

NBEP-03-120

Rhode Island Narragansett Bay Project Area: Trends Analysis

Methodology

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Narragansett Bay Estuary Program

A Narragansett Bay Estuary Program Report

**Rhode Island Narragansett Bay Project Area:
Trends Analysis Methodology**



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June 2003

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**The Narragansett Bay Estuary Program
is part of the federal National Estuary Program
and is sponsored by the U.S. Environmental Protection Agency and
R.I. Department of Environmental Management**

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Prepared for:
**Rhode Island Department of Environmental Management
Narragansett Bay Estuary Program
Providence, RI
and
U.S. Fish & Wildlife Service
National Wetlands Inventory, Northeast Region
Hadley, MA.**

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**Funded by
U.S. Environmental Protection Agency
R.I. Department of Environmental Management Aqua Fund Program
Narragansett Bay Estuary Program**

INTRODUCTION:

The Natural Resources Assessment Group (NRAG) at the University of Massachusetts, Amherst, entered into agreement with the U.S. Fish & Wildlife Service's (FWS) National Wetlands Inventory (NWI), Northeast Region, in cooperation with Rhode Island Department of Environmental Management, Narragansett Bay Estuary Program (NBP) to provide a trends analysis of coastal wetlands and deepwater habitats and land use/land cover within the 500-foot buffer zone of coastal wetlands and deepwater habitats for the Narragansett Bay project area using stereoscopic aerial photointerpretation.

NRAG is a technical services group in the Department of Plant and Soil Sciences, specializing in the inventory and analyses of wetlands, upland vegetation and land use using remote sensing techniques for use in digital data sets.

Coastal wetlands, deepwater habitats and coastal resource features for the Narragansett Bay estuary were inventoried by NRAG in 1996, to include maps of submerged aquatic vegetation (SAV), primarily eelgrass. The 1996 inventory is the base data for further analyses, including buffer zone characterization, potential coastal wetland restoration sites and hardened shorelines (Huber, 2000). Trends analysis is the final phase of the study.

Trends analysis was undertaken in two phases:

- 1) Bay-wide trends from 1950 to 1990 era of coastal wetlands and deepwater habitats and of land use/land cover within the 500-foot buffer zone.
- 2) Featured area trends of coastal wetlands and deepwater habitats for six sites of concern selected by NBP, spanning two eras: 1930 to 1950 and 1950 to 1990 eras (Appendix A).

The University of Rhode Island, Environmental Data Center (URI/EDC) was contracted for digitizing of trends data. Additional GIS technical support was provided by a NRAG GIS specialist.

STUDY AREA:

Narragansett Bay occupied eastern Rhode Island and the upper Mount Hope Bay/Taunton River portions of southeast Massachusetts. Limits of the project area were defined in part by geography, the limits of brackish water and Bay hydro-geomorphology. See Figure 1. Trends analysis was limited to the Rhode Island portion of the project area, located on portions of 11 U.S. Geological Survey 1:24,000 scale topographic quadrangle maps: Providence, East Providence, East Greenwich, Bristol, Fall River, Wickford, Prudence Island, Tiverton, Narragansett Pier, Newport and Sakonnet Point.

METHODS:

1. Aerial Photography and Data Preparation:

Source imagery for the base inventory (1990 era) was 1:40,000 scale true color transparencies flown August 1996, supplemented by 1:12,000 scale true color transparencies flown June 1996, by the James W. Sewell Company, Old Town, Maine.

Source imagery for trends analysis was researched by Helen Cottrell of NBP and obtained and indexed for photointerpretation by NWI National Headquarters in St. Petersburg, FL.

The 1950 imagery is 1:20,000 scale black and white transparencies dated variously October and November, 1951 and May 1952.

The 1930 imagery is 1:28,000 scale black and white transparencies dated primarily October and December 1938, supplemented by smaller portions flown October, 1941.

Photography was data-prepared by NRAG with Grafix Wet Media DuraLar .004 gauge 9-inch by 9-inch mylar overlays, affixed with drafting tape at corners. Mylar overlays were pin- and notation- registered, as needed.

A southwestern portion of the East Providence quad (Bullocks Cove) lacked 1950s coverage, and was not trend-analyzed.

