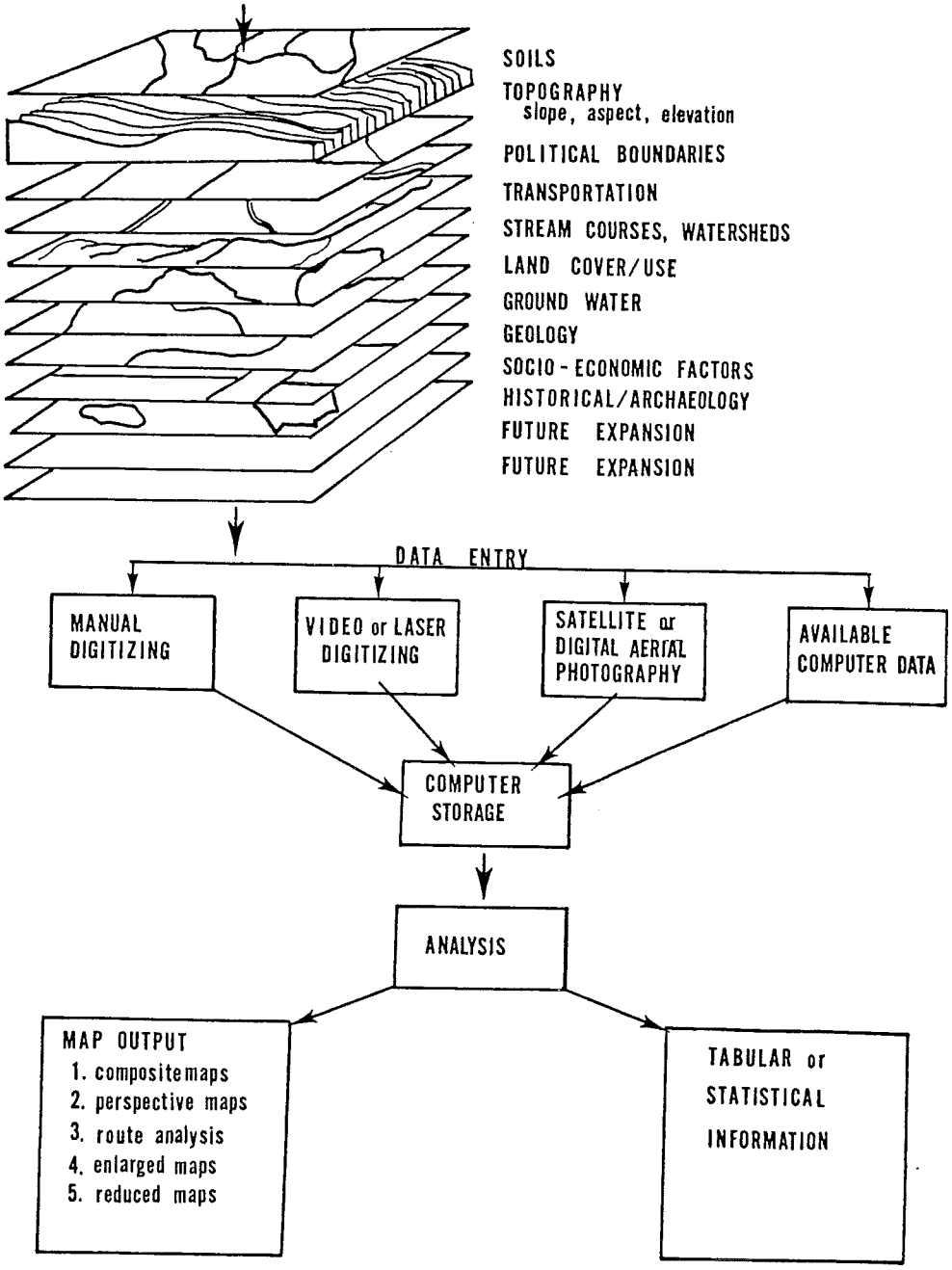
A GEOGRAPHIC INFORMATION SYSTEM for VERMONT



SCHOOL OF NATURAL RESOURCES
UNIVERSITY OF VERMONT
BURLINGTON, VT.

INTRODUCTION TO

A GEOGRAPHIC INFORMATION SYSTEM FOR VERMONT

Recent advancements in computer technology, data handling, and manipulation have made the concept of a detailed statewide geographically related information system a reality. Generally referred to as a geographic information system or simply GIS, these systems are designed to accept large volumes of spatial data derived from a variety of sources and to efficiently store, retrieve, manipulate, analyze and display these data according to user defined specifications.

In late 1980 the University of Vermont's School of Natural Resources acquired a major commercially available geographic information system from the Environmental Systems Research Institute (ESRI) of Redlands, California. Made possible by monies from the U.S. Forest Service, University of Vermont and Digital Equipment Corporation, this system spent much of the next two years in a research and development environment. The current version of the ESRI system, running on a DEC VAX 750 computer is called ARC/INFO. ARC is the graphic or map portion of the system and INFO, a relational data base manager handles feature attributes. INFO is a separate product of Henco Software, Inc. that has been incorporated into the geographic information system by ESRI. Together they make up perhaps the strongest, most flexible GIS available today.

The concept of a Vermont resource data base was considered as early as 1979. In the summer of 1982 a series of meetings were held to begin the formal planning process for a geographically referenced data base in Vermont. Persons attending this meeting included representatives from state and federal agencies, the University of Vermont and the private sector. From these meetings initial information layers were selected for inclusion in the data

base. These data sources include landcover, soils, topography, transportation, stream courses, watersheds and political boundaries. In June 1983 the University of Vermont and the U.S. Soil Conservation Service entered into a cooperative agreement, initiating the data entry process for the statewide geographic information system. Figure 1 contains a state map delineating the area that will be available in the system by October 1985. All of Franklin and Grand Isle Counties are available for use today.

Establishment of a statewide, geographically referenced information system is a major undertaking requiring a significant attitude adjustment in the way information is viewed and utilized. Once information has been incorporated into the manipulative powers of the GIS, it must become the original document if the system is to remain current. Stored in an electronic format it can be reproduced, modified and displayed any number of times, each equivalent to or better than the initial data entry material. Able to be rapidly transmitted to widely dispersed areas, important information can be incorporated in critical resource decision processes at great distances from the original data collector's map case or file drawer. Within a GIS laborious tasks of merging complimentary data sets can be accomplished easily, enhancing the information base.

The remainder of this booklet will be devoted to a brief explanation of the information contained in the system and examples of its use. Examples of the type of output that can be obtained are shown at a state level for 1980 census information and at a county or watershed level for other information sources. The county used in the examples is Franklin County and the watershed selected is Stevens Brook. The Stevens Brook watershed is a subwatershed of the St. Albans Bay watershed and was selected because map examples would fit in this booklet. Much larger maps are of course possible and can be drawn in color. The location of the Stevens Brook watershed is shown in Figure 2.

