128360
DENSITY 2 =	373202
DENSITY 3 =	888893
DENSITY 4 =	0
TOTAL =	1390455

ST. MICHAELS, MD.
VIMS MAP # 037

AA2	77957

BA2	31281
CA2	78893
DA2	163662
EA1	121941
FA2	153007

TOTAL AREA

DENSITY 1 =	121941
DENSITY 2 =	504800
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	626741

FORT BELVOIR, VA.-MD.
VIMS MAP # 039

AA4	19355
BA4	98146
CA1	53343
DA3	163198
EA2	64021
FA1	416321
GA3	115505
HA4	52906
IA4	3825
JA4	60684
KA4	3274

TOTAL AREA

DENSITY 1 =	469664
DENSITY 2 =	64021
DENSITY 3 =	278703
DENSITY 4 =	238190
TOTAL =	1050578

MT. VERNON, VA.-MD.
VIMS MAP # 040

CA1	50991
DA4	40482
EA3	23202
FA3	77700
GA3	7952
HA4	197157
IA2	94995
JA4	148010
KA2	33969
LA4	48170
MA4	3051
NA4	40056
OA2	15310
PA2	5982
QA3	4267
RA2	23086
SA2	8540
TA4	21227
UA4	17924
VA3	73647
WA2	441880
XA4	16457
YA2	181493
ZA4	79038
AA4	334251
BA4	1593704

TOTAL AREA

DENSITY 1 =	50991
DENSITY 2 =	805255
DENSITY 3 =	186768
DENSITY 4 =	2539527
TOTAL =	3582541

TILGHMAN, MD.
VIMS MAP # 043

AA3	35901
BA3	23423
CA3	7224
DA3	32058
EA3	4129
FA3	7832
GA3	7560

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	118127

DENSITY 4 =	0
TOTAL =	118127

OXFORD, MD.
VIMS MAP # 044

AA3	14770
BA2	26432
CA3	61295
DA2	13725
EA3	48211
FA3	15891
GA3	12382

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	40157
DENSITY 3 =	152549
DENSITY 4 =	0
TOTAL =	192706

QUANTICO, VA.-MD.
VIMS MAP # 047

AA4	1136371
BA4	811966
CA4	101746
DA4	139665
EA4	496555
FA4	1158295
GA4	2582673
HA4	332762
IA4	180070

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	0
DENSITY 4 =	6940103
TOTAL =	6940103

INDIAN HEAD, MD.-VA.
VIMS MAP # 048

AA3	123864
BA4	1770423
CA1	27497
DA3	70063
EA3	56469
FA4	35935
GA4	295472
HA4	18693
IA4	63837
JA2	208580
KA4	90992
LA3	67228
MA4	207648

TOTAL AREA

DENSITY 1 =	27497
DENSITY 2 =	208580
DENSITY 3 =	317624
DENSITY 4 =	2483000
TOTAL =	3036701

HUDSON, MD.
VIMS MAP # 051

AA2	58603
BA3	5094
CA3	44080
DA4	13488
EA3	24492
FA3	4152
GA3	223870
HA3	5513
IA3	37324
JA3	6591
KA3	45497
LA3	6298
MA3	23699
NA2	210110
OA3	69393
PA3	189637

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	268713
DENSITY 3 =	685640
DENSITY 4 =	13488
TOTAL =	967841

CHURCH CREEK, MD.
VIMS MAP # 052

AA3	57766
BA3	6790

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	64556
DENSITY 4 =	0
TOTAL =	64556

WIDEWATER, VA.-MD.
VIMS MAP # 055

AA3	536737
BA3	181255
CA3	50042
DA1	956228
EA2	71767
FA4	666861
GA2	451771
HA4	2609258
IA4	428393
JA4	141004
KA4	52082

TOTAL AREA

DENSITY 1 =	956228
DENSITY 2 =	523538
DENSITY 3 =	768034
DENSITY 4 =	3897598
TOTAL =	6145398

NANJEMOY, MD.
VIMS MAP # 056

AA4	407300
BA4	29057
CA4	15337
DA4	4908
EA4	14348
FA4	25938
GA4	7693
HA3	20311
IA4	51781
KA4	11600
LA4	5920
MA3	23847
NA2	2963
JA4	37866
OA4	30959
PA3	19469
QA2	43861
RA4	22276
SA2	48025
TA3	118790
UA4	277163
VA3	47894

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	94849
DENSITY 3 =	230311
DENSITY 4 =	942146
TOTAL =	1267306

MATHIAS POINT, MD.-VA.
VIMS MAP # 057

AA2	301261
BA2	69546
CA3	315248
DA2	51063
EA3	21329
FA4	92416
GA2	151424
HA4	149256
IA2	10036

JA4	39952
KA4	63514
LA3	27283
MA4	112283
NA2	152610
OA3	641704
PA2	194200
QA2	44768
RA4	78312
SA2	4098
TA3	2367
UA3	2678
VA3	3508
WA3	8838
XA2	3985
YA2	5025
ZA2	10886
AB2	7841
BB2	21828
CB3	32631
DB2	4744
EB4	36621
FB4	122831
GB4	20933
HB2	48536

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	1081851
DENSITY 3 =	1055586
DENSITY 4 =	716118
TOTAL =	2853555

POPES CREEK, MD.
VIMS MAP # 058

AA2	27012
BA3	21632

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	27012
DENSITY 3 =	21632
DENSITY 4 =	0
TOTAL =	48644

TAYLORS ISLAND, MD.
VIMS MAP # 062

AA2	61414
BA2	6892
CA2	5361
DA2	13249
EA2	7429
FA2	9339
GA1	23403
HA2	103967
IA3	2333
JA3	35131
KA4	129510
LA4	27451
MA4	158647

TOTAL AREA

DENSITY 1 =	23403
DENSITY 2 =	207651
DENSITY 3 =	37464
DENSITY 4 =	315608
TOTAL =	584126

GOLDEN HILL, MD.
VIMS MAP # 063

AA3	2763
BA3	3553
CA1	12045
DA3	4380
EA2	17787

TOTAL AREA

DENSITY 1 =	12045
DENSITY 2 =	17787
DENSITY 3 =	10696
DENSITY 4 =	0
TOTAL =	40528

KING GEORGE, VA.-MD.
VIMS MAP # 065

AA2	20934
BA4	174638
CA3	87626
DA2	97671
EA4	149612

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	118605
DENSITY 3 =	87626
DENSITY 4 =	324250
TOTAL =	530481

DAHLGREN, VA.-MD.
VIMS MAP # 066

AA3	7704
BA2	8389
CA3	50685
DA3	6001
EA3	2532
FA1	154857
GA2	196204
HA3	73718
IA2	16459

TOTAL AREA

DENSITY 1 =	154857
DENSITY 2 =	221052
DENSITY 3 =	140640
DENSITY 4 =	0
TOTAL =	516549

COLONIAL BEACH NORTH,
VA.-MD.
VIMS MAP # 067

AA4	45345
BA3	47524
CA3	18026
DA3	21199
EA1	67161
FA2	11167
GA2	41324
HA3	199938
IA3	7173

TOTAL AREA

DENSITY 1 =	67161
DENSITY 2 =	52491
DENSITY 3 =	293860
DENSITY 4 =	45345
TOTAL =	458857

BARREN ISLAND, MD.
VIMS MAP # 072

AA3	27771
BA3	25205
CA2	371630
DA2	2573470

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	2945100
DENSITY 3 =	52976
DENSITY 4 =	0
TOTAL =	2998076

HONGA, MD.
VIMS MAP # 073

AA3	206541
BA3	119036
CA3	99155
DA2	88984
EA4	132053
FA2	112196
GA3	26628
HA4	12743
IA4	20375
JA2	42078
KA3	31139

LA3	114428
MA1	126040
NA3	62732
OA1	70491
PA3	154865
QA2	98962
RA1	95791
SA3	107007
TA2	10128
UA4	1990961
VA2	58544
WA1	104183
XA3	21579
YA1	539753
ZA3	182974
AB2	212960
BB2	20857
CB4	13823
DB2	40172
EB3	100896
FB3	164522
GB2	87831
HB3	121760
IB2	27156
JB3	40805
KB4	1184490
LB3	164185
MB2	130883
NB3	877963
OB2	134308
PB3	5578
QB2	232275
RB2	70734
SB2	89300
TB2	167598
UB4	481253
VB2	182564
WB1	31848
XB2	70054
YB3	103628
ZB1	203687
AC3	2493
BC1	82888
CC3	340124
DC2	44453

TOTAL AREA

DENSITY 1 =	1254681
DENSITY 2 =	1922037
DENSITY 3 =	3048038
DENSITY 4 =	3835698
TOTAL =	10060454

WINGATE, MD.
VIMS MAP # 074

AA3	9901
BA4	169660
CA1	135579
DA3	15437
EA1	119282
FA4	1366392
GA4	465748
HA4	873437
IA1	88156
JA4	92888
KA3	39685
LA3	311564
MA4	176918
NA2	21711
OA2	4072
PA1	12440
QA3	98729

TOTAL AREA

DENSITY 1 =	355457
DENSITY 2 =	25783
DENSITY 3 =	475316
DENSITY 4 =	3145043
TOTAL =	4001599

RICHLAND POINT, MD.
VIMS MAP # 082

AA2	239605
BA3	26471
CA3	42211

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	239605
DENSITY 3 =	68682
DENSITY 4 =	0
TOTAL =	308287

BLOODSWORTH ISLAND, MD.
VIMS MAP # 083

AA3	6479
BA3	6691
CA2	155420
DA4	200471
EA2	369411
FA4	17472
GA2	50481
HA3	2611462
IA1	23379
JA4	262771
KA3	200188
LA3	767667
MA3	73165
NA3	93398
OA1	165476
PA2	36068
QA4	199632
RA4	236573
SA2	198823
TA4	250532
UA2	67696
VA3	34405
WA3	11017
XA4	649111
YA2	129192
ZA1	43128
AB4	101906
BB4	13711
CB3	9736
DB3	18010

TOTAL AREA

DENSITY 1 =	231983
DENSITY 2 =	1007091
DENSITY 3 =	3832218
DENSITY 4 =	1932179
TOTAL =	7003471

DEAL ISLAND, MD.
VIMS MAP # 084

AA1	13575
BA2	41335
CA2	4811
DA3	2483
EA3	41988
FA2	56133
GA3	73472
HA3	47794
IA2	14016
JA3	13939
KA3	27950
LA1	5753
MA2	32552
NA3	14945

TOTAL AREA

DENSITY 1 =	19328
DENSITY 2 =	148847
DENSITY 3 =	222571
DENSITY 4 =	0
TOTAL =	390746

MONIE, MD.
VIMS MAP # 085

AA3	29970
BA2	5975
CA3	147625

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	5975
DENSITY 3 =	177595
DENSITY 4 =	0
TOTAL =	183570

KEDGES STRAITS, MD.
VIMS MAP # 091

AA1	49479
BA2	339225
CA4	74769
EA4	52566
FA3	183763
GA2	224989
HA3	2402244
IA4	1445112
JA4	106319
KA2	225370
LA2	50762
MA2	50578
NA1	50723
OA4	361575
PA2	8900
QA2	13809
RA2	8911
DA1	166344
SA3	287813
TA4	585697
UA2	89667
VA3	309027
WA2	12814
XA3	185280
YA2	33913
ZA3	742449
AB1	157429
BB4	369702
CB2	49595
DB4	59303
EB2	66767

TOTAL AREA

DENSITY 1 =	423975
DENSITY 2 =	1175300
DENSITY 3 =	4110576
DENSITY 4 =	3055043
TOTAL =	8764894

TERRAPIN SAND POINT, MD.
VIMS MAP # 092

AA1	23709
BA4	1386039
CA1	60304
DA3	355071
EA1	115165
FA4	266096
GA2	179822
HA4	45127
IA3	93065
JA3	36349
KA2	7318

TOTAL AREA

DENSITY 1 =	199178
DENSITY 2 =	187140
DENSITY 3 =	484485
DENSITY 4 =	1697262
TOTAL =	2568065

MARION, MD.
VIMS MAP # 093

AA3	6012
BA3	28652
CA2	38598
DA3	33111
EA2	5363
FA3	41593
GA4	52998
HA1	21247
IA3	10176
JA4	29961
KA4	20499
LA2	34289
MA3	17202

