An Environmental Evaluation of the Ecosystem of Joe's Rock Wrentham, Massachusetts

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I. Introduction.

Said to be named from an Indian legend dating back to the days of King Philip Sachem's encounters with the English settlers in the 1670's, Joe's Rock is about four miles west of the center of Wrentham, Massachusetts. The actual rock overlooks a region locally referred to as Joe's Rock which includes an unnamed bog pond (henceforth named Joe's Pond), a much smaller pond bordering upon a road (henceforth named Road Pond), and a mixture of wetlands, forests, and meadows. The land (60.25 acres) was purchased by the town in 1970 for the price of $25,000.[1] The objective of this report is not so much to study the actual rock itself but rather to evaluate the health of the entire ecosystem through an interdisciplinary approach of biological, chemical, and geological perspectives. Particular focus is placed upon vegetational zones, the function of the wetlands, the health of the two ponds, and the human impact on the ecosystem.

I conducted all of my fieldwork during the last week of March, 1990. Several tests on the twelve water samples I collected were done at Williams College during the weeks thereafter. Although I'd like to return to the area to perform some follow up research, I feel that I have obtained an accurate interpretation of the health of the Joe's Rock ecosystem. Good write!

II. Methodology.

The maps I have constructed were adapted from the Franklin Quadrangle, Massachusetts-Rhode Island (topographic) [U.S. Department of the Interior, Geological Survey, 1979). Most vegetation identifications were made through use of class handouts (especially for the wetlands) and the Audubon Society's Field Guide to North American Trees, Eastern Region [Alfred A. Knopf, New York, 1986]. I used a rowboat to do bathymetric measurements and collect water samples; water samples were subjected to pH, ANC, ion chromatography and atomic absorption spectroscopy tests. (c.f. Appendix V).

III. Vegetation Trends and Wetlands.

Appendix III is a result from a broad survey of the ecosystem's vegetation. All species appeared healthy; there were no signs of disease or damage from humans. Vegetation tended to fall into one of three categories dependent upon elevation and the presence of water. The first was marsh: this region consisted primarily of leather-leaf (Chamaedapne calyculata), cattails (typha), skunk cabbage (symplocarpus), rushes (juncaceae), false-loose-strife (ludwigia), and sedges (Cyperaceae) [c.f. photo #1 and #2]. The second was swamp: this region of wet or moist soils consisted primarily of red maple (Acer rubrum), red osier dogwood (Cornus stolonifera), bitternut hickory (Carya cordiformis), and swamp white oak (Quercus bicolor) [c.f. photo #3]. The third was upland vegetation: this region of well-drained,

sandy soils consisted primarily of white pine (pinus strobus), black oak (quercus velutina), eastern redcedar (juniperus silicicola), red maple, and bitternut hickory. The southern bank of the pond, with a relatively higher bank, had more upland vegetation when compared to the northern face, which was a dense marsh (mostly leather-leaf [c.f. photo #1]) and the western bank, which was mostly swamp. Joe's Pond itself had a dense population of submergent pond weed (potamogeton) and water lilies (nymphaeaceae).

Appendix IV marks the wetlands of this ecosystem that would be under the protection of the Massachusetts Wetland Protection Act. The majority of the marsh wetlands were located on the northern side, where there was no defined bank but rather a dense cluster of vegetation retreating northward. It was in this region that there appeared to be the best habitat for wildlife since it was sheltered from wind and provided safe cover; once I counted 16 ducks there. !

IV. The Health of the Ponds and Human Impacts.

dam probably was there for the bog since you'd like to be able to raise/lower water levels for the cranberries!