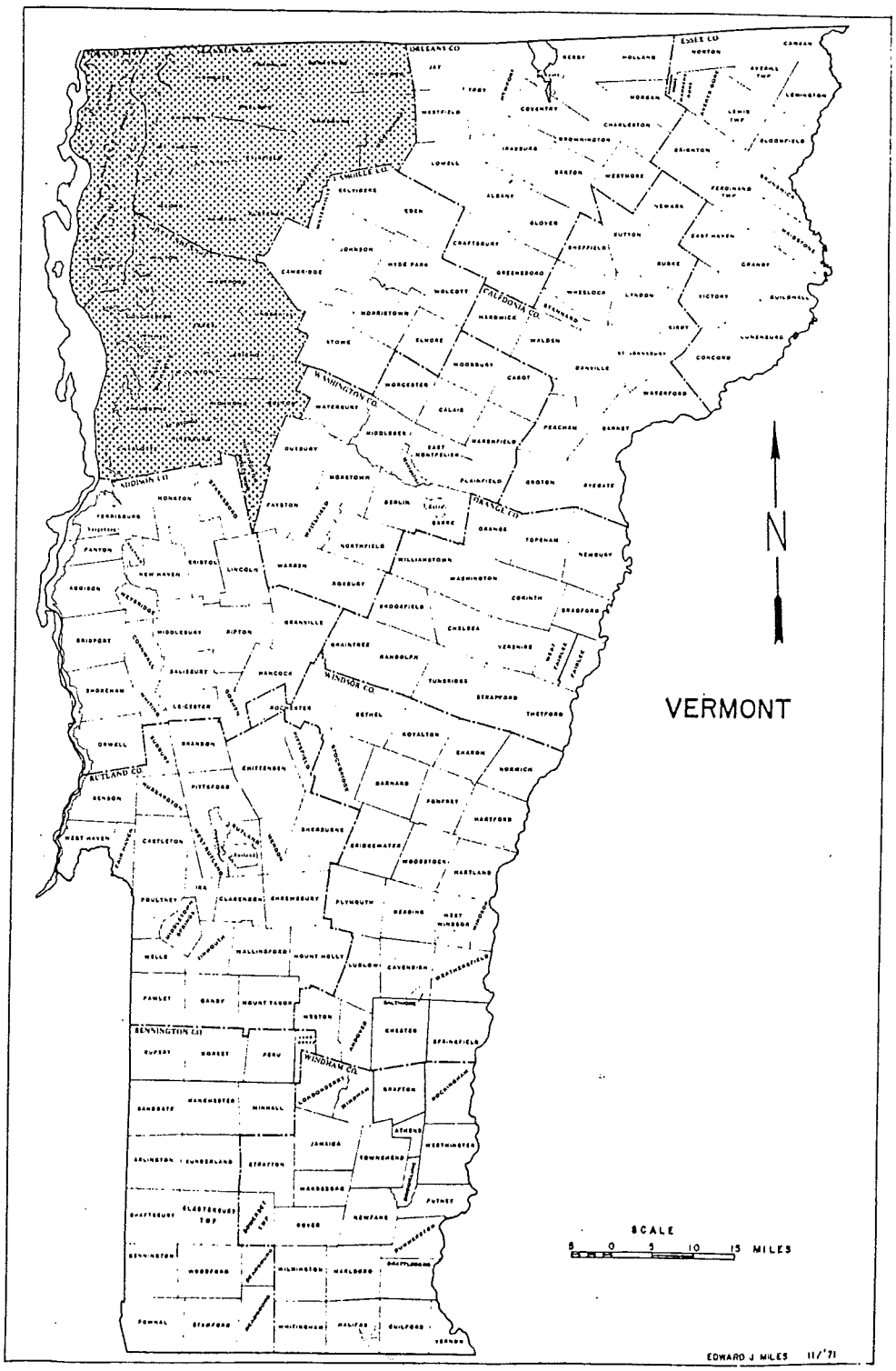


Figure 1. The three-county area available in the GIS.

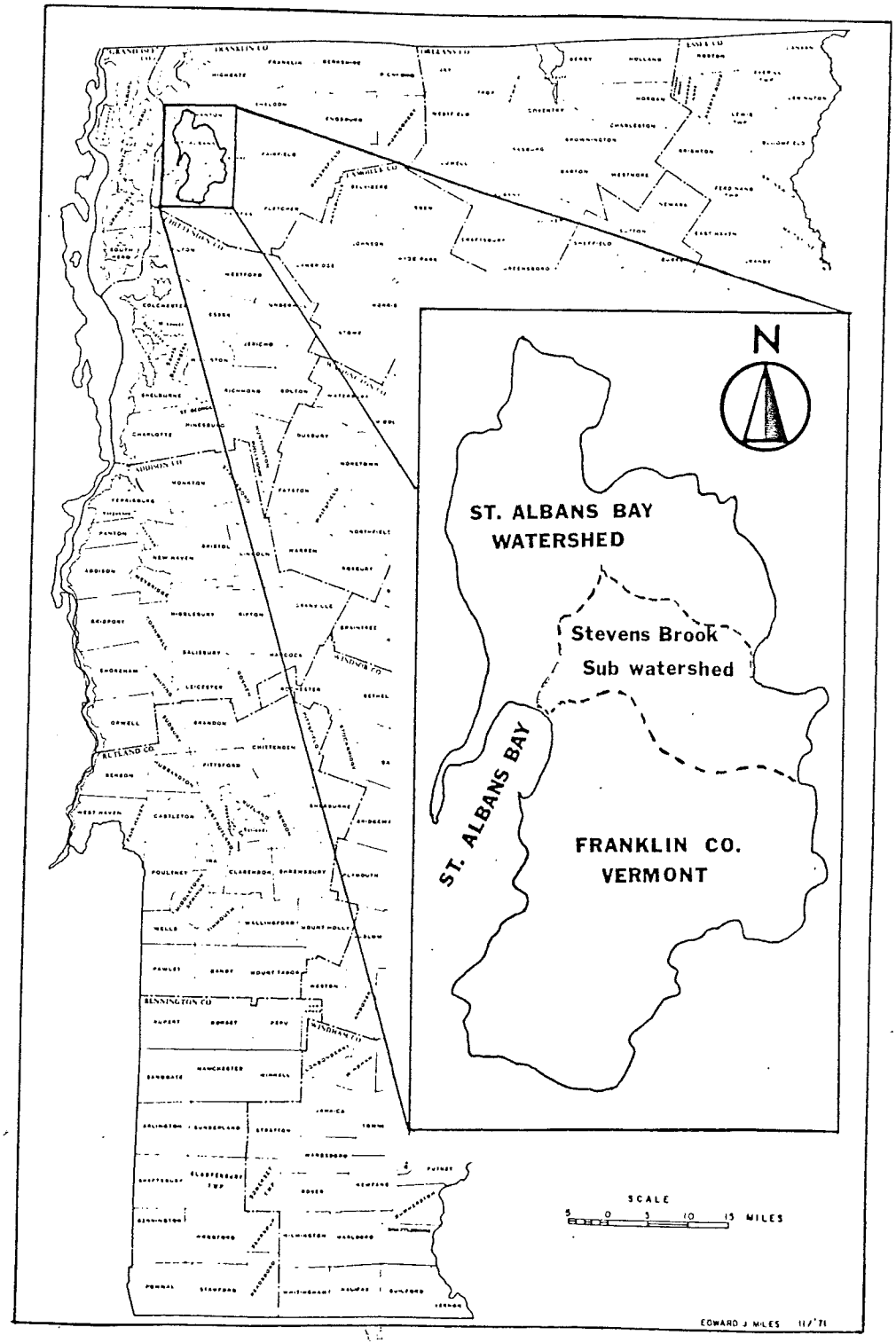


Figure 2. Location of the Stevens Brook subwatershed in Franklin County.