NA4	160218
OA2	109443
PA4	202917
QA2	30834
RA3	5178
SA3	3603
TA2	18337
UA3	5557
VA2	15303
WA3	15762
XA1	14187
YA4	16526
ZA1	20239
AB3	8893
BB4	12800
CB3	7611
DB4	17979
EB4	8010
FB3	11008
GB3	25230
HB1	42789
IB3	241322
JB3	50975
KB3	24922
LB3	44426
MB4	11501
NB3	184102
OB3	58069
PB3	56306
QB3	6324
RB3	39567
SB3	64023
TB1	25215
UB2	5035
VB2	3178
WB2	13283
XB4	1813

TOTAL AREA

DENSITY 1 =	123677
DENSITY 2 =	273663
DENSITY 3 =	989624
DENSITY 4 =	535222
TOTAL =	1922186

EWELL, MD.-VA.
VIMS MAP # 099

AA4	216569
BA1	157313
CA4	65071
DA4	15493
EA2	410431
FA1	458151
GA3	227099
HA2	64906
IA2	140970
JA2	198960
KA1	189794
LA2	109019
MA2	47674
NA2	58865
OA3	214557
PA2	57451
QA4	1661754
RA2	34775
SA2	28867
TA2	143100
UA2	2724058
VA2	51633
WA1	76581
XA1	174750
YA3	648720
ZA1	1080559
DB2	1479620
AB3	2481119
BB1	226993
CB3	613683
EB1	2910050
FB4	4926580
GB4	1314807
HB2	1255436

TOTAL AREA

DENSITY 1 =	5274191
DENSITY 2 =	6805765
DENSITY 3 =	4185178
DENSITY 4 =	8200274
TOTAL =	24465408

GREAT FOX ISLAND, MD.-VA.
VIMS MAP # 100

AA2	115213
BA2	73110
CA4	4180644
DA4	11656
EA2	1705095
FA1	14504
GA4	872292
HA2	55529
IA1	139266
JA4	238870
KA3	623479
LA2	22095
NA3	149111
OA4	13135
PA1	8103
QA1	15384
RA1	10188
SA4	2510401
TA1	31131
UA2	101949
VA1	109852
WA2	23580
XA2	5807
YA2	56933
ZA4	221364
AB2	126941
BB2	27414
CB4	175680
MA4	90862
DB4	1728544
EB1	253022
FB4	8620

TOTAL AREA

DENSITY 1 =	581450
DENSITY 2 =	2313666
DENSITY 3 =	772590
DENSITY 4 =	10052068
TOTAL =	13719774

CRISFIELD, MD.-VA.
VIMS MAP # 101

AA4	887960
BA2	78527
CA1	18526
DA4	167882
EA1	15422
FA4	100328
GA2	24228
HA2	9559
IA2	6747
JA1	94529
KA2	100567
LA2	6405
MA3	7932
NA2	23353
OA2	24904
PA2	32737
QA2	39481
RA2	6101
SA2	26095
TA2	5046
UA3	10959
VA2	8036
WA4	63870
XA2	17961
YA2	12507
ZA4	41037
AB4	186812
BB3	65732
CB3	45591
DB3	20871
EB3	24209
FB3	59496
GB3	6653
HB3	24007

TOTAL AREA

DENSITY 1 =	128477
DENSITY 2 =	422254
DENSITY 3 =	265450
DENSITY 4 =	1447889
TOTAL =	2264070

SAXIS, VA.-MD.
VIMS MAP # 102

AA2	1300
BA3	6472

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	1300
DENSITY 3 =	6472
DENSITY 4 =	0
TOTAL =	7772

REEDVILLE, VA.
VIMS MAP # 106

AA2	1123
BA2	35915
CA2	78878
EA1	438014
FA3	370001
GA2	58675
HA2	5707
IA2	16812
JA2	10575
KA1	255821
DA4	998309

TOTAL AREA

DENSITY 1 =	693835
DENSITY 2 =	207685
DENSITY 3 =	370001
DENSITY 4 =	998309
TOTAL =	2269830

TANGIER ISLAND, VA.
VIMS MAP # 107

AA3	480540
BA4	937202
CA2	42557
DA3	501844
EA2	102553
FA4	410660
GA2	339129
HA4	124136
IA1	29911
LA1	30037
JA4	3862602
KA2	657834

TOTAL AREA

DENSITY 1 =	59948
DENSITY 2 =	1142073
DENSITY 3 =	982384
DENSITY 4 =	5334600
TOTAL =	7519005

CHESCONESSEX, VA.
VIMS MAP # 108

AA2	70341
BA2	45461
CA4	150162
DA2	8603
EA1	9586
FA4	17737
GA1	10321
HA2	1428
IA4	569039
JA2	250394
KA2	45324
LA4	256870
MA3	365204
NA4	70877
OA2	62757
PA4	257370
QA2	41188
RA4	271319
SA1	13672
TA2	98398
UA4	714719
VA2	106677
WA2	191487
XA2	516532
YA4	381348
AB1	153873

BB4	310357
CB1	249493
DB4	43120
EB2	123171
FB4	725121
GB4	47504
HB2	52539
IB4	108733
JB3	7911
KB2	106517
LB4	2017715
MB1	142952
NB2	160502
OB1	146118
ZA4	583494
PB2	34618

TOTAL AREA

DENSITY 1 =	726015
DENSITY 2 =	1915937
DENSITY 3 =	373115
DENSITY 4 =	6525485
TOTAL =	9540552

PARKSLEY, VA.
VIMS MAP # 109

AA2	17602
BA3	5427
CA3	24721
DA2	15465
EA3	9314
FA2	23312
GA3	893
HA3	3725
IA4	13687
JA3	1893
KA4	2090274
LA2	186512
MA2	26342
NA2	3719
OA3	27493
PA2	9318
QA3	7892
RA3	86351
SA1	11433
TA3	577903
UA1	22758
VA2	57775
WA3	7916
XA2	1747
YA3	32066
ZA3	87834
AB2	21104
BB2	12549
CB2	11733

TOTAL AREA

DENSITY 1 =	34191
DENSITY 2 =	387178
DENSITY 3 =	873428
DENSITY 4 =	2103961
TOTAL =	3398758

URBANNA, VA.
VIMS MAP # 110

AA2	9793
BA3	7429
CA2	56298
DA2	19862
EA2	32906
FA2	22251
GA2	10395

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	151505
DENSITY 3 =	7429
DENSITY 4 =	0
TOTAL =	158934

IRVINGTON, VA.
VIMS MAP # 111

AA2	1135
BA2	4101
CA2	16000

DA3	50293
EA3	8994
FA4	24209
GA3	9762
HA3	148272
IA3	371189
JA3	766624
KA3	19848
LA4	89548
MA3	98390
NA3	190429
OA3	1795
PA4	60555
QA3	13736
RA3	1946
SA3	147744
TA3	10287
UA3	2456
VA3	9908
WA4	86648
XA3	43341
YA3	16185
ZA3	8012
AB3	10373
BB3	2805

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	21236
DENSITY 3 =	1932389
DENSITY 4 =	260960
TOTAL =	2214585

FLEETS BAY, VA.
VIMS MAP # 112

AA2	5027
BA2	643646
CA4	104979
DA1	40525
EA4	21611
FA3	285867
GA1	227781
HA3	211952
IA2	340344
JA3	35735
KA4	36863
LA3	41748
MA3	49754
NA3	9361
OA3	2085
PA4	8067
QA3	827518
RA3	13090
SA3	36717
TA3	3085
UA3	5644
VA3	2666
WA2	10248
XA4	14887
YA3	128794
ZA3	290146
AB1	9141
BB3	125839
CB2	120632
DB3	51512
EB2	112900
FB2	1279

TOTAL AREA

DENSITY 1 =	277447
DENSITY 2 =	1234076
DENSITY 3 =	2121513
DENSITY 4 =	186407
TOTAL =	3819443

NANDUA CREEK, VA.
VIMS MAP # 113

AA2	99258
BA3	10723
CA4	64961
DA2	2676
EA3	34307
FA4	499193
GA2	913803
HA4	199368
IA4	101979
JA2	67427
KA3	129335

LA3	304061
MA1	1120435
NA4	111209
TOTAL AREA	
DENSITY 1 =	1120435
DENSITY 2 =	1083164
DENSITY 3 =	478426
DENSITY 4 =	976710
TOTAL =	3658735

PUNGOTEAGUE, VA.
VIMS MAP # 114

AA4	145608
BA2	47752
CA1	33974
DA1	23882
EA4	118864
FA3	7836
GA2	46282
HA4	250365
IA1	45311
JA4	24379
KA1	116331
LA4	2395272
MA1	261814
NA2	2017470
OA4	129690
PA2	9198
QA3	4896
RA3	2208
SA4	249581
TA4	203817
UA3	33208
VA3	38726
WA2	114340
XA3	66000
YA1	77259
ZA4	226754
AB1	211720
BB2	167949
CB1	11589
DB2	10105
EB2	18478
FB3	118935
GB4	79307
HB4	56561
JB2	491223
LB4	55593
KB4	123010
IB2	211762
TOTAL AREA	
DENSITY 1 =	781880
DENSITY 2 =	3134559
DENSITY 3 =	271809
DENSITY 4 =	4058801
TOTAL =	8247049

SALUDA, VA.
VIMS MAP # 116

AA2	19731
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	19731
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	19731

WILTON, VA.
VIMS MAP # 117

AA3	6372
BA3	3489
CA2	8014
DA3	43165
EA3	13085
FA2	19443
GA2	106326
HA2	9962
IA4	164328
JA2	3341
KA2	60938
LA2	8809
MA2	25423

NA2	7552
OA2	6445
TOTAL AREA	
DENSITY 1 =	0
DENSITY 2 =	256253
DENSITY 3 =	66111
DENSITY 4 =	164328
TOTAL =	486692

DELTAVILLE, VA.
VIMS MAP # 118

AA2	155781
BA2	161210
CA3	61077
DA3	13099
EA2	56282
FA4	7109
GA2	27674
HA2	32478
IA3	26170
JA2	103136
KA1	9607
LA2	17471
MA2	2830
NA2	12901
OA2	8528
PA2	35406
QA3	17250
RA2	1524
SA3	36834
TA3	30632
UA3	25142
VA2	62655
TOTAL AREA	
DENSITY 1 =	9607
DENSITY 2 =	677876
DENSITY 3 =	210204
DENSITY 4 =	7109
TOTAL =	904796

JAMESVILLE, VA.
VIMS MAP # 119

AA2	44977
BA2	3754
CA2	593019
DA3	3283
EA1	19711
FA2	71327
GA4	620313
HA2	48711
JA2	46438
KA2	11028
LA2	6425
MA4	15122
NA4	1216
OA4	1014
PA3	28014
QA3	89778
RA4	40404
IA1	105825
SA3	14642
TA2	775982
UA4	86180
VA1	395924
WA2	192177
XA4	382181
YA3	64006
ZA3	31883
AB2	3196
BB2	5848
CB3	323056
DB1	212951
EB4	166834
FB1	90227
GB4	274933
HB2	11079
IB2	1973
JB4	148551
KB2	115952
LB3	28727
MB3	21932
TOTAL AREA	
DENSITY 1 =	824638
DENSITY 2 =	1931886

DENSITY 3 =	605321
DENSITY 4 =	1736748
TOTAL =	5098593

WARE NECK, VA.
VIMS MAP # 122

AA2	35435
BA2	391615
CA1	107091
DA2	39855
EA1	52273
FA4	418202
GA2	281929
HA3	249939
IA3	161293
JA1	22794
KA3	67835
LA4	163267
MA4	673238
OA4	141231
PA1	51246
NA2	180787

TOTAL AREA

DENSITY 1 =	233404
DENSITY 2 =	929621
DENSITY 3 =	479067
DENSITY 4 =	1395938
TOTAL =	3038030

MATHEWS, VA.
VIMS MAP # 123

AA4	7859
BA3	9371
CA3	55531
DA4	176327
EA1	3723
FA4	51978
GA2	14239
HA2	236572
IA4	284798
JA2	173378
KA4	222508
LA3	144132
MA2	119105
NA4	80569
OA3	21237
PA2	56556
QA3	15382
RA4	43164
SA4	9581
TA4	11569
UA3	23860
VA2	7312
WA2	195012

TOTAL AREA

DENSITY 1 =	3723
DENSITY 2 =	802174
DENSITY 3 =	269513
DENSITY 4 =	888353
TOTAL =	1963763

FRANKTOWN, VA.
VIMS MAP # 124

AA4	108405
BA2	50498
CA3	3544
DA3	36431
EA3	110017
FA4	636161
IA4	17446
JA2	36018
KA4	43638
LA3	66994
MA4	74492
NA2	18954
OA2	7250
PA3	2169
WA3	86039
XA1	65162
YA2	12795
ZA3	278972
AB3	83849
BB4	108149
CB3	4484