2. Photointerpretation and Rectification:

NRAG photointerpreted wetland and deepwater habitat changes with Bausch & Lomb Stereo Integration Scopes (SIS), allowing analyses of aerial photos from different eras and different scales, resolved to one stereoscopic view. Base data in the form of original ink-on-mylar photointerpretation was retained on the 1990 imagery. Change polygons were interpreted, delineated and labeled on 1950 imagery overlays, and again on the 1930 overlays for the demonstration sites. Use of the SIS enabled the stereoscopic viewing of wetlands. Interpreted change overlays were then rectified to 1:24K scale stable base mylars using a Bausch & Lomb Zoom Transfer Scope (ZTS) onto frosted mylar manuscripts suitable for digitizing.

Land use/land cover trends in the 500 foot buffer zone were documented with a Bausch & Lomb Stereo ZTS, using 1:24K manuscripts of the rectified 1990 base land use land cover data. These were overlain by frosted mylar manuscripts, where interpreted change polygons were delineated, labeled and made suitable for digitizing. Use of the stereo ZTS allowed efficient stereo viewing of upland changes, adequate for land use/land cover interpretation.

3. *Minimum Mapping Units*

With the exception of wetland loss polygons, the minimum mapping unit for change polygons was .25 acre.

4. *Classification*

Estuarine and marine habitats and freshwater wetlands within the 500-foot buffer zone have been classified according to Cowardin et al. (1976) *Classification of Wetlands and Deepwater Habitats of the United States* and following the U. S. Fish and Wildlife Service's NWI mapping standards. All trends involving wetlands and deepwater habitats utilized this classification.

Land use and land cover has been classified using a modified Anderson (1976) method suited to the needs of this project. Table 1 lists the buffer zone land use/land cover codes used for trends analysis of land use/land cover trends and for wetland loss.

Table 1. Land Use/Land Cover in the 500-foot Buffer Zone (Anderson, 1976).

Level 1	Level 2	Level 3	
1 Urban or Built-up Land	11 Residential	111 Single Family	
		112 Multi-family	
		113 Mobile Home Parks	
	12 Commercial and Services	13 Industrial	114 Lawns (includes non-residential lawns)
			115 Other (e.g., military barracks)
			121 Commercial and Institutional Structures (plazas, malls, schools, universities, military bases)
			122 Recreational structures (e.g., beach pavilions, water slides)
			123 Marinas
			124 Junkyards
			125 Paved surfaces associated with commercial and services
	14 Transportation, Communications and Utilities (includes lighthouses) (for roads, map 4-lane highway corridors; no 2-lanes)	15 Industrial & Commercial Complexes	126 Unpaved surfaces (sandy parking lots in beach areas)
			127 Wharves, piers & shipyards
	16 Mixed Urban or Built-up Land	17 Other Urban or Built-up Land	171 Golf courses
			172 Cemeteries
	2 Agricultural	21 Cropland	173 Other (zoos, urban parks, ski areas, forts)
			22 Orchards, Nurseries, Vineyards, Ornamental Horticulture)
			23 Confined Feeding Operation
24 Pasture and Hayfields			
25 Other			
3 Rangeland	31 Herbaceous Cover	174 Landfills	
		32 Shrub and Brush Cover	
		33 Mixed	
4 Forest	41 Deciduous Forest Cover		
		42 Evergreen Forest Cover	
		43 Mixed	
5 Water, and	Use Cowardin (1979) for freshwater wetlands in the buffer zone**		
6 Wetlands		71 Dry Flats	
7 Barren Land		72 Beaches (classified under Cowardin, 1979)	
		73 Sand Areas other than Beaches (dunes, backdunes) (Note: Dunes were mapped on original wetlands layer as "D")	
		74 Bare exposed rock	
		75 Strip Mines, Quarries and Gravel Pits	
		76 Mixed Barren Land	
		77 <i>Transitional</i>	

Note: **Freshwater wetlands within the 500-foot buffer zone classified under Cowardin (1979) included palustrine wetlands, some of which were tidally-influenced freshwater hydrology and others strictly freshwater types.

Additionally, NRAG developed Cause Codes for wetland-to-wetland trends and wetland gain trends (Table 2). These cause codes were based on interpretable conditions suggestive of cause and as indicated from application of special modifiers from the Cowardin classification system. Causes of wetland loss and upland-to-upland changes in the 500-foot buffer zone can be derived directly from the Anderson codes.