DATA ENTRY AND SOURCE

The map base for the Vermont GIS project is the Vermont orthophoto base map. This is the same product that is being delivered to every town in the state for parcel or tax mapping purposes. Certain pieces of information, such as road networks, are taken directly off the orthophoto. Other features such as soil types and watershed boundaries are registered to fit the orthophoto base map before they are entered into the computer. The original scale of 1:5,000 was too large for use in the project so reductions of the original maps at 1:20,000 were obtained.

There are four principal ways of entering data into the geographic information system. The first is the manual method where data is entered through a computer terminal keyboard or a digitizing tablet. (Digitizing is the entering and storage of X,Y coordinates that define a point or a line.) The second method involves the use of automated digitizing equipment, generally called scanners or line followers. Third is the purchase of pre-digitized data, usually from the U.S. government. The final method of data input involves the incorporation of digitally formatted imaging satellite data to develop a large area land cover map. Each of these methods of data entry are being used in the creation of the Vermont geographic information system.

The soils data layer was taken from the U.S. Soil Conservation Service's (SCS) detailed soil survey. To accurately enter this information soil boundary lines are transferred from the original soil survey aerial photos to the orthophoto base maps. Once the line work is completed and checked, it is entered into the GIS by both manual and automated digitizing techniques. In addition, each soil delineation or polygon is labeled and associated with its soil properties and interpretations contained in the SCS SOI-5 data base.

Transportation networks are manually digitized directly from the orthophoto sheets. Road class, susrface type and ownership is added from the Vermont Highway Department's town highway maps.

Major river watershed boundaries are first outlined on U.S.G.S. topographic maps by SCS personnel. These boundaries are then transferred to the orthophoto base maps and hand digitized into the GIS.

River and stream courses are entered in two separate ways. For large rivers, such as the Missisquoi, Lamoille and Winooski, where each bank is definable, the river is enclosed to make a polygon so that later area estimates can be made. All streams and rivers are digitized as a line so that length measurements can be made. The rivers and streams are labeled by contamination classes of A, B, or C as defined by the State Department of Water Resources.

Political boundaries are confined to town and county lines and are hand digitized using the U.S.G.S. topographic outlines as the source.

Topography (i.e. elevation, slope and aspect) is taken or derived from the U.S.G.S. Digital Terrain Tapes or DTTs. This information was purchased by the School of Natural Resources on computer tape. It was created from the U.S.G.S. 1:250,000 topographic map series with 100 ft. contours and thus is not suitable for small area analysis. It is quite adequate for defining elevation ranges and a large area synoptic views.

Land cover information for the state is obtained through computer processing of NASA's Thematic Mapper Satellite. This satellite with its much finer spatial and spectral resolution when compared to the LANDSAT MSS is capable of viewing down to a 1/4 acre cell. In the final classification of cover types resolutions of approximately 1 acre are expected.

Socio-economic information is limited in scope to the 1980 U.S. census information and can be presented in map form at the town level. Census information is obtained through the Center for Rural Studies at the University of Vermont.

As other projects use the GIS and as more monies become available, new information sources will be added. The geographic information system for Vermont is designed to be just that - a system for Vermont. With remote access to the GIS available through phone lines no portion of Vermont is excluded from potential use of this very powerful resource and planning tool. Combining inventories of soil, water, forest, wildlife and environmental hazards into a central system where merger with other information sources is both logical and economically viable.

The last part of this booklet is devoted to graphical and tabular examples of the type of products that can be obtained. Output from the system is limited only by the data available and the users knowledge and creativity. Questions about the GIS should be addressed to:

Vermont Geographic Information System
University of Vermont
School of Natural Resources
George D. Aiken Center
Burlington, VT 05405

Tel: (802) 656-2684

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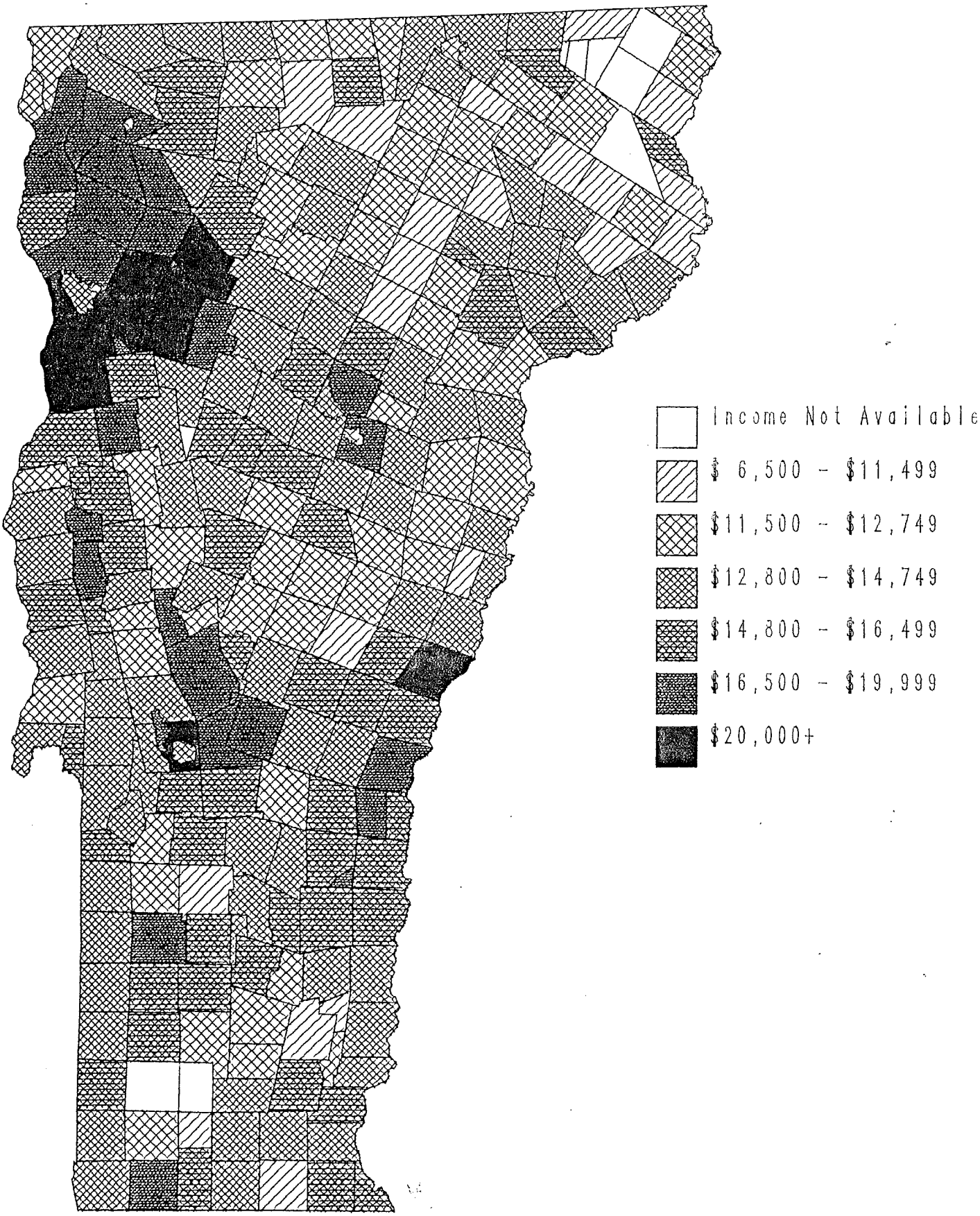