Joe's Pond was originally a cranberry bog, yet has since been dammed along the southern bank (the date of which I failed to find) (c.f. photo #4). Because of this dam, the bog was transformed into a very shallow pond (c.f. Appendix II), with the greatest depth of 5 ft. In Appendix VI, I have calculated the volume of water each pond holds (Joe's Pond: 982,000 ft^3.; Road Pond: 42,000 ft^3., note: the former pond

feeds the latter). Moreover, although I did not conduct any serious tests, there appeared to be very little sediment (maybe an inch) in the Joe's Pond. This lack of sediment can be attributed to the youth of the pond. Appendix V presents the results from the water sample tests; no samples contained fluoride. Basically, both bodies of water appeared to be healthy in respect to the solutes for which they were tested. According to Susan Kegley's letter of June 5, 1989 to the HOORWA samplers, chloride is not harmful to most species of plants and animals so long as it is below 20 ppm; Joe's Pond has an average concentration of 10.78 ppm and the Road Pond's is 8.7 ppm. Because it is the direct receiver of a street run-off drain and would therefore be subject to road salt, I was mistakenly led to believe that the Road Pond would have a higher chloride count than Joe's Pond. However, it appears that the major source of chloride is from run-off from the west; the two highest chloride concentrations are from the two most western samples (#12 with 14.9 ppm and #1 with 15.4 ppm). According to the drainage basin in Appendix I, Joe's Pond is subject to run-off from not only houses (leaking sewage disposal units?) but also roads and therefore road salt.

Kegley further points out that nitrate should be below 10 ppm (Williamstown tap water is 3.8 ppm); Joe's Pond is 0.3 ppm and the Road Pond is 0 ppm. The little nitrate that there is probably comes from nitrogenous organic waste or from a leaking septic tank or cesspool. Kegley finally mentions that the sulfate of Williamstown tap water is 13.6

ppm; Joe's Pond is 5.1 ppm and the Road Pond's is 7.2 ppm. The calcium concentrations of the ponds are also at fairly low and healthy levels. The calcium in these natural waters probably comes from the mineral assemblage of rocks near the land surface. However, because Joe's Pond is geologically quite young, it is understandable that the calcium count is so low, since there has been little time for the weathering and run-off of Joe's Rock.

The only quantified concern for the ponds' health is that Joe's Pond is fairly acidic, with a pH of 5.82. Under the 1985 water standards of the Department of Environmental Quality Engineering (from a Sept. 8, 1989 letter from Paul Hogan of the same source), a Class C water body [which protects aquatic and wildlife and provides secondary recreation], pH may range from 6.5 to 9.0. There are two explanations for this low pH of 5.82. First, there is the well-documented proof that New England suffers from acidic deposition. Secondly, the chemical components of the sunken cranberry plants probably adds to the pond's acidity. If some lime were added to the pond, then the pH would be restored to more nurturing and neutral level. An important water sample to notice is number 11, for it goes on to feed the Diamond Hill, R.I. reservoir; it appears to be a reasonably clean sample. Another sample worth mentioning is number 10 (c.f. photo #5); this sample comes from a stream that passes beneath three houses before entering the Road Pond and is visibly polluted. If different tests had been conducted, this sample would have undoubtedly proven to be

very unhealthy. It is therefore important to realize that only a limited amount of tests were conducted, and that to understand fully the state of the ponds, one must consider bacteria (which I was unable to do because of transportation logistics) and heavy metals.

V. Joe's Rock.

Joe's Rock's 490 ft. elevation is the highest in Wrentham, although the majority of the exposed rock is between 350 and 430 ft., with some vertical and overhanging slopes. The rock formation consists mostly of granite enveloping minerals such as feldspar and quartz. The top surface of the rock is fairly weathered, so we can assume that the rock has been exposed to precipitation, wind, and other natural forces for some time; the overhangs, which are not subjected to as much waterfall are more geometric and jagged. There are some small cracks in the rock face from which on some days water leaked. Blueberry, black oak, and white pines grow on the top of the rock; lichen can be found on most locations of the rock's surface.