Table 2. *Cause Codes for Wetland Changes and Gains in Trends Analysis*

CODE	CONDITION(S)
AG	agriculture
AJG	artificial jetties and groins, construction or removal of
BT	boat traffic
CED	coastal erosion and deposition processes
D	ditching
DR	ditching removed or re-vegetated
IM	impoundment
IMR	impounding structure removed
IS	<i>Iva frutescens</i> succession
MC	marsh plant colonization (may be associated w/ deposition/accretion)
OC	oyster colonization
OD	oyster de-colonization
PI	<i>Phragmites australis</i> invasion
PR	pier removal
PTI	<i>P. australis</i> and <i>Typha angustifolia</i> invasion
S	spoil deposition; not effectively filled
SR	structure removed
TR	tidal restriction
TRP	tidal restriction w/ <i>P. australis</i> invasion
UK	unknown cause
VG	vegetation change, wide variety (successional changes, clearing or cutting; sea level changes)
WTR	water treatment
XM	excavation, marina-related
XU	excavation, unknown use
XR	excavation re-vegetated

Application of cause codes is based on conditions interpreted over the project area during photointerpretation and use of special modifiers in classification; it is not based on in-depth study of any particular site. Multiple coding may occur.

Use of BT (boat traffic) cause code is limited to interpretable loss of fringe marsh in marina areas. It is expected more fringe marsh loss attributable to boat traffic occurred,

but was beyond the scope of this analysis, which was based on polygonal data only. Fringe marsh was mapped as linear data for the original 1996 inventory of coastal wetlands and habitats.

The CED (coastal erosion/deposition) cause may be used offshore of areas with considerable earthwork and construction, such as the Quonset Point demonstration area. In areas of disturbance, CED processes may be aggravated by human disturbance in the upland. Anderson coding in adjacent polygons may provide additional clues as to the causes of change.

MC was used for areas where unconsolidated estuarine habitats changed to marsh; in cases where a water regime change also occurred, CED may also be ascribed.

Change between marsh types (e.g., regularly-flooded to irregularly-flooded) were ascribed VG (vegetation change).

Some areas appeared to have undergone dramatic changes that are not readily ascribed to any one particular cause. An example is The Cove in Portsmouth, located at the southwest corner of the Fall River quadrangle, where orchards or nurseries existed in the 1950s and it appears some type of excavation or leveling of the upland occurred, with subsequent deposition of sands and marsh development.

Within the Calf Pasture Point demonstration site (East Greenwich and Wickford quads), salt marsh occurred in the 1930s that was inland of the 1990s based 500-foot buffer zone. Loss of the marsh area is documented, but the land use/land cover characterization is not available since it is located beyond the limits of the 500-foot buffer zone.

ACKNOWLEDEMENTS:

Principal photointerpreters for wetlands trends analysis and quality control were biologists Todd Nuerminger and Irene Huber.

Land use/land cover trends in the 500-foot buffer zone were analyzed by Mary Johnson, graduate student at the University of Massachusetts, Department of Plant and Soil Sciences. Additional support on buffer trends analysis was provided by Craig Polzen, NRAG GIS specialist.

Craig Polzen also provided internal GIS support to NRAG during final data quality control.

REFERENCES:

Anderson, J.R., E.E. Hardy, J.T. Roach and R.E. Witmer. 1976. *A Land Use and Land Cover Classification System for Use with Remote Sensor Data*. U.S. Geological Survey Professional Paper 96A. U.S. Government Printing Office, Washington, D.C. 28 pp.

Cowardin, L.W., V. Carter, F.C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Fish and Wildlife Service, Washington, D. C. FWS/OBS-79/31.

Huber, I. 2000. *Project Report: Photointerpretation of Buffer Zones, Coastal Wetland Potential Restoration Sites and Hardened Shorelines in the Narragansett Bay Estuary, Rhode Island and Massachusetts*. University of Massachusetts, Natural Resources Assessment Group.