DB4	3072
EB2	922
FB3	15668
GB2	74745
HB2	161342
IB2	47683
JB2	38411
KB2	38182
LB2	5163
MB2	1551
NB3	9807
OB2	17079
PB2	79785
QB2	54342
GA1	54384
HA2	48038
QA3	220956
RA2	3712
SA2	156585
TA2	285233
UA2	65472
VA4	1533516
RB2	83348
TOTAL AREA	
DENSITY 1 =	119546
DENSITY 2 =	1287108
DENSITY 3 =	918930
DENSITY 4 =	2524879
TOTAL =	4850463

CLAY BANK, VA.
VIMS MAP # 130

AA1	13685
BA1	1147
TOTAL AREA	
DENSITY 1 =	14832
DENSITY 2 =	0
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	14832

ACHILLES, VA.
VIMS MAP # 131

AA2	22439
BA4	36129
CA4	73704
DA1	3643
EA4	70060
FA4	1157133
GA2	132101
HA4	32301
IA2	302984
JA4	1141752
KA1	104818
LA2	6856
MA2	16725
NA4	61593
OA4	395044
PA2	423373
QA4	344228
RA1	14171
SA3	218925
TA2	462693
UA4	678722
VA1	129257
WA3	36947
XA3	146392
YA4	8800
ZA2	4700
AB2	36371
BB4	234492
CB4	21685
DB2	44687
EB4	224454
FB2	24365
GB4	1444949
HB2	57397
IB4	619483
JB2	120164
KB4	16809
LB2	28374
MB2	10752
NB4	45417
OB2	39753
PB2	120207
QB4	581116
RB1	275820

TOTAL AREA

DENSITY 1 =	527709
DENSITY 2 =	1853941
DENSITY 3 =	402264
DENSITY 4 =	7187871
TOTAL =	9971785

NEW POINT COMFORT, VA.
VIMS MAP # 132

AA2	71056
BA2	373983
CA2	242614
DA1	90745
EA3	464611
FA4	3791223
GA2	470194
HA2	75508
IA4	52071
JA2	39819
KA4	583127
LA2	230882
MA4	151733
NA4	227048
OA2	261586
PA3	276498
QA4	435254
RA2	195723
SA4	197934
TA2	779112
UA4	1006518
VA2	249651
WA4	1818
XA2	66305
YA2	58504
ZA2	676966
AB4	865203
BB4	443653
CB3	102634
DB4	1108712
EB2	321902
FB3	25538
GB2	50395

TOTAL AREA

DENSITY 1 =	90745
DENSITY 2 =	4164200
DENSITY 3 =	869281
DENSITY 4 =	8864294
TOTAL =	13988520

CAPE CHARLES, VA.
VIMS MAP # 133

AA1	68552
BA4	21579
CA2	139505
DA4	88097
EA3	9858
FA4	434674
GA2	128174
HA2	94471
IA3	142336
JA3	53655
KA3	65407
LA4	11607
MA3	84774
NA1	1049628
OA4	746432
PA1	50937

TOTAL AREA

DENSITY 1 =	1169117
DENSITY 2 =	362150
DENSITY 3 =	356030
DENSITY 4 =	1302389
TOTAL =	3189686

CHERITON, VA.
VIMS MAP # 134

AA2	25537
BA1	92220
CA4	214862
DA2	155521
EA3	3894
FA4	187850

GA1	27055

TOTAL AREA

DENSITY 1 =	119275
DENSITY 2 =	181058
DENSITY 3 =	3894
DENSITY 4 =	402712
TOTAL =	706939

YORKTOWN, VA.
VIMS MAP # 139

AA2	8205
BA1	2338
CA2	3569
DA3	2693

TOTAL AREA

DENSITY 1 =	2338
DENSITY 2 =	11774
DENSITY 3 =	2693
DENSITY 4 =	0
TOTAL =	16805

POQUOSON WEST, VA.
VIMS MAP # 140

AA4	8174
BA4	18984
CA4	29896
DA1	82609
EA3	7252
FA4	72338
GA2	478960
HA4	542857
IA2	16648
JA4	119488
KA2	18729
LA3	15666
MA4	36569
NA4	144838
OA1	21253
PA2	471195
QA3	519273
RA1	30419
SA3	301926
TA2	975186
UA4	445135
VA4	728336
WA2	81059
XA2	57520
YA4	21368
ZA2	23503
AB4	40016
BB1	56639
CB4	47509

TOTAL AREA

DENSITY 1 =	190920
DENSITY 2 =	2122800
DENSITY 3 =	844117
DENSITY 4 =	2255508
TOTAL =	5413345

POQUOSON EAST, VA.
VIMS MAP # 141

AA2	573463
BA4	5543807
CA4	420173
DA2	173641
EA2	1149443
FA4	855950
GA3	1285263
HA4	15715
IA4	27159
JA4	11491
KA4	5414
LA2	1958
MA4	11549

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	1898505

DENSITY 3 =	1285263
DENSITY 4 =	6891258
TOTAL =	10075026

ELLIOTTS CREEK, VA.
VIMS MAP # 142

AA1	46167
BA2	235829

TOTAL AREA

DENSITY 1 =	46167
DENSITY 2 =	235829
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	281996

TOWNSEND, VA.
VIMS MAP # 143

AA2	11223
BA2	3892

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	15115
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	15115

HAMPTON, VA.
VIMS MAP # 147

AA1	13951
BA4	155606
CA1	47238
DA4	153734
EA4	262743
FA4	150341
GA4	100602
HA2	12923
IA1	111246
JA3	199112
KA4	449925
LA4	54299
MA4	103679
NA2	565417
OA4	68881
PA4	574188
QA4	20287
RA4	28351
SA4	169023
TA4	151120
UA4	27328

TOTAL AREA

DENSITY 1 =	172435
DENSITY 2 =	578340
DENSITY 3 =	199112
DENSITY 4 =	2470107
TOTAL =	3419994

CAPE HENRY, VA.
VIMS MAP # 152

AA3	17115
BA3	37196
CA4	3439
DA2	41738
EA1	86219
FA1	15048
GA1	82588

TOTAL AREA

DENSITY 1 =	183855
DENSITY 2 =	41738
DENSITY 3 =	54311
DENSITY 4 =	3439
TOTAL =	283343

PRINCESS ANNE, VA.
VIMS MAP # 157

AA2	2707
BA2	4550

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	7257
DENSITY 3 =	0
DENSITY 4 =	0
TOTAL =	7257

PORT TOBACCO, MD.
VIMS MAP # 161

AA4	118994

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	0
DENSITY 4 =	118994
TOTAL =	118994

BERLIN, MD.
VIMS MAP # 167

AA4	24313
CA3	13413
BA3	25623

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	0
DENSITY 3 =	39036
DENSITY 4 =	24313
TOTAL =	63349

OCEAN CITY, MD.
VIMS MAP # 168

AA2	15264
BA3	14983
CA2	145423
DA2	9785
EA4	8424
FA3	4018

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	170472
DENSITY 3 =	19001
DENSITY 4 =	8424
TOTAL =	197897

TINGLES ISLAND, MD.
VIMS MAP # 170

AA3	685389
BA3	7264869
CA3	338924
DA3	73519
EA3	1102207
FA1	29681
GA4	171239
HA4	66268
IA1	15638
JA4	49989
KA1	26084
LA3	65559
MA4	32014
NA2	15027

TOTAL AREA

DENSITY 1 =	71403
DENSITY 2 =	15027
DENSITY 3 =	9530467
DENSITY 4 =	319510
TOTAL =	9936407

BOXIRON, MD.-VA.
VIMS MAP # 172

AA2	901619
BA3	1584838
CA3	66367

DA3	1276754
EA1	265474
FA4	22245
GA3	236428
HA4	740234
IA4	8887
JA4	21718
KA3	105015
LA4	948056
MA3	183631

TOTAL AREA

DENSITY 1 =	265474
DENSITY 2 =	901619
DENSITY 3 =	3453033
DENSITY 4 =	1741140
TOTAL =	6361266

WHITTINGTON POINT, MD.-VA.
VIMS MAP # 173

AA4	296475
BA4	22802
CA4	9929
DA4	28578
EA3	1717544
FA3	132264
GA3	173879
HA2	17139

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	17139
DENSITY 3 =	2023687
DENSITY 4 =	357784
TOTAL =	2398610

CHINCOTEAGUE EAST, VA.
VIMS MAP # 175

AA3	5771516
BA2	215488

TOTAL AREA

DENSITY 1 =	0
DENSITY 2 =	215488
DENSITY 3 =	5771516
DENSITY 4 =	0
TOTAL =	5987004

APPENDIX E

1990 Submerged Aquatic Vegetation Ground Truth Surveys.

1990 SUBMERGED AQUATIC VEGETATION GROUND TRUTH SURVEYS

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
002	*	AA3	U	Capt.	6/18-21
	BA3	BA2	U	Capt.	6/18-21
	BA3	BA2	U	Cit.	9/24
	EA3	*	Ms	Harford	8/15
	DA3	*	Ms	Harford	8/15
	CA3	*	U	Cit.	9/24
	AA3	*	Ms	Harford	8/15
	FA3	*	Ms	Harford	8/15
003	EA1	AA1	Ms	Harford	8/15
	FA1	BA1	Ms,Va	Harford	8/15
	JA4	FA1	Ms	Harford	8/15
	OA2,PA1,CA2	HA1	Ms,Hv,Va	HPEL	7/4
	OA2	HA1	Ms,Hv,Va	Harford	8/15
	PA1	HA1	Ms	Harford	8/15
	MA4	IA2	Ms,Hv,Va,Cd,N,Hd	Harford	8/15
	LA4	JA2	Hv,Ms,Va	Harford	8/15
	NA3	KA2	Ms,Va,Hv,Cd,Ppc	Harford	8/15
	TA3	LA2	Ms,Hv,Va	Harford	8/15
	UA4	MA2	Ms,Va,Hv,Cd,N	Harford	8/15
	VA4	NA2	Ms,Va,Hv,Cd,N	Harford	8/15
	WA4	OA2	Ms,Va,Hv,Cd,N	Harford	8/15
	XA4	PA2	Ms,Va,Hv,Cd,N	Harford	8/15
	YA3	QA4	Va,Ms,Hv	Harford	8/15
	ZA3	RA2	Va,Ms,Hv	Harford	8/15
	FB4	SA3	Ms	Harford	8/15
	JB4	TA2	Ms	Harford	8/15
	KB4	UA2	Ms	Harford	8/15
	LB4	VA2	Ms	Harford	8/15
	MB3	WA2	Ms	Harford	8/15
	QB3	XA3	Ms	Harford	8/15

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
003	RB3	YA3	Ms	Harford	8/15
	TB4	ZA2	Ms	Harford	8/15
	IB4	AB3	Ms,Hv,Cd	Harford	8/15
	DB4	BB3	Ms	Harford	8/15
	DB4	CB3	Ms	Harford	8/15
	DB4	DB3	Ms	Harford	8/15
	DB4	EB3	Ms	Harford	8/15
	BB3	GB2	Ms,Hd,Cd	Harford	8/15
	SA4	IB3	Ms,Hv,Cd,Va,N,Hd	Harford	8/15
	DA2	KB2	Ms,Cd	Harford	8/15
	AA2	NB2	Ms	Harford	8/15
	EB4	OB3	Ms	Harford	8/15
	BA2	*	Ms	Harford	8/15
	CA1	*	Ms	Harford	8/15
	IA3	*	Ms	Harford	8/15
	GB3	*	Ms	Harford	8/15
	HB3	*	Ms	Harford	8/15
	PB3	*	Ms	Harford	8/15
	SB2	*	Ms	Harford	8/15
	High Point #		Ms	Cit.	7/21
004	AA2	GA2	Ms	Harford	8/15
	CA2	FA2	Ms	Harford	8/15
	GA2	EA2	Ms	Harford	8/15
	*	CA1	U	Capt.	6/18-21
	EA1	BA1	Ms,Va	Harford	8/15
	DA2	AA1	Ms,Va	Harford	8/15
	FA2	*	Ms	Harford	8/15
	BA2	GA2	Ms	Harford	8/15
	HA2	DA1	Ms	Harford	8/15
005	AA2	BA2	Ms	Harford	8/15
	BA2	AA2	Ms	Harford	8/15