VI. Conclusion.

Ironically, I found this report slightly disappointing because of the relative high level of health (except for the low pH) in the ecosystem; were there more problems for concern, I would have had more material and issues with

which to work. Having done extensive work with Bridges Pond, I had begun to assume that all the ponds in Massachusetts had some significant pollution problems. The health of the ecosystem was an unexpected but welcome surprise. In simplest terms, the Joe's Rock ecosystem is successful because of the valuable presence of the wetlands and lack of human contact and encroachment. I hope that the appendixes, maps, and photographs that follow are helpful in presenting a visual interpretation of the health of the Joe's Rock ecosystem.

Ben - Excellent work -- you might have been a bit more ambitious in your interpretation of the data, since you worked so hard and collected such good information. Because of low ANC and slightly acidic pH, this is one of those ponds that is susceptible to acid deposition and needs to be watched quite closely. Its waters are really quite clean except for Cl (and, I presume Na). It would be nice if these constituents were kept out!

Oh... are there any fish? other aquatic life?

1. Wrentham Conservation Commission, The Wrentham Guide to Open Spaces and Conservation Lands, 1988, p.19.

Appendix I

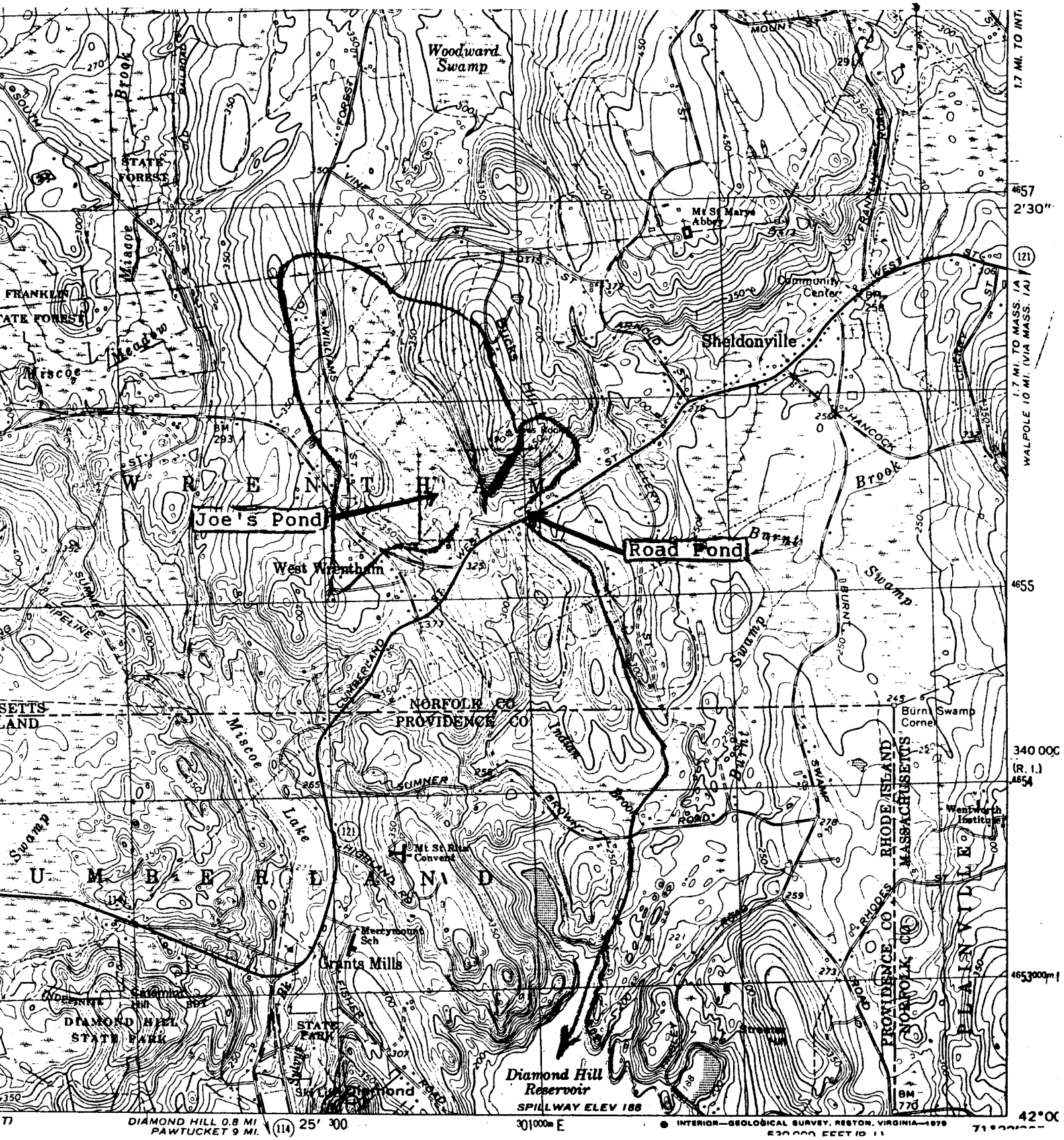
Lower right quarter of black square is the area of detail.