Appendix A

**Demonstration Sites for Additional Analysis in
Narragansett Bay Coastal Wetland Reverse Trends Analysis Project**

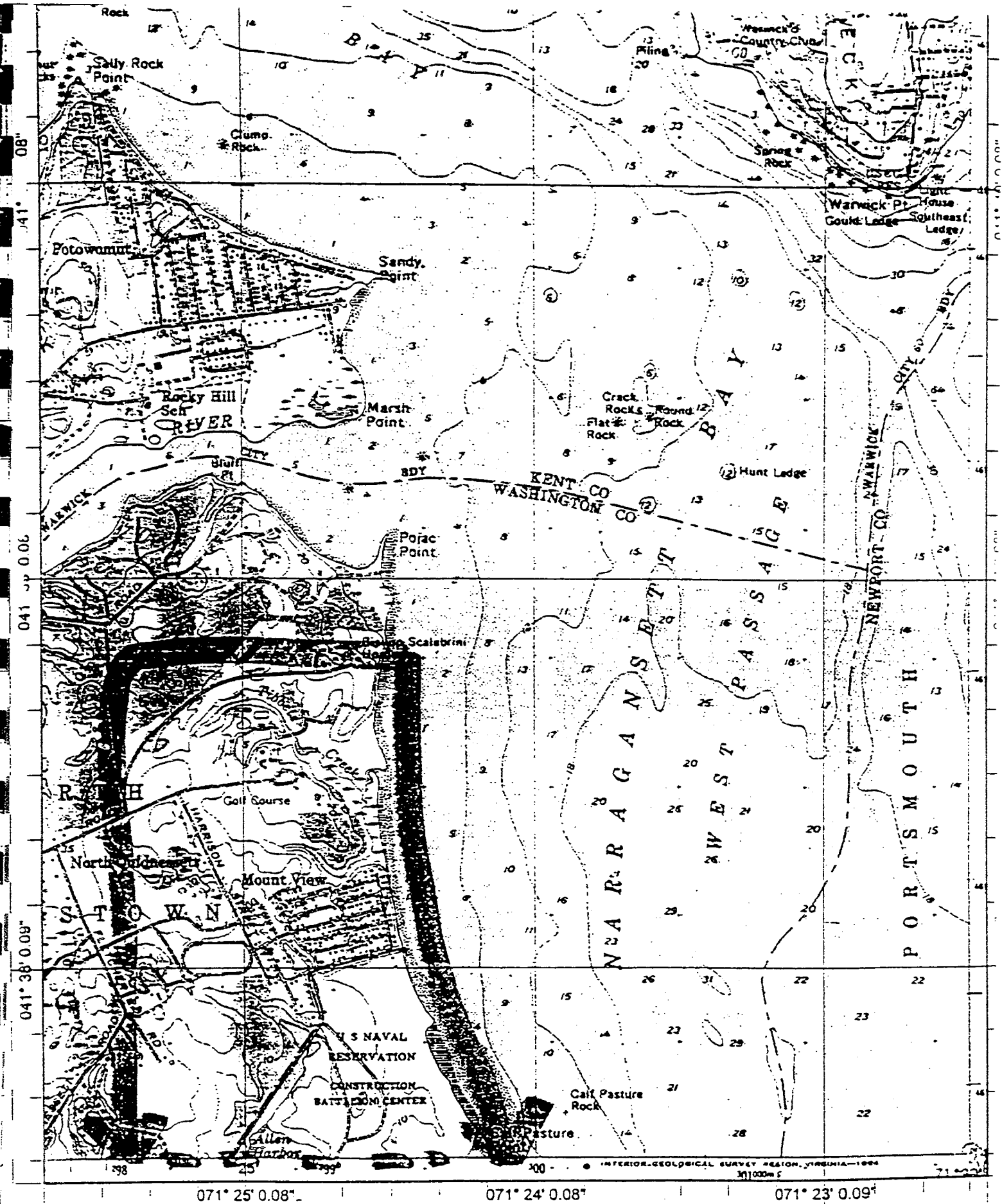
The following coastal wetland sites have been selected to perform additional analysis using two time periods of historical aerial photography:

- ✓ 1. Allin's Cove (from Nyatt Point to Bullock Cove), Barrington-Bristol Quadrangle
- ✓ 2. Palmer River System (Belcher Cove north of 195), Barrington-Providence, R.I.-Mass. & Bristol Quadrangles
- ✓ 3. Inland of Calf Pasture Point, North Kingstown-Wickford & East Greenwich Quadrangles
- ✓ 4. Jacob's Point, Warren & Bristol-Bristol Quadrangle
- ✓ 5. Sachuest Point, Middletown-Sakonnet Point & Newport Quadrangles
- ✓ 6. Wesquage Pond, Narragansett-Narragansett Pier Quadrangle