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
009	EA2	GA2	Ms,Va,Hv,Cd	Harford	8/15
	*	DA1	U	Capt.	6/18-21
	EA2	FA2	Ms, Va,Hv,Cd	Harford	8/15
	*	EA1	U	Capt.	6/18-21
	FA2	HA1	U	Capt.	6/18-21
	CA2	CA2	Ms,Va	Harford	8/15
	CA2	BA2	Ms,Va	Harford	8/15
	AA2	AA2	Ms,Hv	Harford	8/15
	BA2	AA2	Ms,Hv,Va,Pcr	Harford	8/15
010	IA2	LA2	Ms,Va,Ppc	Harford	8/15
	HA2	MA1	Ms,Va	Harford	8/15
	HA2	NA4	Ms,Va	Harford	8/15
	FA2	FA2	N,Va,Ms	Harford	8/15
	EA2	EA1	Ms,Hv	Harford	8/15
	CA2	DA2	Va	Harford	8/15
	BA2	CA2	Ms,Va	Harford	8/15
	JA1	GA1	U	Capt.	6/18-21
	IA2	HA2	U	Capt.	6/18-21
	IA2	IA1	U	Capt.	6/18-21
	IA2	JA1	U	Capt.	6/18-21
	IA2	KA1	U	Capt.	6/18-21
	*	AA2	U	Capt.	No Date
	AA2	BA2	Ms,Hd	Harford	8/15
	Veazy Cove #		U	Cit.	7/20
013	*	BA1	U	Capt.	6/18-21
	*	CA2	U	Capt.	6/18-21
	*	EA1	U	Capt.	6/18-21
	*	EA1	Ms,Va,Rm,U	Cit.	5/90
	Seneca Cr. #		U	Essex	7/7
	Seneca Cr. #		U	Essex	7/7
	Seneca Cr. #		U	Essex	7/7

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
013	Seneca Cr. #		U	Essex	7/7
	Seneca Cr. #		U	Essex	7/7
014	OA3	GA3	U\Ms,C,Ec,Va	Capt.\Essex	6/18-21\7/30-10/26
	*	FA3	U	Capt.	6/18-21
	*	EA3	U\Ms,C	Capt.\Essex	6/18-21\7-24
	*	DA4	U	Capt.	6/18-21
	AA2	CA2	U	Capt.	6/18-21
	EA2	SA3	U	Capt.	6/18-21
	DA2	RA2	U	Capt.	6/18-21
	CA2	QA2	U	Capt.	6/18-21
	*	OA3	U	Capt.	6/18-21
	FA3	NA3	U	Capt.	6/18-21
	FA3	MA3	U	Capt.	6/18-21
	HA3	LA3	U	Capt.	6/18-21
	HA3,IA1	KA3	U	Capt.	6/18-21
	KA3	JA3	U	Capt.	6/18-21
	LA3,JA3	IA2	U\Ec,Cd,Ms	Capt.\Essex	6/18-21\7/30
	Dundee Cr. #		Ec,Ms,Va	Essex	7/30
	Dundee Cr. #		Va,Ms,Ngu	Essex	7/30
015	*	DA1	U	Capt.	6/18-21
	AA2	BA3	U	Cit.	8/3
	Worton Cr.#		U	Cit.	7/20
	Churn Cr. #		U	Cit.	8/31
016	AA2	BA2	U\Ms,Va	Capt.\Harford	6/18-21\8/15
	*	AA2	U	Capt.	6/18-21
	Betterton Pier #		Ms	Cit.	11/6
	Sassafrass R. #		Ms	Harford	8/15
017	BA1	BA2	Ms,Va,Hd	Harford	8/15
	AA2	AA3	Ms,Va,Hd	Harford	8/15

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
018	Stony Cr. #		Rm	Cit.	6/4
	Stony Cr. #		Rm	Cit.	6/4
	Nabbs Cr. #		Rm	Cit.	6/4
019	Main Cr. #		Zp,Ppc	Cit.	5/1,7/15
	Back Cr. #		Ppc	Cit.	5/1,7/15
020	BA2	AA2	U	Capt.	6/27-30
	AA2	BA3	U	Capt.	6/27-30
	DA2	DA4	U\U	Capt.\Cit.	6/27-30\7-8
021	AA2	HA2	U	Capt.	6/27-30
	*	GA2	U	Capt.	6/27-30
	DA3	CA3	Rm	Capt.	6/27-30
	GA2	AA2	Rm	Capt.	6/27-30
	CA3	DA4	U	Capt.	6/27-30
023	Forked Cr. #		Zp	Cit.	6/30
	Branch Cr. #		Zp	Cit.	5/10
	Severn R. #		Zp	Cit.	5/10
	Herald Harbor #		Zp	Cit.	5/10
	Clements Cr. #		Zp,U	Cit.	6/16
	Luce Cr. #		Zp	Cit.	6/16
	Brewer Pond #		Zp	Cit.	5/10
	Maynedier Cr. #		Zp	Cit.	5/10
	Severn R. #		Zp	Cit.	5/10
024	Burley Cr. #		Zp	FWS	6/5
	Broad Cr. #		Zp	Cit.	6/24
	Inner Harbor #		Rm	Cit.	8/2
	Redhouse Cove #		Ppc	Cit.	8/23
	Deep Cr. #		Ms	Cit.	9/9

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
026	*	FA3	Rm	Capt.	6/27-30
	AA2	BA3	Rm	Capt.	6/27-30
	CA1	AA3	U	Capt.	6/27-30
	*	IA2	U	Capt.	6/27-30
	*	JA3	U	Capt.	6/27-30
	*	KA4	Rm	Capt.	6/27-30
	*	LA4	Rm	Capt.	6/27-30
	*	NA1	Rm	Capt.	6/27-30
	*	WA1	Rm	Capt.	6/27-30
	IA2	TA4	Rm	Capt.	6/27-30
	KA2	UA3	Rm	Capt.	6/27-30
	NA2	VA3	Rm	Capt.	6/27-30
	EA1	PA2	Rm	Capt.	6/27-30
	*	SA1	Ec	Capt.	6/27-30
	DA3	MA3	U	Capt.	6/27-30
	MA1	BB1	Rm	Capt.	6/27-30
	LA3	CB2	Rm	Capt.	6/27-30
	RA3,QA1	YA3	Rm	Capt.	6/27-30
	PA1	XA2	Rm	Capt.	6/27-30
	HA1	QA1	Ppf	Cit.	7/22
	OA2	*	Zp	Cit.	6/9
	LA3	CB2	Ms,Ppf,Ec	Cit.	7/2
	Piney Point #		Rm,Ppf	Cit.	7/24
	Piney Cove #		Rm	Cit.	7/24
	Cacaway Point #		Rm	Cit.	8/3
	Boxes Point #		Ppf	Cit.	7/22
	Blakeford Point #		Zp,U	Cit.	7/22
	Spaniard Neck #		Ms,Ppf,U	Cit.	8/90
	Lucy Cove #		Zp	Cit.	6/9
	Tilghman Cr. #		Ec	Cit.	No Date
	Gum Point #		Rm	Cit.	No Date
	Eastern Neck Narrows #		Ec,Ppf,Ppc	HPEL	7/10

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
029	Anacostia R. #		Hv	COG	No Date
030	Selby Bay #		Zp	FWS	6/5
	Almshouse Cr. #		Zp	Cit.	6/13
	Beards Cr. #		Rm	Cit.	6/3,9/9
031	Lake Ogleton #		Zp	Cit.	7/2
	Lake Ogleton #		Zp	Cit.	7/2
	Lake Ogleton #		Zp	Cit.	7/2
	Lake Ogleton #		Zp	Cit.	7/2
	Lake Ogleton #		Zp	Cit.	7/2
	Black Walnut Cr. #		Zp,U	Cit.	7/2
	Black Walnut Cr. #		Zp,U	Cit.	7/2
	Black Walnut Cr. #		Zp,U	Cit.	7/2
	Black Walnut Cr. #		Zp,U	Cit.	7/2
	Black Walnut Cr. #		Zp,U	Cit.	7/2
	Black Walnut Cr. #		Zp,U	Cit.	7/2
	Kitty Duvall Cr. #		U	Cit.	6/90,7/90
	Kitty Duvall Cr. #		U	Cit.	6/90,7/90
032	IA2	*	Zp	FWS	6/28
	LA2	WA2	Zp\Rm	FWS\Capt.	6/28\No Date
	NA2	YA2	Rm,Zp\Rm	FWS\Capt.	6/28\No Date
	CA1	QA3	Rm,Ppc	FWS	6/28
	QA1	AB4	Rm	FWS	6/28
	QA1	BB1	Rm	Capt.	No Date
	KA1	VA2	Rm	FWS	6/28
	JA2	UA2	Rm,Zp	FWS	6/28
	FA2,EA4	TA2	Rm,Zp\Rm	FWS\Capt.	6/28\No Date
	DA1	SA3	Rm,Ppc,Zp\Rm	FWS\Capt.	6/28\No Date
	DA1	SA3	Rm	HPEL	8/7
	CA1	QA3	Rm	Capt.	No Date
	CA1	PA2	Rm	Capt.	No Date

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
032	GA1	OA2	Rm	Capt.	No Date
	*	MA3	Rm	Capt.	No Date
	*	LA3	Rm	Capt.	No Date
	*	KA3	Rm	Capt.	No Date
	*	GA3	Rm	Capt.	No Date
	AA2	BA1	Rm	Capt.	No Date
	AA2	AA3	Rm	Capt.	No Date
	*	IA2	Rm	Capt.	No Date
	*	JA3	Rm	Capt.	No Date
	*	ZA1	Rm	Capt.	No Date
	Kirwan Cr. #		Ppf,Rm	Cit.	10/12
	Cox Cr. #		Rm,Zp	FWS	7/13
	Crab Alley Neck #		Zp	FWS	6/28
	Crab Alley Neck #		Zp	FWS	6/28
033	HA2	MA3	Rm	Capt.	6/27-30
	GA2	NA3	U	Capt.	6/27-30
	*	OA3	Rm	Capt.	6/27-30
	FA2	KA2	Rm	Capt.	6/27-30
	EA2	HA2	Rm	Capt.	6/27-30
	BA2	DA2	Rm	Capt.	6/27-30
	BA2	CA1	Rm\Rm	Capt.\HPEL	7/2-6\7/18
	BA2	EA4	Rm	Capt.	7/2-6
	DA1	GA4	Rm	Capt.	7/2-6
	CA1	FA2	Rm\Rm	Capt.\FWS	7/2-6\8/2
	EA2	HA2	Rm	FWS	8/2
	AA2	AA2	Rm	FWS	8/2
	DA1	GA4	Rm,Ppc	FWS	8/2
034	UA4	RA4	Hv,Va,Hd,Ms\Hv,Ms,Va,Hd	Cit.\COG	9/3\9/10-11
	VA2	SA2	Hv,Va,Ms	Cit.	9/3
	AA3	AA2	Hv,Ms,Nm	COG	9/10-11
	AA3	BA4	Hv	COG	9/10-11

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
034	BA3	CA2	Hv	COG	9/10-11
	EA2	DA4	Hv	COG	9/10-11
	*	FA3	Hv	COG	9/10-11
	FA2	GA4	Ms,Cd,Nm	COG	9/10-11
	FA2	HA2	Hv,Cd	COG	9/10-11
	GA4	IA4	Hv,Ms,Va	COG	9/10-11
	FA2	JA1	Hv,Cd	COG	9/10-11
	FA2	KA4	Hv,Cd	COG	9/10-11
	HA2	LA4	Hv	COG	9/10-11
	IA2	MA2	Hv	COG	9/10-11
	JA2	NA3	Hv,Ms	COG	9/10-11
	LA3,MA2	PA2	Ms,Nm,Va,Hv	COG	9/10-11
	TA3	QA2	Hv	COG	9/10-11
	XA3	TA4	Va	COG	9/10-11
	ZA4	VA4	Ms,Hv	COG	9/10-11
	AB4	WA4	Hv	COG	9/10-11
	EB4	ZA4	Hv, Ms	COG	9/10-11
	BB4	AB4	Hv	COG	9/10-11
	IB4	CB4	Hv,Ms,Cd	COG	9/10-11
	GB3,HB4	DB2	Hv	COG	9/10-11
	HB4	EB4	Hv	COG	9/10-11
	LB3,KB4	GB4	Ms,Va,Hv	COG	9/10-11
	LB3	HB2	Hv,Ms	COG	9/10-11
	NA3	*	Ms,Hv	COG	9/10-11
	OA2	*	Ms	COG	9/10-11
	PA2	*	Hv	COG	9/10-11
	QA2	*	Hv	COG	9/10-11
	RA3	*	Hv	COG	9/10-11
	SA1	*	Ms	COG	9/10-11
	WA2	*	Ms	COG	9/10-11
	Yacht Basin #		Va	COG	9/10-11
	Yacht Basin #		Hv	COG	9/10-11
	Yacht Basin #		Hv,Va	COG	9/10-11