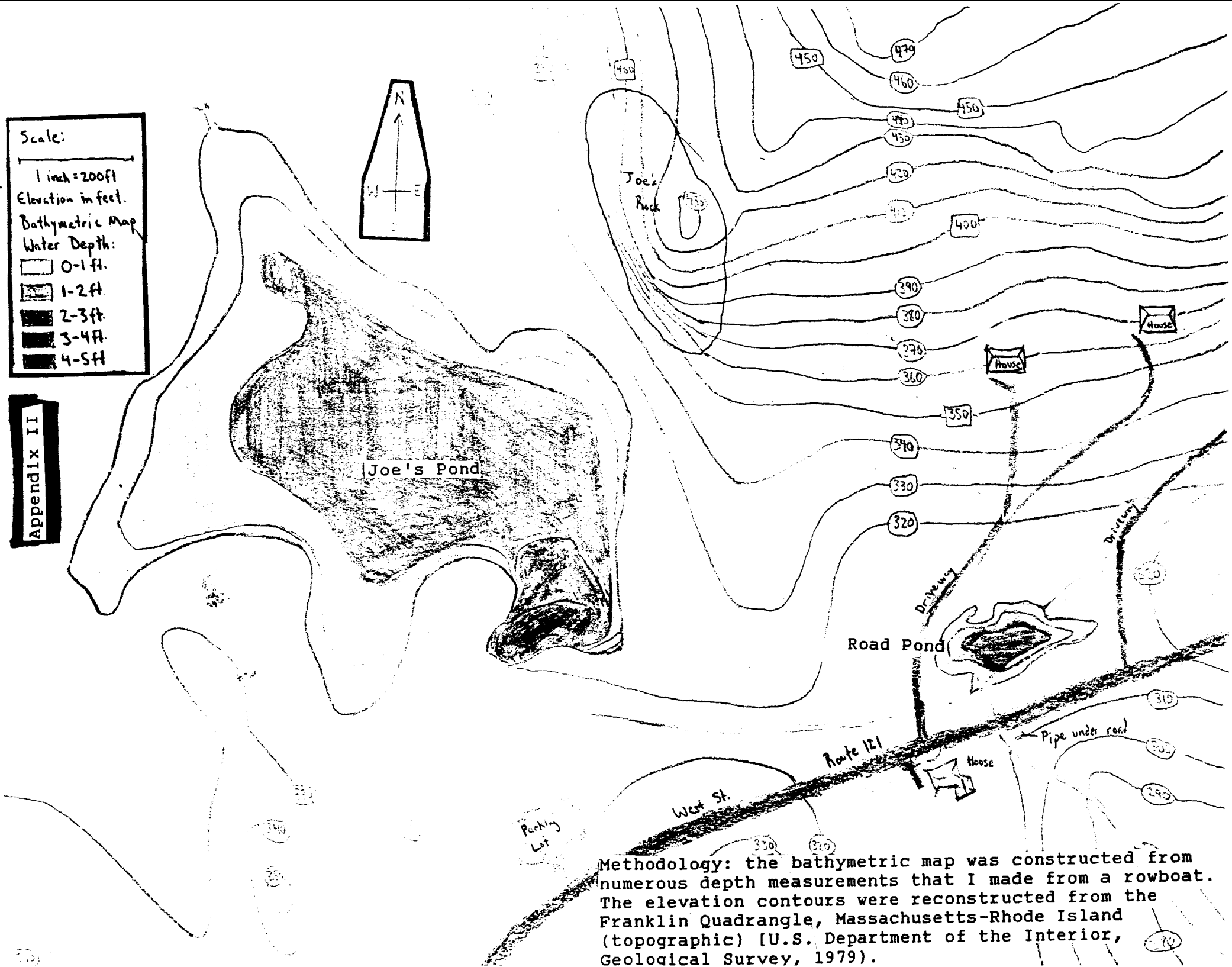
Area of ecosystem studied: ☐

Drainage basin