Fig. 3. VERMONT MEDIAN INCOME - 1980

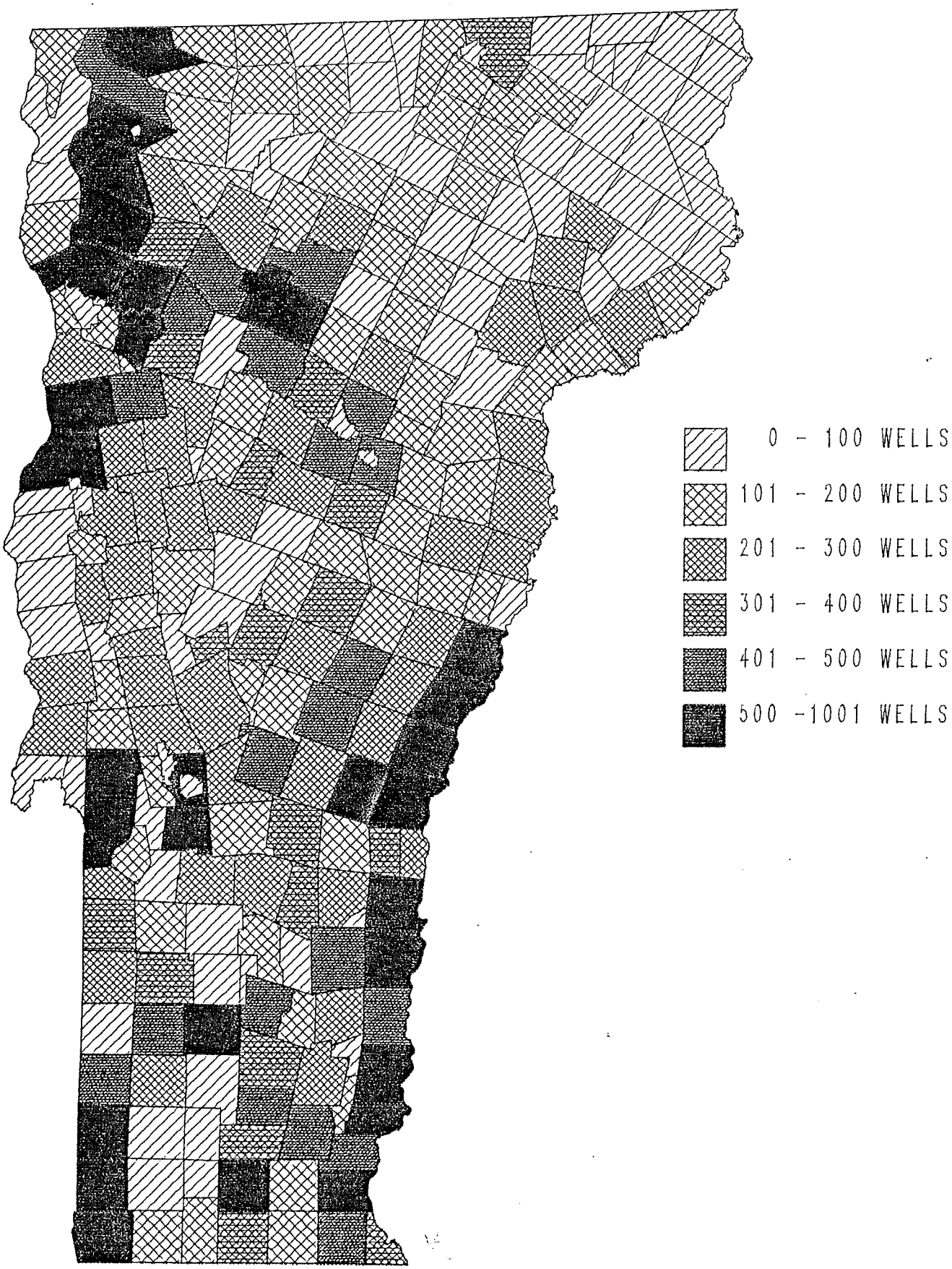


Fig. 4. HOUSING UNITS WITH INDIVIDUAL WELLS - 1980

Table 1.

SOIL SUMMARY FOR FRANKLIN COUNTY
SERIES/SLOPE AREAS IN HECTARES & ACRES WITH PERCENT BREAKDOWN

			HECTARES	ACRES	PERCENT
AU A	AU GRES LOAMY FINE SAND	00-06%	1,298.5	3,209.6	0.73
BE B	BELGRADE SILT LOAM	02-08%	843.8	2,085.0	0.47
BE C	BELGRADE SILT LOAM	08-15%	628.3	1,552.6	0.35
BE			1,472.1	3,637.7	0.83
BG	BINGHAMVILLE SILT LOAM		2,269.4	5,605.2	1.28
BR	BIRDSALL SILT LOAM		855.0	2,112.8	0.48
BX C	BUXTON SILT LOAM	08-15%	692.9	1,712.2	0.39
BX D	BUXTON SILT LOAM	15-25%	1,216.5	3,005.1	0.68
BX E	BUXTON SILT LOAM	25-45%	407.3	1,005.4	0.23
BX			2,316.8	5,724.7	1.30
CA A	CABOT STONY FINE SANDY LOAM	00-03%	534.0	1,319.5	0.30
CA B	CABOT STONY FINE SANDY LOAM	03-08%	566.2	1,399.2	0.32
CA			1,100.3	2,718.8	0.62
CB A	CABOT EXTREMELY STONY FINE SANDY LOAM	00-03%	1,796.2	4,433.5	1.01
CB B	CABOT EXTREMELY STONY FINE SANDY LOAM	03-15%	9,905.2	24,475.9	5.57
CB			11,701.5	28,914.3	6.58
CE	CARLISLE MUCK		2,474.3	5,114.1	1.39
CO B	COLTON GRAVELLY LOAMY SAND	02-08%	448.1	1,107.3	0.25
CO C	COLTON GRAVELLY LOAMY SAND	08-15%	427.0	1,055.1	0.24
CO D	COLTON GRAVELLY LOAMY SAND	15-25%	417.3	1,031.2	0.23
CO E	COLTON GRAVELLY LOAMY SAND	25-60%	281.6	695.7	0.16
CO			1,574.0	3,889.3	0.88
CP B	COPAKE FINE SANDY LOAM	02-08%	529.3	1,307.9	0.30
CV	COVINGTON CLAY		997.4	2,464.7	0.56
DE B	DEERFIELD LOAMY FINE SAND	00-08%	1,113.8	2,752.3	0.63
DE C	DEERFIELD LOAMY FINE SAND	08-15%	148.8	367.7	0.08
DE			1,262.6	3,120.0	0.71

Table 1 (cont.)