MAP NOT CAPTURED

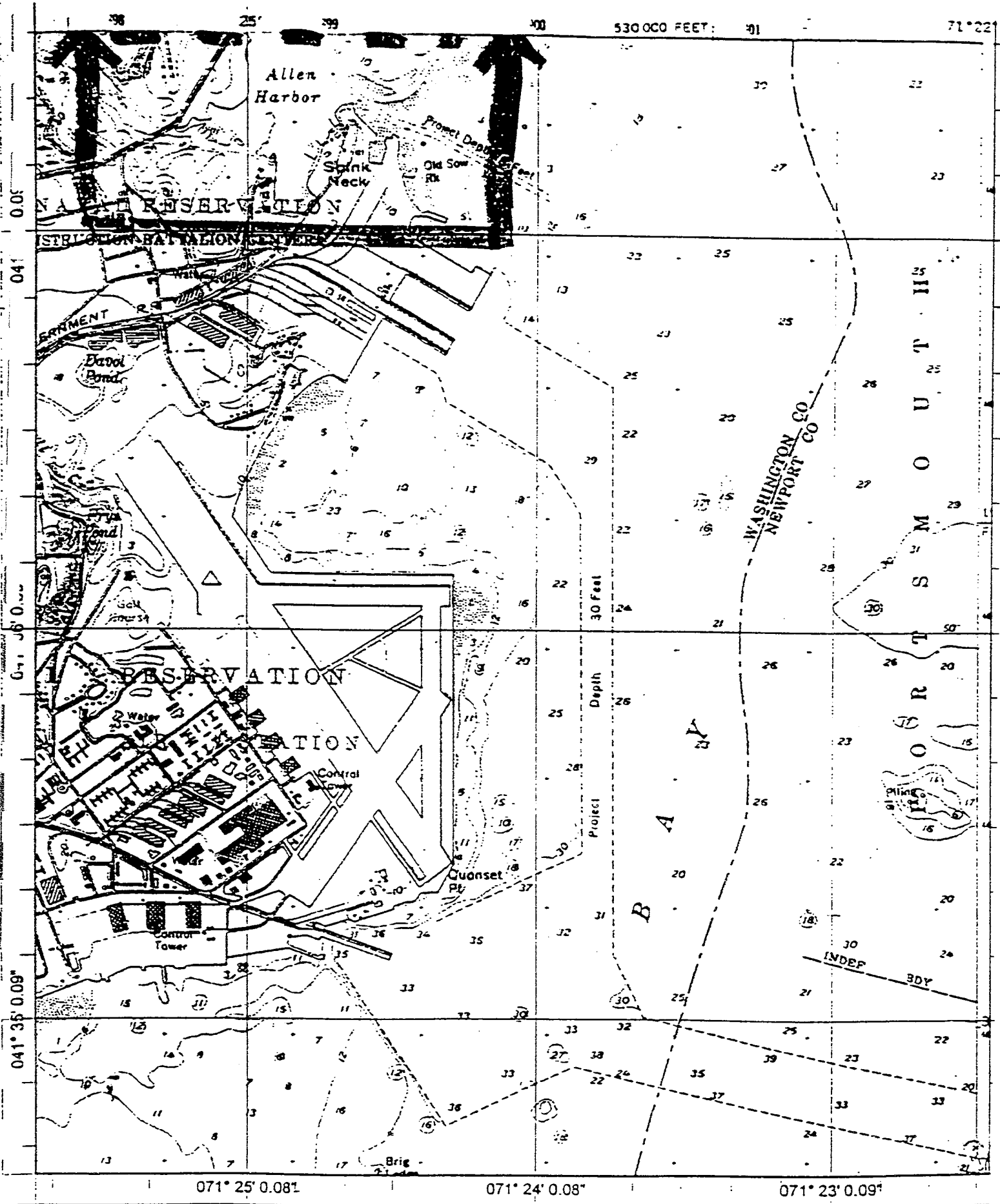
MAP NOT CAPTURED

MAP NOT CAPTURED



Name: EAST GREENWICH
 Date: 11/9/98
 Scale: 1 inch equals 2000 feet

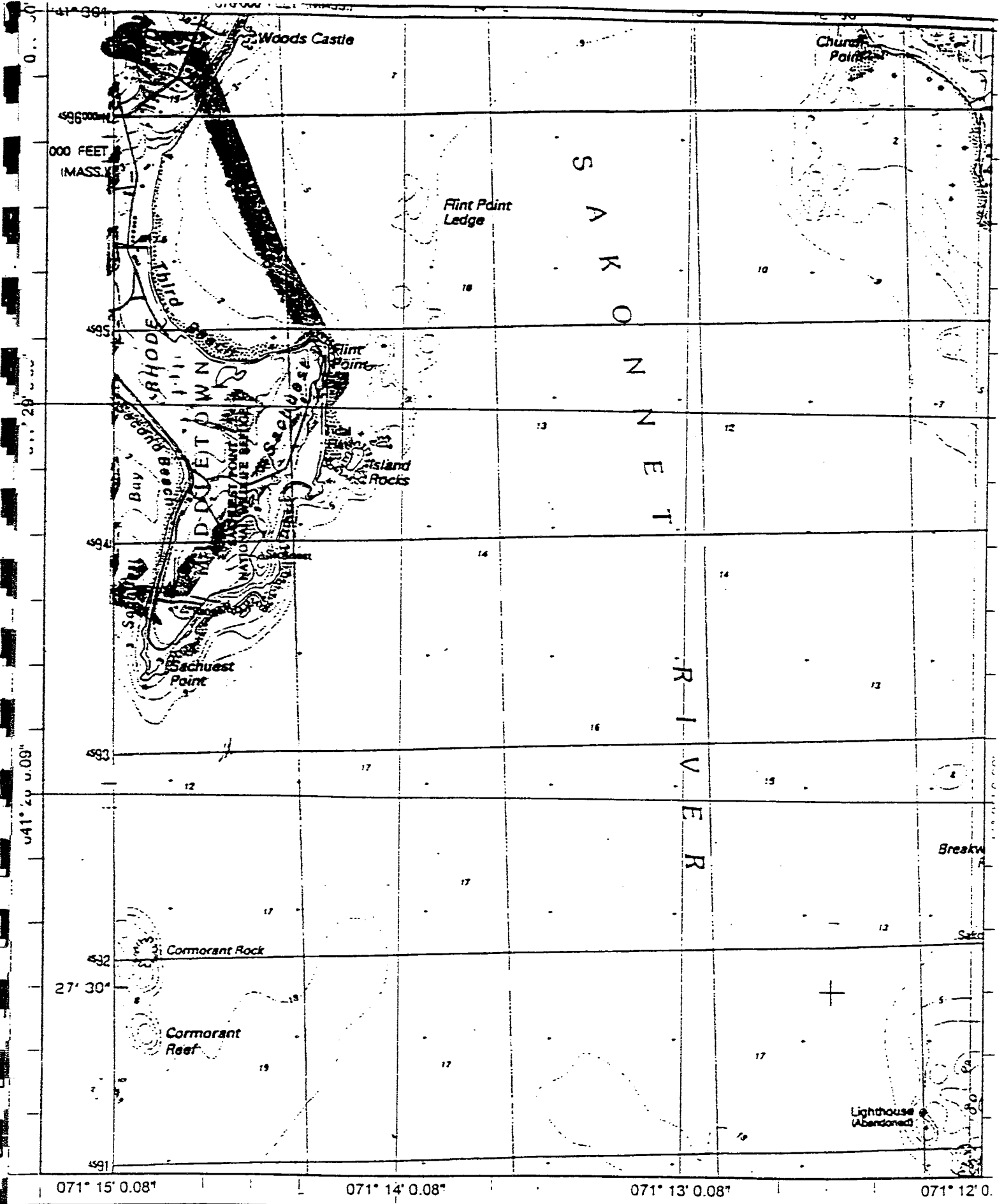
Location: 041° 38' 56.8" N 071° 24' 04.2" W
 Caption: Inland of Calf Pasture Point-Town of North Kingstown
 R.I.-East Greenwich and Wickford Quadrangles



Name: WICKFORD
 Date: 11/9/98
 Scale: 1 inch equals 2000 feet

Location: 041° 36' 06.1" N 071° 24' 05.3" W
 Caption: Inland of Calf Pasture Point, North Kingstown, R.I.-E
 Greenwich and Wickford Quadrangles