of Joe's Pond:

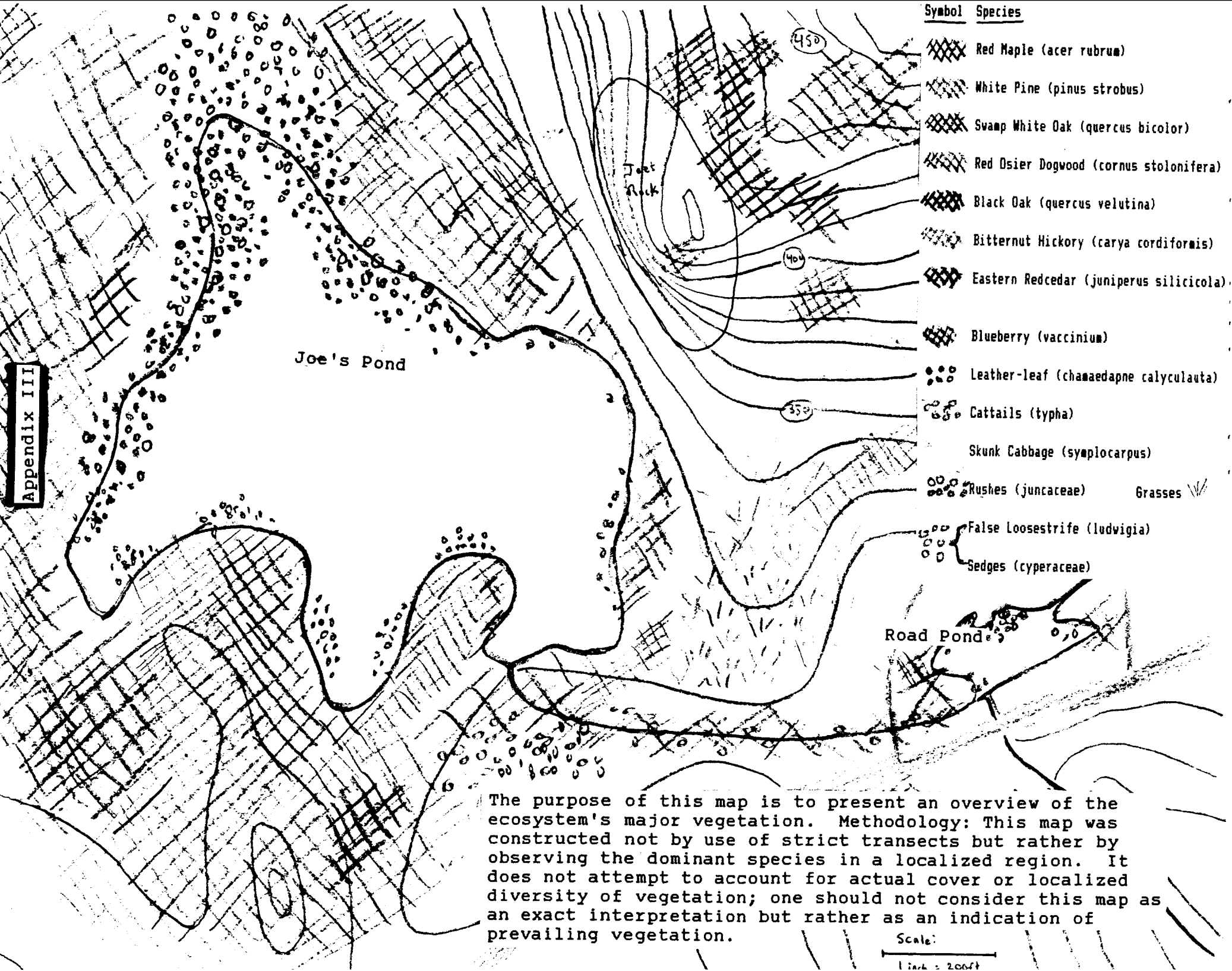
Drainage basin of Road Pond:

Streamflow of output water: →

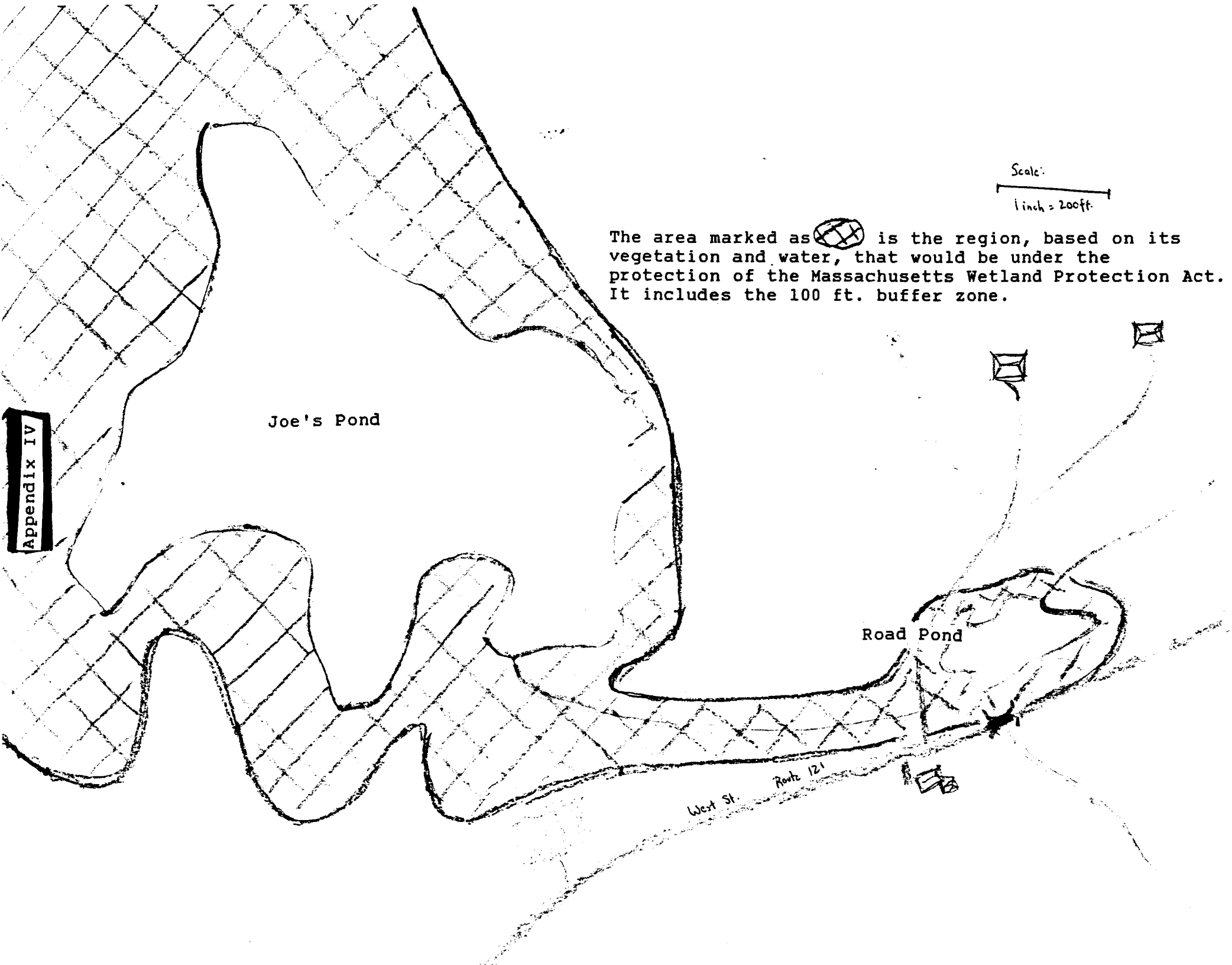




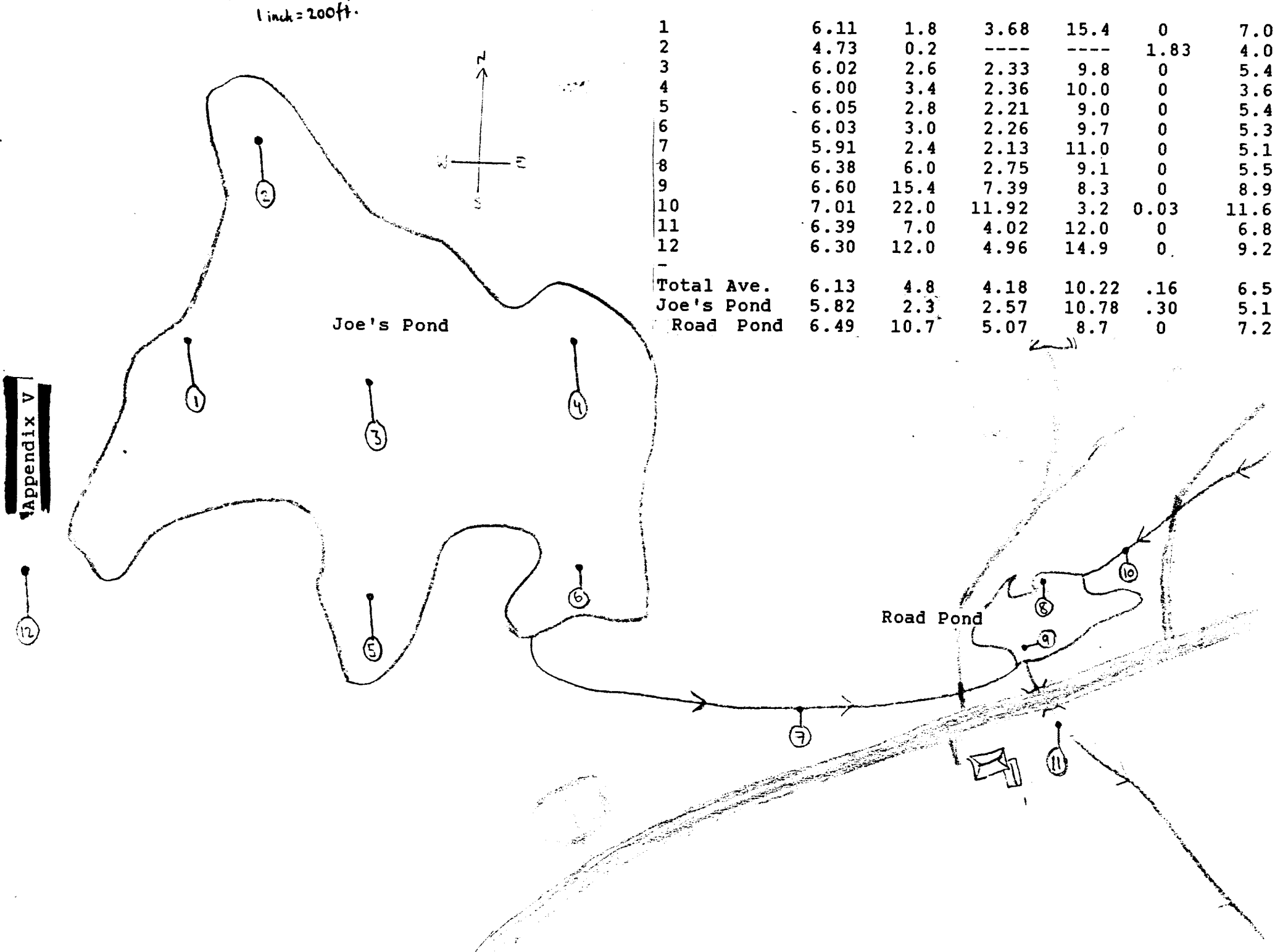
Methodology: the bathymetric map was constructed from numerous depth measurements that I made from a rowboat. The elevation contours were reconstructed from the Franklin Quadrangle, Massachusetts-Rhode Island (topographic) [U.S. Department of the Interior, Geological Survey, 1979).