SOIL SUMMARY FOR FRANKLIN COUNTY
SERIES/SLOPE AREAS IN HECTARES & ACRES WITH PERCENT BREAKDOWN

			HECTARES	ACRES	PERCENT
ED A	ELDRIDGE LOAMY FINE SAND	00-03%	651.1	1,609.9	0.37
ED B	ELDRIDGE LOAMY FINE SAND	03-08%	517.7	1,279.1	0.29
ED C	ELDRIDGE LOAMY FINE SAND	08-15%	331.6	819.3	0.19
ED			1,500.3	3,707.3	0.84
EN A	ENOSBURG LOAMY FINE SAND	00-03%	1,032.6	2,551.5	0.58
EN B	ENOSBURG LOAMY FINE SAND	03-08%	435.3	1,073.2	0.25
EN			1,468.9	3,629.7	0.83
FA B	FARMINGTON LOAM-VERY ROCKY	03-08%	311.3	769.3	0.18
FA C	FARMINGTON LOAM-VERY ROCKY	08-15%	500.0	1,235.4	0.28
FA			811.3	2,004.7	0.46
FM C	FARMINGTON-ROCK OUTCROP COMPLEX	08-15%	1,727.5	4,268.7	0.97
FM D	FARMINGTON-ROCK OUTCROP COMPLEX	15-60%	2,000.0	4,942.0	1.12
FM			3,727.5	9,210.7	2.10
GE A	GEORGIA STONY LOAM	00-03%	867.6	2,143.8	0.49
GE B	GEORGIA STONY LOAM	03-08%	2,052.6	5,072.1	1.15
GE C	GEORGIA STONY LOAM	08-15%	387.1	956.5	0.22
GE			3,307.4	8,172.5	1.86
GR B	GEORGIA EXTREMELY STONY LOAM	03-08%	308.4	762.1	0.17
GR C	GEORGIA EXTREMELY STONY LOAM	08-15%	42.4	104.7	0.02
GR			350.8	866.8	0.20
HA	HADLEY SILT LOAM		270.6	668.6	0.15
HB A	HINESBURG LOAMY FINE SAND	00-03%	115.5	285.4	0.06
HB B	HINESBURG LOAMY FINE SAND	03-08%	122.8	303.4	0.07
HB C	HINESBURG LOAMY FINE SAND	08-15%	55.4	137.0	0.03
HB D	HINESBURG LOAMY FINE SAND	15-25%	154.1	380.9	0.09
HB E	HINESBURG LOAMY FINE SAND	25-60%	107.4	265.3	0.06
HB			555.2	1,372.0	0.31
KB A	KINGSBURY CLAY	00-03%	1,060.2	2,619.8	0.60
KB B	KINGSBURY CLAY	03-08%	77.9	192.4	0.04
KB			1,138.1	2,812.3	0.64

Table 1 (cont.)

SOIL SUMMARY FOR FRANKLIN COUNTY
SERIES/SLOPE AREAS IN HECTARES & ACRES WITH PERCENT BREAKDOWN

			HECTARES	ACRES	PERCENT
LE	LIMERICK SILT LOAM		2,146.2	5,303.3	1.21
LO B	LORDSTOWN LOAM	03-08%	939.9	2,322.4	0.53
LO C	LORDSTOWN LOAM	08-15%	651.1	1,603.9	0.37
LO D	LORDSTOWN LOAM	15-25%	97.2	240.1	0.05
LO			1,688.1	4,171.4	0.95
LR C	LORDSTOWN-ROCK OUTCROP COMPLEX	05-15%	1,050.2	2,595.0	0.59
LR D	LORDSTOWN-ROCK OUTCROP COMPLEX	15-25%	757.1	1,870.8	0.43
LR E	LORDSTOWN-ROCK OUTCROP COMPLEX	25-60%	446.4	1,103.0	0.25
LR			2,253.7	5,563.8	1.27
LY	LYONS STONY LOAM		932.4	2,304.1	0.52
MA	MARSH		664.8	1,642.6	0.37
ME A	MASSENA STONY LOAM	00-03%	3,691.2	9,121.1	2.08
ME B	MASSENA STONY LOAM	03-08%	1,034.1	2,555.2	0.58
ME			4,725.3	11,676.3	2.66
MN A	MASSENA EXTREMELY STONY LOAM	00-06%	1,613.7	3,987.3	0.91
MS A	MISSISQUOI LOAMY SAND	00-03%	931.2	2,300.9	0.52
MS B	MISSISQUOI LOAMY SAND	03-08%	1,066.6	2,635.5	0.60
MS C	MISSISQUOI LOAMY SAND	08-15%	1,085.9	2,683.1	0.61
MS D	MISSISQUOI LOAMY SAND	15-25%	495.9	1,225.4	0.28
MS E	MISSISQUOI LOAMY SAND	25-60%	412.2	1,018.4	0.23
MS			3,991.7	9,863.4	2.24
MU B	MUNSON SILT LOAM	03-08%	3,547.4	8,765.6	1.99
MU C	MUNSON SILT LOAM	08-15%	1,107.8	2,737.5	0.62
MU			4,655.2	11,503.1	2.62
OD	ONDAWA VARIANT SILT LOAM		726.8	1,795.9	0.41
PA	PEACHAM STONY SOILS		879.5	2,173.2	0.49
PE B	PERU STONY FINE SANDY LOAM	03-08%	2,850.8	7,044.3	1.60
PE C	PERU STONY FINE SANDY LOAM	08-15%	3,504.5	8,659.7	1.97
PE D	PERU STONY FINE SANDY LOAM	15-25%	359.5	888.3	0.20
PE			6,714.8	16,592.4	3.78

Table 1 (cont.)

SOIL SUMMARY FOR FRANKLIN COUNTY
SERIES/SLOPE AREAS IN HECTARES & ACRES WITH PERCENT BREAKDOWN

			HECTARES	ACRES	PERCENT
PR C	PERU EXTREMELY STONY FINE SANDY LOAM	03-15%	9,200.3	22,734.0	5.17
PR D	PERU EXTREMELY STONY FINE SANDY LOAM	15-25%	4,463.0	11,028.0	2.51
PR			13,663.3	33,762.0	7.68
PU	PODUNK VARIANT SILT LOAM		514.2	1,270.7	0.29
RA B	RAYNHAM SILT LOAM	03-08%	1,585.8	3,918.6	0.89
RO E	ROCK OUTCROP-WOODSTOCK COMPLEX	20-60%	925.0	2,285.7	0.52
RU	RUMNEY VARIANT SILT LOAM		2,013.1	4,974.4	1.13
SA A	ST. ALBANS SLATY LOAM	00-03%	236.0	583.2	0.13
SA B	ST. ALBANS SLATY LOAM	03-08%	986.1	2,435.6	0.55
SA C	ST. ALBANS SLATY LOAM	08-15%	325.3	803.9	0.18
SA			1,547.5	3,823.7	0.87
SB B	ST. ALBANS VERY STONY LOAM	02-08%	78.5	193.9	0.04
SB C	ST. ALBANS VERY STONY LOAM	08-15%	61.9	152.9	0.03
SB D	ST. ALBANS VERY STONY LOAM	15-25%	102.8	254.0	0.06
SB E	ST. ALBANS VERY STONY LOAM	25-60%	37.7	93.2	0.02
SB			280.9	694.0	0.16
SC A	SCANTIC SILT LOAM	00-03%	3,136.2	7,749.6	1.76
SC B	SCANTIC SILT LOAM	03-08%	331.7	819.6	0.19
SC			3,467.9	8,569.2	1.95
ST B	STOWE STONY FINE SANDY LOAM	03-08%	300.9	743.6	0.17
ST C	STOWE STONY FINE SANDY LOAM	08-15%	452.3	1,117.6	0.25
ST D	STOWE STONY FINE SANDY LOAM	15-25%	339.0	837.7	0.19
ST			1,092.2	2,698.8	0.61
SW C	STOWE EXTREMELY STONY FINE SANDY LOAM	05-15%	459.8	1,136.1	0.26
SW D	STOWE EXTREMELY STONY FINE SANDY LOAM	15-25%	1,355.2	3,348.8	0.76
SW			1,815.0	4,484.9	1.02
SY E	STOWE STONY SOILS	25-60%	2,447.1	6,045.8	1.38
TM	TERRIC MEDISAPRISTS		1,299.7	3,211.6	0.73

Table 1 (cont.)