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
034	Sheperds Landing #		Hv,Ms	COG	9/10-11
	Interchange #		Hv,Ms	COG	9/10-11
	Indian Queen Bluff #		Hv	COG	9/10-11
	Indian Queen Bluff #		Hv,Ms	COG	9/10-11
	Indian Queen Bluff #		Hv,Ms	COG	9/10-11
	Indian Queen Bluff #		Hv	COG	9/10-11
	Indian Queen Bluff #		Hv,Ms	COG	9/10-11
	Anacostia R. #		Hv,Va,Ms	Cit.	9/3
	Hog Island #		Hv,Va,Nm	COG	9/10-11
	Hog Island #		Hv	COG	9/10-11
	Hog Island #		Hv	COG	9/10-11
	Hog Island #		Hv	COG	9/10-11
	Potomac R. #		Hv	COG	9/10-11
	Potomac R. #		Hv	COG	9/10-11
	Potomac R. #		Hv	COG	9/10-11
035	South Cr. #		Rm	Cit.	6/21
	South Cr. #		Rm	Cit.	6/21
	South Cr. #		Rm	Cit.	6/21
036	*	BB3	Rm	Capt.	7/10-24
	*	YA3	Rm	Capt.	7/10-24
	DA2	TB2	Rm	Capt.	7/2-6
	*	RB3	Rm	Capt.	7/2-6
	*	SB3	Rm	Capt.	7/2-6
	*	EA3	Rm	Capt.	7/2-6
	*	FA4	Rm	Capt.	7/2-6
	*	GA2	Rm	Capt.	7/2-6
	IA3,JA1	CC1	Rm	Capt.	7/2-6
	BA1,CA3	YB2	Rm	Capt.	7/2-6
	CA3	XB4	Rm	Capt.	7/2-6
	*	FB2	Rm	Capt.	7/2-6
	AA3	DB2	Rm	Capt.	7/2-6

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
037	GA2	WB2	Rm	Capt.	7/2-6
	Miles R. #		Rm	Cit.	8/9
038	Glebe Cr. #		Rm	Cit.	7/5,9/4
	Glebe Cr. #		Rm	Cit.	7/5,9/4
	Goldborough Cr. #		Rm	Cit.	7/5,9/4
	Goldborough Cr. #		Rm	Cit.	7/5,9/4
039	DA3	CA4	Va,Hv,Ms	COG	9-4
	DA3	DA3	Va,Hv,Ms,Cd,Nm	COG	9-4
	EA2	EA3	Va,Hv,Ms	COG	9-4
	EA2	FA1	Hv,Ms,Va	COG	9-4
	IA4,HA4	IA4	Va,Ms,Hv,Nm,Ngr,Hd	COG	9-4
	GA3	JA3	Hv,Cd,Nm	COG	9-4
	CA1	*	Va,Hv,Ms	COG	9-4
	EA2	*	Hv,Ms,Va	COG	9-4
	Sycamore Pt. #		Hv,Ms,Nm	COG	9-4
	Sycamore Pt. #		Hv,Ms,Nm	COG	9-4
	Hallowing Pt. #		Va,Ms,Hv	COG	9-4
	Gunston Cove #		Hv	COG	9-4
	Pohick Bay #		Cd,Hv	COG	9-4
	Pohick Bay #		Cd,Hv	COG	9-4
	Accotink Bay #		Hv	COG	9-4
040	AA4	AA3	Hv,Va	COG	9/13-14
	BA4	BA4	Hv,Ms,Va,Hd,Ngu	COG	9/13-14
	BA4	BA4	Hv,Ms,Ngr,Cd,N,Nm	Cit.	7/19
	BA4	CA2	Hv,Va	Cit.	7/19
	CA1	DA3	Hv,Ms\Hv,Ms	COG\Cit.	9/13-14\7/19
	DA4	EA4	Hv\Hv,Ms,Ngr	COG\Cit.	9/13-14\7/30
	EA3	FA4	Hv\Hv	COG\Cit.	9/13-14\7/19
	JA4	HA4	Hv\Hv,Ngr,Cd	COG\Cit.	9/13-14\7/19
	KA2	IA2	Hv,Va,Ms,Hd	COG	9/13-14

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
040	KA2	IA2	Hv,Ms,Va,Hd,Nm	Cit.	7/19
	LA4	JA4	Hv\Hv	COG\Cit.	9/13-14\7/19
	NA4	KA4	Hv\Hv,Cd,N	COG\Cit.	9/13-14\7/19
	OA2	LA2	Va,Ms,Hv\Va,Ms,Hv	COG\Cit.	9/13-14\7/19
	MA4,NA4	*	Hv	Cit.	7/19
	SA2	OA2	Hv	COG	9/13-14
	VA3	PA4	Hv	COG	9/13-14
	*	QA4	Ms	Cit.	10/1
	WA2	TA2	Ms	Cit.	8/16,4/9
	YA2	UA2	Ms	Cit.	8/16,4/9
	ZA4	VA4	Cd,Nm,Hv,Ms	COG	9/13-14
	ZA4	WA2	Va,Ms,Hv,Cd	COG	9/13-14
	FA3	*	Hv,Ms	Cit.	7/19
	MA4	*	Hv	COG	9/13-14
	PA2	*	Hv\Hv	COG\Cit.	9/13-14\7/19
	QA3	*	Hv,Ms,Cd	COG	9/13-14
	XA4	*	Hv	COG	9/13-14
	Mockley Point #		Hv,Ms	COG	9/13-14
	Mockley Point #		Hv	Cit.	7/19
	Piscataway Park #		Hv	Cit.	7/19
	Piscataway Park #		Hv	COG\Cit.	9/13-14\7/30
	Potomac R. #		Va,Ms,Hv	Cit.	7/19
	Swan Tantallon #		Hv,Ms	COG	9/13-14
	Swan Tantallon #		Hv	COG	9/13-14
	Swan Tantallon #		Hv	COG	9/13-14
	Riverview #		Hv	COG	9/13-14
	Riverview #		Hv	COG	9/13-14
	Hulks #		Hv,Ms\Hv	COG\Cit.	9/13-14\7/19
	Spoil areas #		Hv,Ms	COG	9/13-14
	Harmon Hall #		Hv,Ms	COG	9/13-14
	Henson Cr. Park #		Hv	COG	9/13-14
	Henson Cr. Park #		Hv,Ms\Hv	COG\Cit.	7/19
	Potomac R. #		Hv	COG	9/13-14

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
040	Potomac R. #		Hv	COG	9/13-14
	Potomac R. #		Hv,Ms	COG	9/13-14
	Potomac R. #		Hv	COG	9/13-14
	Potomac R. #		Hv	COG	9/13-14
	Potomac R. #		Hv	COG	9/13-14
	Mount Vernon #		Hv	COG	9/13-14
	Potomac R. #		Hv,Ms	COG	9/13-14
	Potomac R. #		Hv,Ms	COG	9/13-14
	Potomac R. #		Ms	COG	9/13-14
041	Mattaponi Cr. #		Cd,Pcr,Ngr	Park	8/17
	Lyons Cr. #		Cd	Park	8/17
	Hall Cr. #		Ngu,Cd,Pcr,Va	Park	8/17
	Patuxent R. #		Zp	Park	8/17
	Black Swamp Cr. #		Pcr,Ec,Cd	Park	8/17
	Cocktown Cr. #		Ec,Cd,Pcr	Park	8/17
043	*	QA3	Rm	Capt.	7/2-6
	FA3,EA3	RA2	Rm	Capt.	7/2-6
	*	SA3	Rm	Capt.	7/2-6
	*	KA2	Rm	Capt.	7/10-24
	AA3	AA2	Rm	Capt.	7/10-24
	*	BA2	Rm	Capt.	7/10-24
	*	IA2	Rm	Capt.	7/10-24
	Upper Bar Neck #		Zp	HPEL	6/20
044	*	JA3	Rm	Cit.	6/7
	Boone Cr. #		Ppc	Cit.	6/2
	Tar Cr. #		Zp	Cit.	6/7
	Tred Avon R. #		Zp	Cit.	6/7
047	BA4	JA4	Cd,Hv,Va,Ms	Cit.	7/9
	EA4	AA4	Hv,Va,Ms,Hd	COG	9/5-6,9/14

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
047	EA4	CA4	Hv,Va,Ms,Hd,Nm	COG	9/5-6,9/14
	EA4	FA2	Hv,Va	COG	9/5-6,9/14
	EA4	GA1	Hv,Va	COG	9/5-6,9/14
	AA4	HA4	Hv,Ms,Hd,Cd,Ngu	COG	9/5-6,9/14
	BA4	IA2	Ms,Hv,Va,Hd	COG	9/5-6,9/14
	BA4	JA4	Hv,Ms,Va,Cd,Ngu,Hd	COG	9/5-6,9/14
	CA4	KA4	Hv,Ms	COG	9/5-6,9/14
	CA4	LA2	Hv,Va,Ms	COG	9/5-6,9/14
	FA4	NA4	Hv	COG	9/5-6,9/14
	FA4	OA2	Hv,Ms	COG	9/5-6,9/14
	FA4	RA2	Hv	COG	9/5-6,9/14
	FA4	SA4	Hv,Va	COG	9/5-6,9/14
	FA4	TA4	Hv,Cd,Hd,Va	COG	9/5-6,9/14
	DA4	UA4	Hv,Ms,Va,Hd,Cd	COG	9/5-6,9/14
	DA4	VA1	Hv,Ms,Va,Cd,Hd	COG	9/5-6,9/14
	GA4	WA4	Hv,Cd,Hd,Ms	COG	9/5-6,9/14
	GA4	XA1	Hv,Ms,Hd,Va	COG	9/5-6,9/14
	GA4	YA4	Hv,Ms,Hd,Va	COG	9/5-6,9/14
	GA4	ZA2	Hv,Va,Cd,Hd	COG	9/5-6,9/14
	HA4	AB4	Hv	COG	9/5-6,9/14
	HA4	BB2	Hv	COG	9/5-6,9/14
	IA4	*	Hv,Nm,Cd	COG	9/5-6,9/14
	Quantico #		Hv	COG	9/5-6,9/14
	Shipping Pt. #		Hv,Cd,Va,Hd	COG	9/5-6,9/14
	Quantico Cr. #		Hv	COG	9/5-6,9/14
	Quantico Cr. #		Hv,Ms	COG	9/5-6,9/14
	Quantico Cr. #		Hv	COG	9/5-6,9/14
	Quantico Cr. #		Hv,Va	COG	9/5-6,9/14
	Quantico Cr. #		Hv	COG	9/5-6,9/14
	Quantico Cr. #		Hv,Va	COG	9/5-6,9/14
	Neabsco #		Ms,Hv	COG	9/5-6,9/14
	Neabsco #		Hv,Ms,Hd	COG	9/5-6,9/14

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
048	BA4	AA2	Hv,Va,Ms	COG	9-5
	BA4	BA4	Hv,Ms,Va	COG	9-5
	BA4	CA1	Va,Hd,Ms,Nm	COG	9-5
	BA4	DA4	Hv,Ms,Va,Cd,Nm	COG	9-5
	CA1,DA3	EA4	Hv,Hd,Ngu,Va	COG	9-5
	EA3	FA1	Ms,Hv,Va,Hd	COG	9-5
	EA3	GA3	Ms,Hv,Va,Hd	COG	9-5
	BA4	JA4	Hv,Ms,Va	COG	9-5
	*	KA4	Hv	COG	9-5
	HA4	LA3	Hv,Nm	COG	9-5
	*	MA3	Hv,Nm,Ms	COG	9-5
	IA4	MA3	Hv,Ms,Nm	COG	9-5
	GA4	NA4	Nm,Hv,Va,Ms,Cd,Hd	COG	9-5
	JA2	OA1	Hv,Ms,Cd	COG	9-5
	KA4	PA4	Hv,Ms,Hd,Va	COG	9-5
	LA3	QA3	Va,Ms,Hv,Hd	COG	9-5
	MA4	RA4	Hv,Va,Ms,Cd,Nm	COG	9-5
	MA4	SA2	Hv,Va,Hd	COG	9-5
	Mattawoman Cr. #		Hv	COG	9-5
	Mattawoman Cr. #		Hv,Ms,Nm	COG	9-5
	Mattawoman Cr. #		Hv,Ms	COG	9-5
	Mattawoman Cr. #		Hv,Ms,Va	COG	9-5
	Grinders Wharf #		Hv,Nm	COG	9-5
	Grinders Wharf #		Hv,Ms,Nm	COG	9-5
	Bullocks Neck #		Hv	COG	9-5
	Marsh Island #		Hv,Nm,Cd	COG	9-5
	Thorofare Island #		Cd	COG	9-5
	Tidal Flat #		Va	COG	9-5
	Mattingly Wharf #		Va	COG	9-5
	Mason Neck #		Hv,Ms	COG	9-5
049	Holland Cliff #		Zp	Cit.	7/1
	Patuxent R. #		Ec	Park	8/17