The purpose of this map is to present an overview of the ecosystem's major vegetation. Methodology: This map was constructed not by use of strict transects but rather by observing the dominant species in a localized region. It does not attempt to account for actual cover or localized diversity of vegetation; one should not consider this map as an exact interpretation but rather as an indication of prevailing vegetation.


Scale:
1 inch = 200ft.
The area marked as is the region, based on its vegetation and water, that would be under the protection of the Massachusetts Wetland Protection Act. It includes the 100 ft. buffer zone.
Appendix IV
Joe's Pond
Road Pond
West St.
Route 121

Appendix V



Sample	pH	ANC	(MG/L) Ca^{+2}	Cl^-	NO_3^-	$^{-2}SO_4$
1	6.11	1.8	3.68	15.4	0	7.0
2	4.73	0.2	----	----	1.83	4.0
3	6.02	2.6	2.33	9.8	0	5.4
4	6.00	3.4	2.36	10.0	0	3.6
5	6.05	2.8	2.21	9.0	0	5.4
6	6.03	3.0	2.26	9.7	0	5.3
7	5.91	2.4	2.13	11.0	0	5.1
8	6.38	6.0	2.75	9.1	0	5.5
9	6.60	15.4	7.39	8.3	0	8.9
10	7.01	22.0	11.92	3.2	0.03	11.6
11	6.39	7.0	4.02	12.0	0	6.8
12	6.30	12.0	4.96	14.9	0	9.2
Total Ave.	6.13	4.8	4.18	10.22	.16	6.5
Joe's Pond	5.82	2.3	2.57	10.78	.30	5.1
Road Pond	6.49	10.7	5.07	8.7	0	7.2

Appendix VI

Pond Areas and Volumes:

Joe's Pond:

Water Depth (ft.)	Area ($ft.^2$)	Depth Coefficient	Volume ($ft.^3$)
0-1	124,800	0.5	62,000
1-2	145,600	1.5	218,400
2-3	192,400	2.5	481,000
3-4	36,400	3.5	127,400
4-5	20,800	4.5	93,600
Total	520,000		982,000

Road Pond:

Water Depth (ft.)	Area ($ft.^2$)	Depth Coefficient	Volume ($ft.^3$)
0-1	12,000	0.5	6,000
1-2	9,000	1.5	13,500
2-3	9,000	2.5	22,500
Total	30,000		42,000

Photo #1 - Northern face

Photo #2 - Western face

Photo #3 - South-Western swamp.

Photo #4

- dam on South bank

Photo # 5 - Sample 10

Photo # 6

Joe's Rock -

Photo #7 Joe's Rock (Notice people on top)

Photo #8 Joe Rock - Top.