SOIL SUMMARY FOR FRANKLIN COUNTY
SERIES/SLOPE AREAS IN HECTARES & ACRES WITH PERCENT BREAKDOWN

			HECTARES	ACRES	PERCENT
TW B	TUNBRIDGE-WOODSTOCK FINE SANDY LOAMS-VERY ROCKY	03-08%	1,696.3	4,191.4	0.95
TW C	TUNBRIDGE-WOODSTOCK FINE SANDY LOAMS-VERY ROCKY	08-15%	3,569.1	8,815.8	2.01
TW D	TUNBRIDGE-WOODSTOCK FINE SANDY LOAMS-VERY ROCKY	15-25%	1,209.4	2,983.5	0.68
TW			6,473.8	15,995.7	3.64
WA	WALLKILL SILT LOAM		386.1	954.1	0.22
WH	WAREHAM LOAMY FINE SAND		1,026.9	2,537.4	0.58
WR A	WESTBURY STONY FINE SANDY LOAM	00-03%	743.1	1,835.3	0.42
WR B	WESTBURY STONY FINE SANDY LOAM	03-08%	3,291.1	8,132.3	1.85
WR C	WESTBURY STONY FINE SANDY LOAM	08-15%	876.0	2,164.6	0.49
WR			4,910.2	12,133.2	2.76
WS A	WINDSOR LOAMY FINE SAND	00-03%	1,464.5	3,618.8	0.82
WS B	WINDSOR LOAMY FINE SAND	03-08%	1,685.9	4,165.9	0.95
WS C	WINDSOR LOAMY FINE SAND	08-15%	1,217.2	3,007.8	0.68
WS D	WINDSOR LOAMY FINE SAND	15-25%	770.7	1,904.5	0.43
WS E	WINDSOR LOAMY FINE SAND	25-60%	14,873.9	36,753.3	8.36
WS			20,012.3	49,450.3	11.25
WT	WINOOSKI SILT LOAM		628.9	1,554.0	0.35
WX C	WOODSTOCK-ROCK OUTCROP COMPLEX	08-15%	8,537.3	21,095.7	4.80
WX D	WOODSTOCK-ROCK OUTCROP COMPLEX	15-25%	15,022.3	37,120.1	8.45
WX E	WOODSTOCK-ROCK OUTCROP COMPLEX	25-60%	18,237.6	45,065.0	10.25
WX			41,797.1	103,280.8	23.50
			177,859.7	439,491.3	100.00

Table 2. Franklin County Transportation Network Summary

FRANKLIN COUNTY ROAD CLASSIFICATION SUMMARY*

Road Classification	Kilometers	Miles
Private Road	21.55	13.39
Class 1 Town Highway	11.58	7.19
Class 2 Town Highway	267.18	166.02
Class 3 Town Highway	944.05	586.60
Class 4 Town Highway	86.63	53.83
State Numbered Route	285.08	177.14
State Forest Highway	5.89	3.66
Interstate/U.S. Numbered Highway	88.65	55.08
Unclassified/Unknown	207.84	129.14
Railroad	147.76	91.81

FRANKLIN COUNTY ROAD & RAILROAD LENGTHS BY SURFACE TYPE*

Road Surface	Kilometers	Miles
Bituminous/Macadam/Concrete/Brick/Block	633.90	424.95
Surface Treated Gravel	127.10	78.98
Gravel	634.81	394.45
Soil Surface (Second class gravel)	132.05	82.05
Graded and Drained Earth	34.93	21.71
Unimproved Earth	21.85	13.57
Primitive	44.67	27.76
Unclassified/Unknown	239.12	148.58
Railroad	147.76	91.81

FRANKLIN COUNTY TRANSPORTATION AREA SUMMARY*

Interstate	57,712,367.24 sq. ft. using an average 433' width
Other Roads	303,606,230.40 sq. ft. using an average 49.5' width
Railroads	25,821,840.00 sq. ft. using an average 50' width

*All distances are measured in a horizontal plane.

Table 3. Franklin County Watershed Area Summary

Cataloging Unit	Watershed	Hectares	Acres
02010005	0200	216.09	533.96
02010005	0300	19,390.55	47,914.05
02010005	0500	2,949.24	7,237.57
02010005	0600	6,703.09	16,563.33
02010005	0701	2,360.89	5,833.76
02010005	0702	5,250.15	12,973.12
02010005	0703	3,771.56	9,319.53
02010005		40,641.57	100,425.33
02010007	0100	4.87	12.03
02010007	0200	19,369.74	47,862.64
02010007	0300	11,609.41	28,686.85
02010007	0401	7,492.23	18,513.29
02010007	0402	15,277.33	37,750.29
02010007	0500	29,454.06	72,780.99
02010007	0601	18,998.73	46,945.86
02010007	0602	4,948.56	12,227.89
02010007	0700	19,479.99	48,135.05
02010007		126,634.92	312,914.89
		167,276.49	413,340.21

Table 4. FRANKLIN COUNTY STREAM LENGTHS
BREAK DOWN BY CONTAMINATION CLASS

Contamination Class	Tile	Kilometers	Miles
A	0202	1.79	1.111
A	0203	0.59	0.368
A	0301	7.50	4.662
A	0401	28.28	17.575
A	0501	5.22	3.245
A		43.39	26.961
B	0101	18.67	11.602
B	0102	23.96	14.886
B	0103	11.70	7.269
B	0201	417.45	259.392
B	0202	368.04	228.692
B	0203	241.31	149.941
B	0301	307.74	191.218
B	0302	448.97	278.979
B	0303	86.78	53.925
B	0401	403.28	250.584
B	0402	258.88	160.860
B	0501	17.26	10.725
B	0502	13.15	8.172
B		2,617.19	1,626.246
C	0201	4.25	2.643
C	0202	13.77	8.554
C	0203	1.03	0.640
C	0301	3.25	2.019
C	0302	2.96	1.839
C	0401	5.49	3.409
C		30.75	19.104
		2,691.33	1,672.311

Figure 5. Detailed soils map for the Stevens Brook Watershed

SOILS MAP OF STEVENS BROOK WATERSHED

Table 5. Soil Summary for Stevens Brook Watershed.