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
049	Kennedy Run #		Zp	Park	8/17
051	MA3,KA3,JA3,IA3,HA3,GA3	FA3	Rm	Capt.	7/2-6
	NA2,OA3	GA3	Rm	Capt.	7/2-6
	BA3	AA3	Rm	Capt.	7/2-6
	*	EA3	Rm	Cit.	8/10
	OA3	GA3	Zp	HPEL	6/22
052	*	DA3	Rm	Capt.	7/2-6
	*	CA2	Rm	Capt.	7/2-6
	BA3	FA3	Rm	Capt.	7/2-6
	AA3	EA4	Rm	Capt.	7/2-6
	*	BA3	Rm	Capt.	7/2-6
055	AA3	AA1	Ms,Nm,Cd	COG	9/6,9/14
	BA3	BA2	Hv,Nm,Ngu,Va,Ms,Hd	COG	9/6,9/14
	CA3	CA4	Hv,Ms,Cd,Va	COG	9/6,9/14
	DA1	*	Ms	COG	9/6,9/14
	GA2	DA1	Ms	COG	9/6,9/14
	GA2,HA4	EA2	Ms	COG	9/6,9/14
	HA4	HA4	Hv,Ms,Ngu,Va,Hd,Cd	COG	9/6,9/14
	HA4	IA3	Hv,Ngu,Cd,Ms,Hd	COG	9/6,9/14
	KA4	JA4	Hv,Ms	COG	9/6,9/14
	JA4	KA4	Hv,Va,Ms,Hd	COG	9/6,9/14
	*	LA1	Va,Hv	COG	9/6,9/14
	IA4	MA4	Hv,Va	COG	9/6,9/14
	FA4	NA1	Ms,Va,Hv,Cd	COG	9/6,9/14
	FA4	OA4	Ms,Va,Hv	COG	9/6,9/14
	FA4	QA2	Va,Ms,Hv,Cd,Hd	COG	9/6,9/14
	EA2	RA2	Va,Ms	COG	9/6,9/14
	EA2	RA2	Cd	COG	9/6,9/14
	Aquia Cr. #		Hv,Ms	COG	9/6,9/14
	Aquia Cr. #		Ms	COG	9/6,9/14

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
055	Thomas Point #		Ms	COG	9/6,9/14
	Thomas Point #		Ms,Va	COG	9/6,9/14
	Sandy Point #		Hv,Ms,Va,Hd,Cd	COG	9/6,9/14
	Sandy Point #		Va,Hv	COG	9/6,9/14
	Smith Point #		Va,Ms,Cd,Hd	COG	9/6,9/14
	Thomas Point #		Va	COG	9/6,9/14
	M.C. Air Station #		Hv,Hd,Va,Cd,Ngu	COG	9/6,9/14
056	BA4	CA4	U	Capt.	8/24
	AA4	AA4	U	Capt.	8/24
	SA2,RA4,TA3,UA4,VA3	IA4	U	Capt.	8/24
	TA3	LA2	U	Capt.	8/24
	VA3	JA2	U	Capt.	8/24
	VA3	KA3	U	Capt.	8/24
	EA4,GA4,DA4	SA4	U	Capt.	8/24
	DA4,FA4	RA4	U	Capt.	8/24
	HA3	TA2	U	Capt.	8/24
	IA4	QA4	U	Capt.	8/24
	JA4	UA4	U	Capt.	8/24
	LA4	PA4	U	Capt.	8/24
	MA3	OA2	U	Capt.	8/24
	NA2	NA4	U	Capt.	8/24
	OA4,IA4	MA4	U	Capt.	8/24
	QA2,PA3	GA4	U	Capt.	8/25
	QA2	FA1	U	Capt.	8/25
	QA2	EA4	U	Capt.	8/25
	CA4	DA4	U	Capt.	8/25
	AA4	BA3	U	Capt.	8/25
057	DA2,CA3,BA2	VB4	Va,Ppf	FWS	7/20
	DA2	UB3	Va,Ppf,Hv,Ec,Ppc	FWS	7/20
	EA3	TB4	Va,Ppc,Ms,Pcr	FWS	7/20
	GA2,FA4	RB4	Va,Ms,Pcr	FWS	7/20

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
057	HA4	OB4	Va	FWS	7/20
	IA2	NB1	Va,Ppc	FWS	7/20
	MA4	JB4	Va,Pcr,Cd,Ms,Ppf	FWS	7/20
	MA4	JB4	Va,Ppc,Ppf	VIMS	8/20
061	Cape Leonard #		Zp	Cit.	4/90,6/90
	Leonard Cr. #		Zp	Cit.	4/90,6/90
062	LA4	AA3	Rm	Capt.	6/30
	KA4	BA2	Rm	Capt.	6/30
	HA2	CA4	Rm	Capt.	6/30
063	DA3	BA4	Rm	Capt.	9/10
	DA3	CA2	Rm	Capt.	9/10
	AA3	EA4	Rm	Capt.	9/10
	CA1	DA3	Rm	Capt.	9/10
066	*	PA4	U	Capt.	7/16
	*	OA4	U	Capt.	7/16
	AA3	AA4	U	Capt.	7/16
	*	BA4	U	Capt.	7/16
	BA2	CA4	U	Capt.	7/16
	CA3	EA1	U	Capt.	7/16
	CA3	FA3	U	Capt.	7/16
	EA3	IA3	U	Capt.	7/16
	GA2	KA2	U\Va	Capt.\VIMS	7/16\8/3
	HA3	LA4	U	Capt.	7/16
	HA3	MA2	U	Capt.	7/16
	*	QA4	U	Capt.	7/16
	IA2	NA3	U	Capt.	7/16
067	AA4	AA4	U	Capt.	7/16
	*	BA4	U	Capt.	7/16

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
067	*	DA4	U	Capt.	7/16
	BA3	EA2	U	Capt.	7/16
	BA3	FA4	U	Capt.	7/16
	CA3	GA4	U	Capt.	7/16
	DA3	IA4	U	Capt.	7/16
	*	JA1	U	Capt.	7/16
	HA3	LA2	U	Capt.	7/16
	HA3	MA3	U	Capt.	7/16
	HA3	NA2	U	Capt.	7/16
	HA3	OA4	U	Capt.	7/16
	IA3	PA3	U	Capt.	7/16
068	Neale Sound #		Zp	Cit.	6/29
069	Fox Point #		Zp	Cit.	6/90
070	Cuckold Cr. #		Zp	Cit.	6/25
	Sam Abell Cove #		Zp,Ppc	Cit.	5/15
	Cuckold Cr. #		Zp	Cit.	5/15
	Cuckold Cr. #		Zp	Cit.	5/15
071	*	AA3	Ec	Capt.	9/18
	Patuxent R. #		Zp	Cit.	6/3
	Goose Cr. #		Rm	Cit.	7/5
	Goose Cr. #		Rm	Cit.	7/5
	Pearson Cr. #		Rm	Cit.	7/5
	Patuxent R. #		Zp	Cit.	5/15
	Cuckold Cr. #		Zp	Cit.	5/15
	Harpers Cr. #		Rm	Cit.	9/10-11
	N. Barrett Island #		U	Cit.	9/21
072	BA3	EA2	Rm,U	Capt.	8/24

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
072	CA2	GA4	Rm	Capt.	8/24
	DA2	IA4	Rm	Capt.	8/24
	DA2	HA2	Rm	Capt.	8/24
	*	CA4	U	Capt.	8/24
	DA2	IA4	Rm	Cit.	10/20
073	KB4	QA2	Rm	Capt.	8/24
	JB3	NA3	Rm	Capt.	8/24
	NB3	TA4	Rm,U	Capt.	8/24
	TB2	UA4	Rm	Capt.	8/24
	SB2	ZA3	Rm	Capt.	8/24
	NB3	VA3	Rm	Capt.	8/24
	AA3	BA1	Rm	Capt.	8/24
	UB4,VB2	WA2	Rm,U	Capt.	8/24
	LA3	XB2	Rm	Capt.	9/5
	MA1,LA3	WB4	Rm	Capt.	9/5
	NA3	VB2	Rm	Capt.	9/5
	PA3	UB4	Rm	Capt.	9/5
	QA2	TB2	Rm	Capt.	9/5
	UA4,VA2	RB4	Rm	Capt.	9/5
	YA1	PB3	Rm	Capt.	9/5
	XA3	OB2	Rm	Capt.	9/5
	FB3	NB3	Rm	Capt.	9/5
	FB3,GB2	MB2	Rm	Capt.	9/5
	HB3	LB3	Rm,U	Capt.	9/5
	EB3	KB3	Rm	Capt.	9/5
	EB3	JB4	Rm,U	Capt.	9/5
	AB2,ZA3,YA1	GB4	Rm,U	Capt.	9/5
	YA1	HB2	Rm	Capt.	9/5
	ZB1	CB3	Rm	Capt.	9/10
	*	EB2	Rm	Capt.	9/10
	AC3	DB4	Rm	Capt.	9/10
	AA3	AA1	Rm	Capt.	9/13

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
073	EA4	LA4	Rm\Rm	Capt.\HPEL	9/13\6/29
	GA3	KA3	Rm	Capt.	9/13
	HA4	JA3	Rm	Capt.	9/13
	IA4	IA2	Rm	Capt.	9/13
	*	GA2	Rm	Capt.	9/13
	KA3	HA3	Rm	Capt.	9/13
	DA2	FA3	Rm	Capt.	9/13
	CA3	EA3	Rm	Capt.	9/13
	BA3	DA3	Rm	Capt.	9/13
	AA3	BA1	Rm	Capt.	9/13
	AA3	CA4	Rm	Capt.	9/13
	OA1	*	Rm	Capt.	9/13
074	*	LA4	Rm	Capt.	9/7
	*	KA2	Rm	Capt.	9/7
	BA4	CA4	Rm	Capt.	9/7
	CA1	DA2	Rm	Capt.	9/7
	FA4	EA2	Rm	Capt.	9/7
	FA4	FA4	Rm	Capt.	9/7
	FA4	GA2	Rm	Capt.	9/7
	FA4	HA2	Rm	Capt.	9/7
	FA4	IA3	Rm	Capt.	9/7
	GA4	JA3	Rm	Capt.	9/7
	HA4	MA3	Rm	Capt.	9/7
	IA1	NA4	Rm	Capt.	9/7
	MA4	QA4	Rm	Capt.	9/7
	LA3	PA2	Rm	Capt.	9/7
	LA3	OA3	Rm	Capt.	9/7
	Fallins Cove #		Rm	Capt.	9/7
079	Tall Timbers Cove #		Zp	Cit.	6/90
082	*	CA2	Rm	Capt.	9/13