MAP NOT CAPTURED



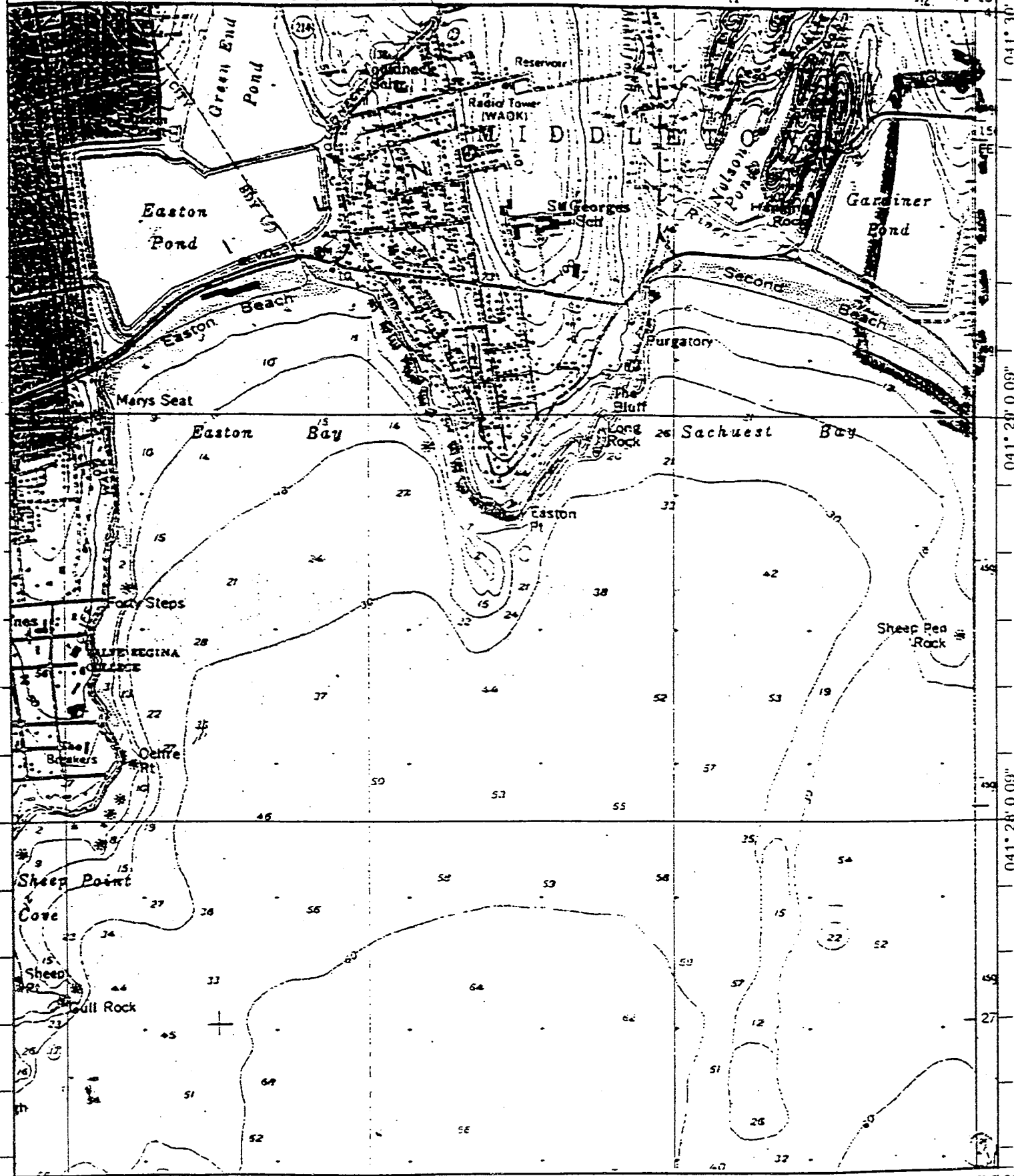
Name: SAKONNET POINT
 Date: 11/9/98
 Scale: 1 inch equals 2000 feet

Location: 041° 28' 31.1" N 071° 13' 35.5" W
 Caption: Sachuest Point Marsh, Town of Middletown,
 R.I.-Sakonnet Point, R.I.-Mass. and Newport
 Quadrangles

VER. MASS. 18 MI.
W 12 MI

17°30' 09" 560 000 FEET; 1.7 MI. TO R. 1.138

11 12 71°15'