ACREAGE AND PROPORTIONAL EXTENT OF THE SOILS

Map Symbol	Soil name	Acres	Percent
AuA	AU GRES LOAMY FINE SAND, 00 to 06 percent slopes	18	0.2
Bs	BINGHAMVILLE SILT LOAM	105	1.1
Br	BIRDSALL SILT LOAM	82	0.9
CbA	CABOT EXTREMELY STONY FINE SANDY LOAM, 00 to 03 percent slopes	11	0.1
CbB	CABOT EXTREMELY STONY FINE SANDY LOAM, 03 to 15 percent slopes	15	0.2
Ce	CARLISLE MUCK	184	2.0
CrB	CORTLAND FINE SANDY LOAM, 02 to 08 percent slopes	251	2.7
Cv	COVINGTON CLAY	166	1.8
DeB	DEERFIELD LOAMY FINE SAND, 00 to 08 percent slopes	24	0.3
EdA	ELDRIDGE LOAMY FINE SAND, 00 to 03 percent slopes	22	0.2
EdB	ELDRIDGE LOAMY FINE SAND, 03 to 08 percent slopes	4	(1)
EnA	ENOSBURG LOAMY FINE SAND, 00 to 03 percent slopes	214	2.3
EnB	ENOSBURG LOAMY FINE SAND, 03 to 08 percent slopes	76	0.8
FaB	FARMINGTON LOAM-VERY ROCKY, 03 to 08 percent slopes	164	1.8
FaC	FARMINGTON LOAM-VERY ROCKY, 08 to 15 percent slopes	97	1.0
FmC	FARMINGTON-ROCK OUTCROP COMPLEX, 08 to 15 percent slopes	441	4.7
FmD	FARMINGTON-ROCK OUTCROP COMPLEX, 15 to 60 percent slopes	156	1.7
GeA	GEORGIA STONY LOAM, 00 to 03 percent slopes	219	2.3
GeB	GEORGIA STONY LOAM, 03 to 08 percent slopes	1008	10.8
GeC	GEORGIA STONY LOAM, 08 to 15 percent slopes	163	1.7
GrB	GEORGIA EXTREMELY STONY LOAM, 03 to 08 percent slopes	169	1.8
HbA	HINESBURG LOAMY FINE SAND, 00 to 03 percent slopes	13	0.1
KbA	KINGSBURY CLAY, 00 to 03 percent slopes	809	8.7
KbB	KINGSBURY CLAY, 03 to 08 percent slopes	41	0.4
Le	LIMERICK SILT LOAM	6	0.1
LoB	LORDSTOWN LOAM, 03 to 08 percent slopes	20	0.2
LoC	LORDSTOWN LOAM, 08 to 15 percent slopes	11	0.1
LrC	LORDSTOWN-ROCK OUTCROP COMPLEX, 05 to 15 percent slopes	8	0.1
LrD	LORDSTOWN-ROCK OUTCROP COMPLEX, 15 to 25 percent slopes	64	0.7
LrE	LORDSTOWN-ROCK OUTCROP COMPLEX, 25 to 60 percent slopes	46	0.5
Ly	LYONS STONY LOAM	143	1.5
MaA	MASSENA STONY LOAM, 00 to 03 percent slopes	1453	15.6
MaB	MASSENA STONY LOAM, 03 to 08 percent slopes	345	3.7
MnA	MASSENA EXTREMELY STONY LOAM, 00 to 06 percent slopes	621	6.6
MsB	MISSISQUOI LOAMY SAND, 03 to 08 percent slopes	27	0.3
MsD	MISSISQUOI LOAMY SAND, 15 to 25 percent slopes	13	0.1
PeB	PERU STONY FINE SANDY LOAM, 03 to 08 percent slopes	16	0.2
PeC	PERU STONY FINE SANDY LOAM, 08 to 15 percent slopes	58	0.6
PeD	PERU STONY FINE SANDY LOAM, 15 to 25 percent slopes	21	0.2
PrC	PERU EXTREMELY STONY FINE SANDY LOAM, 03 to 15 percent slopes	75	0.8
PrD	PERU EXTREMELY STONY FINE SANDY LOAM, 15 to 25 percent slopes	195	2.1
Pu	PODUNK VARIANT SILT LOAM	43	0.5
RaB	RAYNHAM SILT LOAM, 03 to 08 percent slopes	7	0.1
Ru	RUMNEY VARIANT SILT LOAM	72	0.8
SaA	ST. ALBANS SLATY LOAM, 00 to 03 percent slopes	53	0.6
SaB	ST. ALBANS SLATY LOAM, 03 to 08 percent slopes	729	7.8
SaC	ST. ALBANS SLATY LOAM, 08 to 15 percent slopes	41	0.4
SbB	ST. ALBANS VERY STONY LOAM, 02 to 08 percent slopes	74	0.8
SbC	ST. ALBANS VERY STONY LOAM, 08 to 15 percent slopes	32	0.3
SbD	ST. ALBANS VERY STONY LOAM, 15 to 25 percent slopes	12	0.1
SbE	ST. ALBANS VERY STONY LOAM, 25 to 60 percent slopes	80	0.9
ScA	SCANTIC SILT LOAM, 00 to 03 percent slopes	151	1.6
StD	STOWE STONY FINE SANDY LOAM, 15 to 25 percent slopes	1	(1)
SvC	STOWE EXTREMELY STONY FINE SANDY LOAM, 05 to 15 percent slopes	4	(1)
SvD	STOWE EXTREMELY STONY FINE SANDY LOAM, 15 to 25 percent slopes	0	(1)
SvE	STOWE STONY SOILS, 25 to 60 percent slopes	37	0.4
Tm	TERRIC MEDISAPRISTS	84	0.9
TwB	TUNBRIDGE-WOODSTOCK FINE SANDY LOAMS-VERY ROCKY, 03 to 08 percent slopes	4	(1)
TwC	TUNBRIDGE-WOODSTOCK FINE SANDY LOAMS-VERY ROCKY, 08 to 15 percent slopes	21	0.2
Wh	WAREHAM LOAMY FINE SAND	26	0.3
WrB	WESTBURY STONY FINE SANDY LOAM, 03 to 08 percent slopes	6	0.1
WsB	WINDSOR LOAMY FINE SAND, 03 to 08 percent slopes	3	(1)
WxC	WOODSTOCK-ROCK OUTCROP COMPLEX, 08 to 15 percent slopes	39	0.4
WxD	WOODSTOCK-ROCK OUTCROP COMPLEX, 15 to 25 percent slopes	153	1.6
WxE	WOODSTOCK-ROCK OUTCROP COMPLEX, 25 to 60 percent slopes	71	0.8
W	WATER	23	0.2
	Total	9340	100.0

1) Less than 0.1 percent.

Table 6. Summary of Soil Capability Classes and Subclasses for Stevens Brook Watershed.

CAPABILITY CLASSES AND SUBCLASSES

Class	Total acrease	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problems (s)
		Acres	Acres	Acres
I	53	---	---	---
II	2286	2012	261	13
III	3477	466	2981	30
IV	1129	663	466	---
V	11	---	---	11
VI	366	153	82	131
VII	1199	273	---	926
VIII	---	---	---	---

Table 7. Example of Agricultural Soil Potential Summaries

AGRICULTURAL SOIL POTENTIAL SUMMARY OF FRANKLIN COUNTY

Agricultural Soil Potential	Acres	Percent
High	45,909.4	10.4
Good	93,954.5	21.4
Other	299,627.5	68.2

AGRICULTURAL SOIL POTENTIAL SUMMARY OF STEVENS BROOK

Agricultural Soil Potential	Acres	Percent
High	4,425.9	47.4
Good	1,478.7	15.8
Other	3,435.4	36.8

Figure 6. Map of soil agricultural potential for Stevens Brook Watershed.