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
082	BA3	AA3	Rm	Capt.	9/13
	AA2	BA4	Rm	Capt.	9/13
083	EA2,DA4	EA4	Rm	Capt.	7/8
	LA3	MA4	Rm	Capt.	7/8
	MA3	NA4	Rm	Capt.	7/8
	MA3,NA3,OA1	OA4	Rm	apt.	7/8
	OA1	PA4	Rm	Capt.	7/8
	QA4	RA4	Rm	Capt.	7/8
	VA3	TA4	Rm	Capt.	7/8
	SA2,TA4,UA2	UA4	Rm	Capt.	7/8
	RA4	VA4	Rm	Capt.	7/8
	KA3	LA4	Rm	Capt.	7/8
	HA3	JA2	Rm	Capt.	7/8
	HA3,IA3	HA4	Rm	Capt.	7/8
	HA3	IA2	Rm	Capt.	7/9
	AB4	WA2	Rm	Capt.	9/7
	AB4	XA4	Rm	Capt.	9/7
	ZA1	YA2	Rm	Capt.	9/7
	XA4,YA2	ZA4	Rm	Capt.	9/7
	Okahanikan Cove #		Rm	Capt.	No Date
084	KA3	EA3	Rm	Cit.	10/15
	HA3,JA3	FA3	Rm	Cit.	10/15
	GA3	GA3	Rm	Cit.	10/15
	FA2	IA1	Rm	Cit.	10/15
	FA2	JA2	Rm	Cit.	10/15
	*	KA3	Rm	Cit.	10/15
	EA3	LA2	Rm	Cit.	10/15
	*	MA3	Rm	Cit.	10/15
	AA1	OA4	Rm	Cit.	10/15
	BA2	NA3	Rm	Cit.	10/15
	LA1	DA3	Rm	Cit.	10/15

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
085					
	CA3	AA3	Rm	Capt.	9/10
	BA2	CA3	Rm	Capt.	9/10
	AA3	DA4	Rm	Capt.	9/10
091	KA2	IA2	Rm	Capt.	6/27
	JA4	HA3	Rm	Capt.	6/27
	IA4	GA4	Rm	Capt.	6/27
	EA4	AA4	Rm	Capt.	7/11
	DA1	BA2	Rm	Capt.	7/11
	DA1,CA4	CA4	Rm	Capt.	7/11
	GA2	EA2	Rm	Capt.	7/11
	BA2,AA1,HA3	DA4	Rm,Zm,U	Capt.	7/10
	XA3	TA3	Rm	Capt.	7/10
	*	SA3	Rm	Capt.	7/10
	VA2,TA4	OA4	Rm	Capt.	7/10
	QA2	MA3	Rm	Capt.	7/10
	RA2	LA4	Rm	Capt.	7/10
	LA2	JA4	Rm	Capt.	7/10
	OA4,NA1,MA2	KA4	Rm,U	Capt.	7/10
	SA3	NA4	Rm	Capt.	No Date
092	FA4,GA2	AA4	Rm	Capt.	6/27
	EA1	BA1	Rm	Capt.	6/27
	BA4,DA3	CA4	Rm	Capt.	6/27
	HA4	FA4	Rm	Capt.	6/27
	IA3	DA4	Rm	Capt.	9/10
	JA3	EA4	Rm	Capt.	9/10
	BA4,DA3	CA4	Rm	Cit.	9/1
	BA4	CA4,BA1	Rm,Zm	VIMS	8/27
093	*	QA1	U	Capt.	6/29
	PA4	PA4	Rm	Capt.	6/29

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
093	OA2	OA2	Rm	Capt.	6/29
	NA4	NA4	Rm,U	Capt.	6/29
	*	LA2	U	Capt.	6/29
	KA4	KA4	U	Capt.	6/29
	KA4	JA2	Rm	Capt.	6/29
	JA4	HA3	Zm,U	Capt.	6/29
	IA3	GA3	Zp	Capt.	6/29
	HA1	FA2	Rm	Capt.	6/29
	GA4	EA4	Rm,Zm	Capt.	6/29
	FA3	DA3	Zm	Capt.	6/29
	*	CA2	Rm	Capt.	6/29
	CA2,DA3	BA2	Rm	Capt.	6/29
	BA3,CA2	AA2	Rm,Zm	Capt.	6/29
	XB4	SA2	Rm	Capt.	6/30
	*	TA4	Rm	Capt.	6/30
	CB3	UA4	Rm	Capt.	6/30
	*	VA4	Rm	Capt.	6/30
	BB4	WA4	Rm	Capt.	6/30
	VA2	XA3	Rm	Capt.	6/30
	XA1	YA2	Rm	Capt.	6/30
	YA4	ZA4	Rm	Capt.	6/30
	AB3	AB2	Rm	Capt.	6/30
	EB4,DB4	BB4	Rm	Capt.	6/30
	FB3	CB2	Rm	Capt.	6/30
	GB3	DB4	Rm	Capt.	6/30
	HB1	EB1	Rm	Capt.	6/30
	IB3	FB3	Rm,U	Capt.	6/30
	LB3,MB4	KB4	Rm,Zm	Capt.	6/30
	KB3	IB4	Rm	Capt.	6/30
	JB3	HB3	Rm	Capt.	6/30
	IB3	GB4	Rm	Capt.	6/30
	OB3	MB2	Rm	Capt.	9/22
	NB3	NB3	Rm	Capt.	9/22

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
093	*	OB2	Rm	Capt.	9/22
	*	XB3	Rm	Capt.	9/22
	VB2	WB4	Rm	Capt.	9/22
	WB2	VB2	Rm	Capt.	9/22
	UB2	UB2	Rm	Capt.	9/22
	TB1,SB3	TB3	Rm	Capt.	9/22
	*	SB2	Rm	Capt.	9/22
	PB3	PB4	Rm	Capt.	9/22
	RB3	RB3	Rm	Capt.	9/22
	VA3	*	Rm	Capt.	No Date
	Annemessex R. #		Rm	Capt.	No Date
099	BA1	BA2	Rm,U	Capt.	7/8
	AA4	AA4	Rm	Capt.	7/8
	CA4	CA4	Rm	Capt.	7/8
	DA4	DA2	Rm,U	Capt.	7/8
	QA4	PA4	Rm	Capt.	7/8
	FB4,SA2	SA4	Rm	Capt.	7/8
	UA2	RA2	Rm	Capt.	7/8
	UA2	QA3	Rm	Capt.	7/8
	TA2	OA3	Rm	Capt.	7/8
	SA2	NA3	Rm	Capt.	7/8
	MA2	HA2	Rm	Capt.	7/8
	FA1	EA4	Rm	Capt.	7/8
	LA2,KA1	IA3	Rm	Capt.	7/8
	IA2,GA3	JA2	Rm	Capt.	7/8
	IA2	LA3	Rm	Capt.	7/8
	JA2	MA2	Rm	Capt.	7/8
	IA2	WA2	Rm	Capt.	7/8
100	DB4,EB1,FB4	SA2	Rm	Capt.	7/11
	DB4	TA4	Rm,Zm	Capt.	7/11
	EA2	BA2	Rm,Zm	Capt.	7/11

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
100	BA2,CA4,EA2,FA1,GA4	AA4	Rm,Zm,U\Rm,Zm	Capt.\VIMS	7/11\8-12
	AA2	AA4	Rm,Zm	VIMS	8/12
	IA1	CA1	Rm	Capt.	7/11
	*	DA4	Rm	Capt.	7/11
	JA4	EA3	Rm,Zm	Capt.	7/11
	LA2	FA4	Rm,U	Capt.	7/11
	KA3	GA4	Rm,Zm	Capt.	7/11
	NA3	JA4	Zm,Rm	Capt.	7/11
	*	IA1	Rm,Zm	Capt.	7/11
	MA4	HA4	Rm,Zm	Capt.	7/11
	CB4	RA4	Rm	Capt.	7/11
	BB2	QA1	Rm	Capt.	7/11
	BB2	UA4	Rm	Capt.	7/11
	ZA4	OA4	Rm	Capt.	7/11
	YA2	NA2	Rm	Capt.	7/11
	XA2	MA2	Rm	Capt.	7/11
	SA4,UA2,VA1,TA1	KA4	Rm,Zm,U	Capt.	7/11
	SA4	MA2,KA4	Rm,Zm	VIMS	8/27
	Fox Islands #		Rm,Zm	Capt.	7/11
101	ZA4,YA2	XA4	Rm	Capt.	6/30
	XA2,WA4	WA4	Rm,Zp	Capt.	6/30
	VA2	VA3	U	Capt.	6/30
	UA3	UA3	Rm,U	Capt.	6/30
	SA2	RA3	Rm	Capt.	6/30
	SA2	SA4	Rm	Capt.	6/30
	TA2	TA4	Rm	Capt.	6/30
	*	MA3	Rm,Zm	Capt.	6/30
	MA3	LA2	Rm	Capt.	6/30
	*	KA3	Rm	Capt.	6/30
	LA2	JA3	Rm	Capt.	6/30
	KA2	IA4	Rm	Capt.	6/30
	JA1	HA4	Zm	Capt.	6/30

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
101	IA2,HA2	GA3	Zm	Capt.	6/30
	FA4,GA2	FA1	Zm	Capt.	6/30
	FA4,GA2	EA3	Zm	Capt.	6/30
	OA2	NA3	Rm,Zm,Zp	Capt.	6/30
	QA2	PA2	Rm	Capt.	6/30
	RA2	QA2	Rm	Capt.	6/30
	PA2	OA3	Rm	Capt.	6/30
	AA4,BA2	AA4	Rm,Zm	Capt.	6/30
	AA4	BA1	Zm	Capt.	6/30
	AA4	CA4	Zm	Capt.	6/30
	CA1,DA4	DA3	Rm,Zm	Capt.	6/30
	AB4	YA4	Rm,Zm	Cit.	7/9
	AB4	ZA3	Rm,Zm	Cit.	7/9
	BB3	AB4	Rm,Zm	Cit.	7/9
	CB3	BB4	Rm	Cit.	7/9
	DB3	CB3	Rm	Cit.	7/9
	EB3	DB3	Rm	Cit.	7/9
	FB3	EB3	Rm	Cit.	7/9
	GB3	FB4	Rm	Cit.	7/9
	HB3	GB3	Rm	Cit.	7/9
	HB3	HB3	Rm	Cit.	7/9
	EA1,GA2	EA3	Zm	Cit.	7/9
	IA2	GA3	Zm	Cit.	7/9
	GA2	FA1	Zm	Cit.	7/9
	Prong Cr. #		Rm	Cit.	7/9
106	KA1	QA4	Rm	Cit.	8/30
	DA4	FA2,GA4	Zm,Rm	VIMS	7/24
107	BA4	BA4,CA2	Zm	VIMS	8/26
	JA4	KA4,LA4,IA2	Rm,Zm	VIMS	8/26
108	ZA4	CB4,DB2	Rm,Zm	VIMS	8/13

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
110	BA3	AA2	Rm	VIMS	7/3
111	JA3	FA2,GA3,HA1	Rm	VIMS	7/3
	HA3	EA1,DA3	Rm,Zm	VIMS	7/3
	IA3	FB2,EB4,DB2	Rm	VIMS	7/3
	NA3	XA3,YA3	Rm	VIMS	7/3
	DA3	BA4	Rm,Zm	VIMS	7/3
112	CB2	IB3	Rm	Cit.	6/20
	BB3	FB3	Rm	Cit.	6/20
	EB2	NB3	Rm	Cit.	6/20
	EB2	MB3	Rm	Cit.	6/20
	DB3	KB3	Rm	Cit.	6/20
	*	JB3	Rm	Cit.	6/20
	FB2	*	Rm	Cit.	6/20
	IA2	HA2	Rm,Zm	Cit.	9/2
	CA4	CA3	Rm	Cit.	9/2
	QA3	TA3	Rm	Cit.	7/5,9/4
	BA2	AA1	Rm,Zm	Cit.	7/5,9/4
	BA2	BA2	Rm	Cit.	7/5,9/4
	CA4	CA3	Rm,Zm	Cit.	7/5,9/4
	GA1,HA3	FA1	Rm	Cit.	7/5,9/4
	IA2	HA2	Rm,Zm	Cit.	7/5,9/4
	JA3	JA4	Rm	Cit.	7/5,9/4
	*	KA4	Rm	Cit.	7/5,9/4
	*	NA3	Rm	Cit.	7/5,9/4
	KA4	OA4	Rm	Cit.	7/5,9/4
	YA3	CB3	Rm	Cit.	7/5,9/4
	ZA3	EB2	Rm	Cit.	7/5,9/4
	XA4	BB4	Rm	Cit.	7/5,9/4
	WA2	AB3	Rm	Cit.	7/5,9/4
	RA3	VA4	Rm	Cit.	7/5,9/4