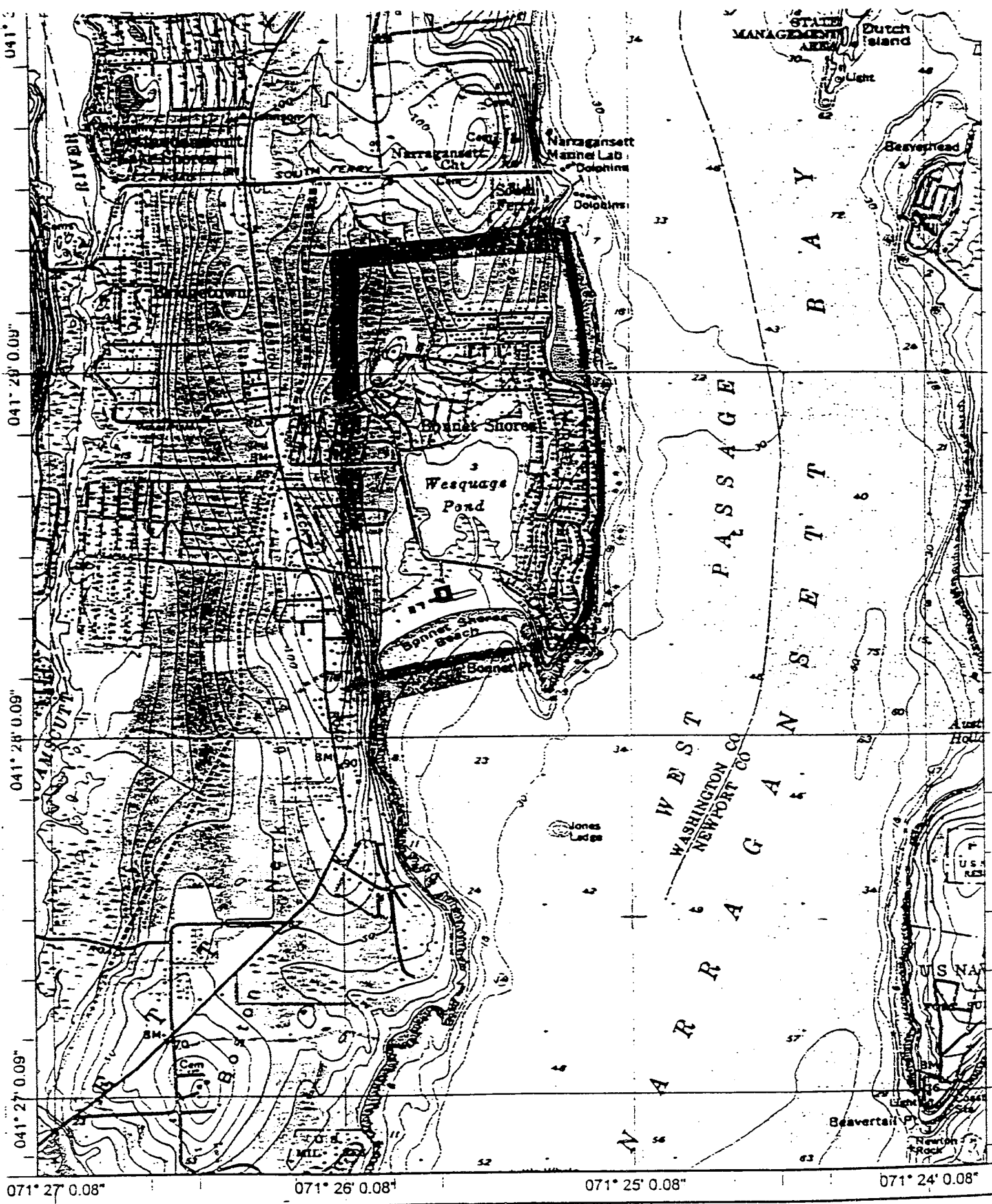


071° 18' 0.08" 071° 17' 0.08" 071° 16' 0.08" 071° 15' 0.08"

Name: NEWPORT
Date: 11/9/98
Scale: 1 inch equals 2000 feet

Location: 041° 28' 37.4" N 071° 16' 33.3" W
Caption: Sachuest Point Marsh, Town of Middletown,
R.I.-Sakonnet Point, R.I.-Mass. and Newport
Quadrangles

MAP NOT CAPTURED



Name: NARRAGANSETT PIER
 Date: 11/9/98
 Scale: 1 inch equals 2000 feet

Location: 041° 28' 24.8" N 071° 25' 25.8" W
 Caption: Wesquage Pond, Narragansett, R.I.-Narragansett Pie
 Quadrangle