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
112	RA3	UA2	Rm	Cit.	7/5,9/4
	TA3	WA3	Rm,Zm	Cit.	8/15
	PA4	SA2	Rm,Zm	Cit.	8/15
	MA3	QA2	Rm,Zm	Cit.	8/15
	LA3	PA3	Rm,Zm	Cit.	8/15
	*	MA3	Rm,Zm	Cit.	8/15
	IA2	IA3	Rm,Zm	Cit.	8/15
113	KA3	BA3	Rm	VIMS	No Date
	GA2	EA1,DA2	Rm	VIMS	No Date
	CA4	HA4	Rm	VIMS	No Date
	BA3	HA4	Rm	VIMS	No Date
114	EB2	CB3	Zp	Cit.	8/18
	FB3	DB3	Zp	Cit.	8/18
	GB4	EB4	Zp,Zm	Cit.	8/18
	HB4	FB4	Zp,Zm	Cit.	8/18
	IB2	GB1	Rm,Zm,Zp	Cit.	8/18
	AA4	AA3,BA3	Zm,Rm	VIMS	No Date
	BA2	DA3	Rm,Zm	VIMS	No Date
	LA4	LA4,KA1,NA2	Rm,Zm	VIMS	No Date
	NA2	NA2,MA1	Rm,Zm	VIMS	8/13
	AB1	TA2,UA1,VA3	Rm,Zm	VIMS	No Date
117	AA3	*	Rm	VIMS	6/29
	IA4	HA4	Rm,Zp	VIMS	7/3
	GA2	FA3	Rm,Zm	VIMS	6/29
118	GA2	FA3	Rm\Rm	Cit.\VIMS	6/24\6/29
	HA2	EA3	Rm\Rm	Cit.\VIMS	6/24\6/29
	IA3	GA3	Rm	Cit.	6/24
	JA2	HA2	Rm	Cit.	6/24
	JA2	IA3	Rm	Cit.	6/24

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
118	JA2	JA2	Rm	Cit.	6/24
	BA2,CA2,DA3	BA3	Rm,Zm	Cit.	6/24
	AA2	CA2	Rm,Zm	Cit.	6/24
	AA2	DA1	Rm\Rm	Cit.\VIMS	6/24\6/29
	CA3	BA3	Zm,Rm	VIMS	6/29
122	BA2	KA2,JA3	Zm	VIMS	8/90
	FA4	IA4,HA2	Zm,Rm	VIMS	8/90
123	IA4	BA4	Zm	Cit.	7/27
	LA3	FA2	Rm	Cit.	7/27
124	QA3	LA4	Rm,Zm	VIMS	No Date
	JA2	IA4	Rm	VIMS	No Date
	RA2	*	Zm	VIMS	No Date
	SA2	PA3	Rm,Zm	VIMS	No Date
	TA2	MA2,NA2,PA3	Rm,Zm	VIMS	6/5
	UA2	OA2	Rm,Zm	VIMS	6/5
	VA4	PA3,QA2,RA4	Rm,Zm	VIMS	6/4-5
125	Herring Cr. #		Cd	Cit.	9/15
	Herring Cr. #		C	Cit.	9/15
	Herring Cr. #		Cd	Cit.	9/15
130	AA1	*	Zm	VIMS	No Date
	BA1	*	Zm	VIMS	No Date
131	BB4	DB4	Zm	Cit.	6/17
	JA4	KA4	Zm,Rm	VIMS	6/29
	FA4	GA4	Zm	VIMS	6/26
	TA2	WA4	Rm,Zm	VIMS	6/21
	QB4	RB4	Rm,Zm	VIMS	7/9
	RB1	SB2	Rm,Zm	VIMS	7/9

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
131	IB4	JB4	Rm,Zm	VIMS	8/90
	OA4	QA4	Rm,Zm	VIMS	6/21
132	RA2	PA4	Zm	Cit.	6/17
	RA2	OA2	Zm	Cit.	6/17
	QA4	NA4	Zm	Cit.	6/17
	SA4	QA4	Rm,Zm	Cit.	6/17
	OA2	MA2	Zm	Cit.	6/17
	NA4	LA4	Rm,Zm\Rm,Zm	Cit.\VIMS	6/17\7/11
	MA4	KA3	Rm,Zm\Rm,Zm	Cit.\VIMS	6/17\7/11
	FA4	GA4	Rm,Zm	VIMS	7/18
	DB4	CB2	Rm,Zm	VIMS	7/30
139	AA2	BA2	Rm,Zm	VIMS	No Date
	BA1	*	Zm	VIMS	No Date
	DA3	AA3	Zm	VIMS	No Date
140	YA4	XA3,YA1	Zm	VIMS	No Date
	VA4	QA4,VA4	Zm,Rm	VIMS	No Date
141	GA3	FA3	Zm	VIMS	6/18
152	BA3	*	Zm	Cit.	9/8
	BA3	AA3	Zm,Rm	Cit.	9/8
	DA2,CA4	BA3	Zm	Cit.	9/8
159	Patuxent R. #		Ec,Nm,Ngu,Ngr,Cd	Cit.	8/13
	Patuxent R. #		Ec,Ngu,Cd	DNR	8/18
	Patuxent R. #		Ec,Cd	Park	7/14
	Back Channel #		Cd,Ec,Zp,Ngu,Va,Pcr,Nm	Park	7/14
	Patuxent R. #		Ec,Cd,Pcr,Ppu,Pe	Park	7/14
	Mill Cr. #		Ec,Cd,N,Zp	Park	7/14
	Galloway Gut #		N,Cd	Park	7/14

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
159	Railroad Cr. #		N	Park	7/14
	Western Branch #		N,Ec,Cd	Park	7/14
	Charles Branch #		Zp	Park	7/14
166	Caine Harbor Mile #		Rm	Cit.	9/5
167	CA3	CA3	Zm	Cit.	9/21
	BA3	BA3	Zm,Rm	Cit.	9/21
	AA4	AA4	Zm	Cit.	9/21
	BA3	BA3	Rm	DNR	No Date
	Gray's Cove #		Zm	DNR	No Date
168	CA2	AA3	Zm	Cit.	9/21
	EA4	*	Rm	DNR	No Date
	BA3	*	Rm	DNR	No Date
	Isle of Wright Bay #		Rm	DNR	No Date
	Isle of Wright Bay #		Zm	Cit.	No Date
	Isle of Wright Bay #		Rm	Cit.	No Date
	Turville Cr. #		Rm	Cit.	No Date
170	CA3	EA3	Zm	Cit.	9/2
	DA3	FA3	Zm,Rm	Cit.	9/2
	BA3	GA3	Zm	Cit.	9/2
	EA3	IA3	Zm	Cit.	9/2
	EA3	JA3	Zm,Rm	Cit.	9/2
	EA3	LA3	Zm	Cit.	9/2
	AA3	AA3	Zm,Rm	Cit.	9/21
	BA3	CA3	Zm,Rm	Cit.	9/21
	BA3	BA1	Zm,Rm	Cit.	9/21
	BA3	DA3	Zm,Rm	Cit.	9/21
	EA3	JA3	Zm,Rm	Cit.	9/21
	BA3	HA3	Zm,Rm	Cit.	9/21
	BA3	GA3	Zm,Rm	Cit.	9/21

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
170	DA3	FA3	Zm	Cit.	9/21
	CA3	EA3	Zm	Cit.	9/21
	BA3	IA3	Zm	Cit.	9/24
	LA3	QA4	Zm	Cit.	9/24
	JA4	PA4	Zm	Cit.	9/24
	HA4	OA4	Zm	Cit.	9/24
	EA3	LA3	Zm,Rm	Cit.	9/24
	GA4	NA4	Zm,Rm	Cit.	9/24
	BA3	HA3	Rm	DNR	No Date
	Newport Bay #		Zm	DNR	No Date
	Newport Bay #		Zm	DNR	No Date
	Newport Bay #		Zm	DNR	No Date
	Chincoteague Bay #		Rm	DNR	No Date
	Tingles Narrows #		Rm	DNR	No Date
	Sinepuxent Bay #		Rm,Zm	Cit.	No Date
172	DA3	FA3	Zm,Rm	Cit.	9/24
	EA1	DA3	Zm,Rm	Cit.	9/24
	*	CA4	Zm	Cit.	9/24
	HA4	HA3	Zm,Rm	Cit.	9/24
	GA3	GA4	Zm	Cit.	9/24
	FA4	EA4	Zm	Cit.	9/24
	KA3	JA3	Zm,Rm	Cit.	9/24
	LA4	LA4	Zm,Rm	Cit.	9/24
	LA4	KA1	Zm	Cit.	9/24
	MA3	NA4	Zm,Rm	Cit.	9/24
	MA3	MA1	Zm,Rm	Cit.	9/24
	IA4	IA4	Rm	DNR	No Date
	Blue Pond #		Zm	DNR	No Date
	Martin Bay #		Rm	DNR	No Date
	Purnell Pond #		Rm	DNR	No Date
	Scott Landing #		Rm	DNR	No Date
	Brockatonorton Bay #		Rm	DNR	No Date

QUAD	1990 BED	1989 BED	SPECIES**	SOURCE***	1990 SURVEY DATE
172	Brockatonorton Bay #		Rm	DNR	No Date
	Bridge Cr. #		Rm	DNR	No Date
	Johnson Bay #		Rm	DNR	No Date
	Purnell Bay #		Zm	DNR	No Date
	Parker Bay Tumps #		Rm	DNR	No Date
	Parker Bay #		Zm	DNR	No Date
	Rowley Cove #		Rm	DNR	No Date
	Muddy Thorofare #		Rm	DNR	No Date
	Big Bay Marsh #		Rm,Zm	DNR	No Date
173	GA3	EA3	Zm,Rm	Cit.	9/21
	HA2	DA3	Zm,Rm	Cit.	9/21
	EA3	IA2	Zm	Cit.	9/21
	EA3	KA2	Zm,Rm	Cit.	9/21
	EA3	LA4	Zm	Cit.	9/21
	EA3	HA3	Zm,Rm	Cit.	9/21
	EA3	GA3	Zm,Rm	Cit.	9/21
	FA3	FA3	Zm,Rm	Cit.	9/21
	BA4	BA4	Rm	Cit.	9/27
	AA4	AA4	Zm	Cit.	9/27
	EA3	MA1	Zm,Rm	Cit.	9/27
	EA3	OA1	Rm	Cit.	9/27
	EA3	NA4	Zm,Rm	Cit.	9/27
	DA4	CA4	Rm	Cit.	9/27
	Lone Pond #		Rm	DNR	No Date
	Middlemoor Thorofare #		Rm	DNR	No Date
	Pope Bay #		Rm	DNR	No Date
175	AA3	AA4,BA3	Zm,Rm	VIMS	No Date

** Abbreviations under column "Species" are as follows:

Zm -	*Zostera marina* (eelgrass)
Rm -	*Ruppia maritima* (widgeon grass)
Ms -	*Myriophyllum spicatum* (Eurasian watermilfoil)
Ppf -	*Potamogeton perfoliatus* (redhead-grass)
Ppc -	*Potamogeton pectinatus* (sago pondweed)
Zp -	*Zannichellia palustris* (horned pondweed)
N -	*Najas* sp. (naiad)
Ec -	*Elodea canadensis* (common elodea)
Va -	*Vallisneria americana* (wild celery)
Tn -	*Trapa natans* (water chestnut)
Pe -	*Potamogeton epihydrus* (leafy pondweed)
Hv -	*Hydrilla verticillata* (hydrilla)
Hd -	*Heteranthera dubia* (water stargrass)
Pcr -	*Potamogeton crispus* (curly pondweed)
Cd -	*Ceratophyllum demersum* (coontail)
Ppu -	*Potamogeton pusillus* (slender pondweed)
Ngu -	*Najas guadalupensis* (southern naiad)
Ngr -	*Najas gracillima* (naiad)
C -	*Chara* sp. (muskgrass)
Nm -	*Najas minor* (slender naiad)
U -	Unknown species composition

*** Abbreviations under column "Source" are as follows:

Capt. -	Charterboat Captain's Survey
Cit. -	Citizen's Survey
FWS -	U. S. Fish and Wildlife Service Surveys
DNR -	Maryland Department of Natural Resources
COG -	Metropolitan Washington Council of Governments
HPEL -	University of Maryland Horn Point Environmental Laboratory
Harford -	Harford Community College - Stan Kollar
VIMS -	Virginia Institute of Marine Science/School of Marine Science/College of William and Mary
Park -	Maryland-National Capital Parks and Planning Commission, Patuxent River Park.
Essex -	Essex Community College SAV Research Group

\ - Slash mark separates species data of independent survey sources and independent survey dates.

- No SAV bed mapped from 1989 or 1990 aerial photography but SAV bed presence was verified by 1990 groundtruth survey at this location.

* - No SAV bed mapped from 1990 aerial photography but SAV bed presence was verified in 1990 at the 1989 bed location by groundtruth survey.

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