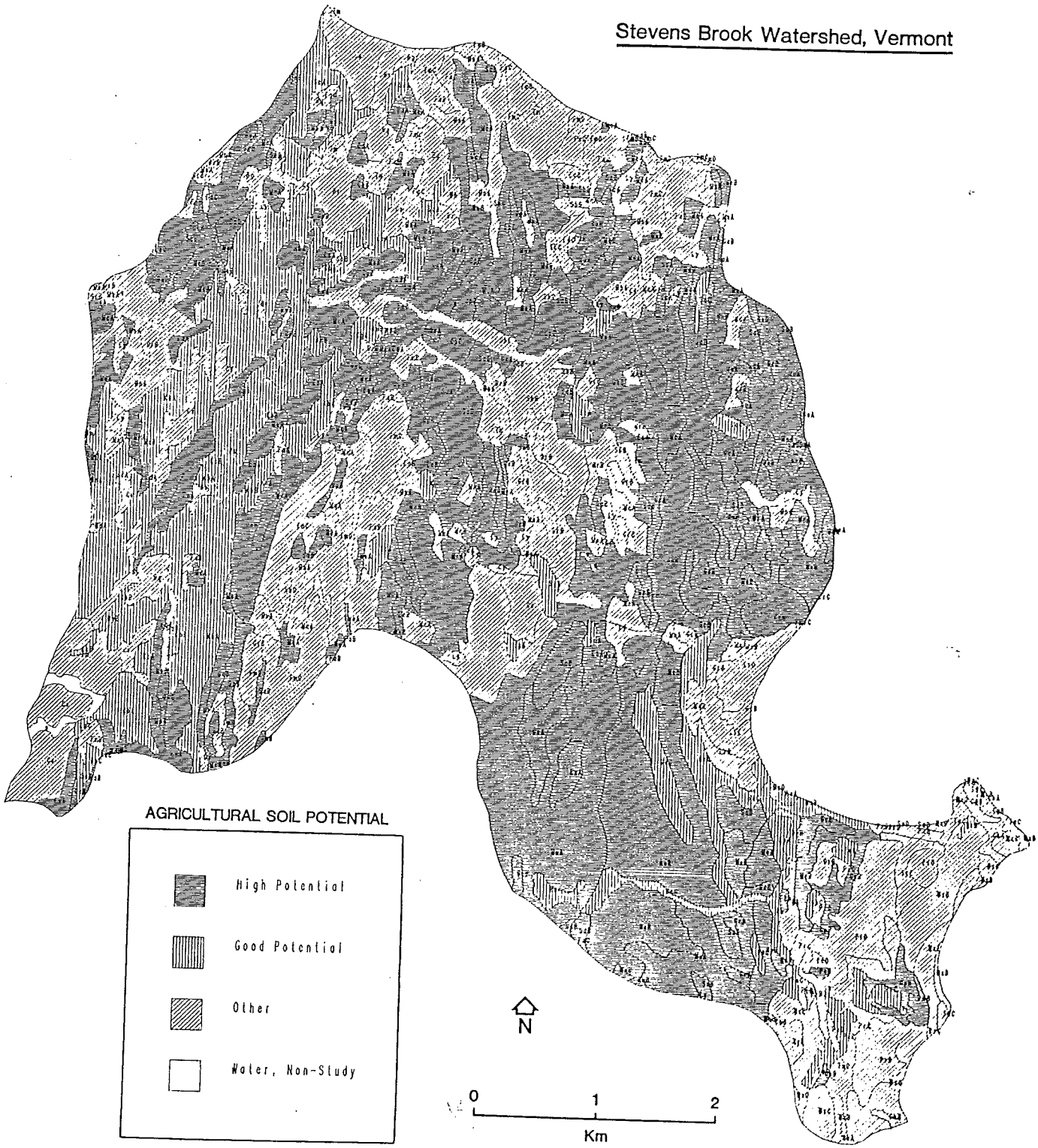


Figure 7. Map of soil hydrologic units for Stevens Brook Watershed.

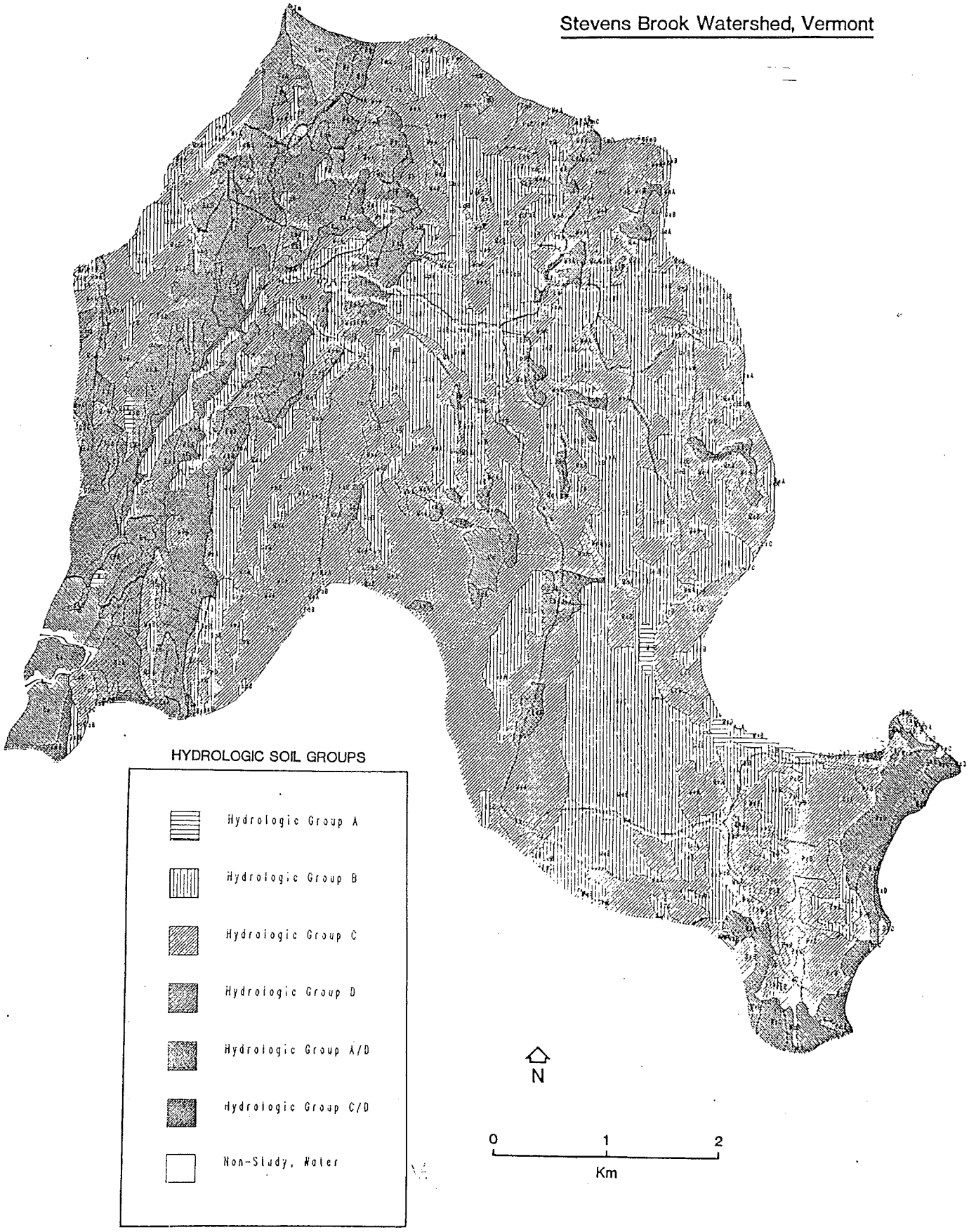
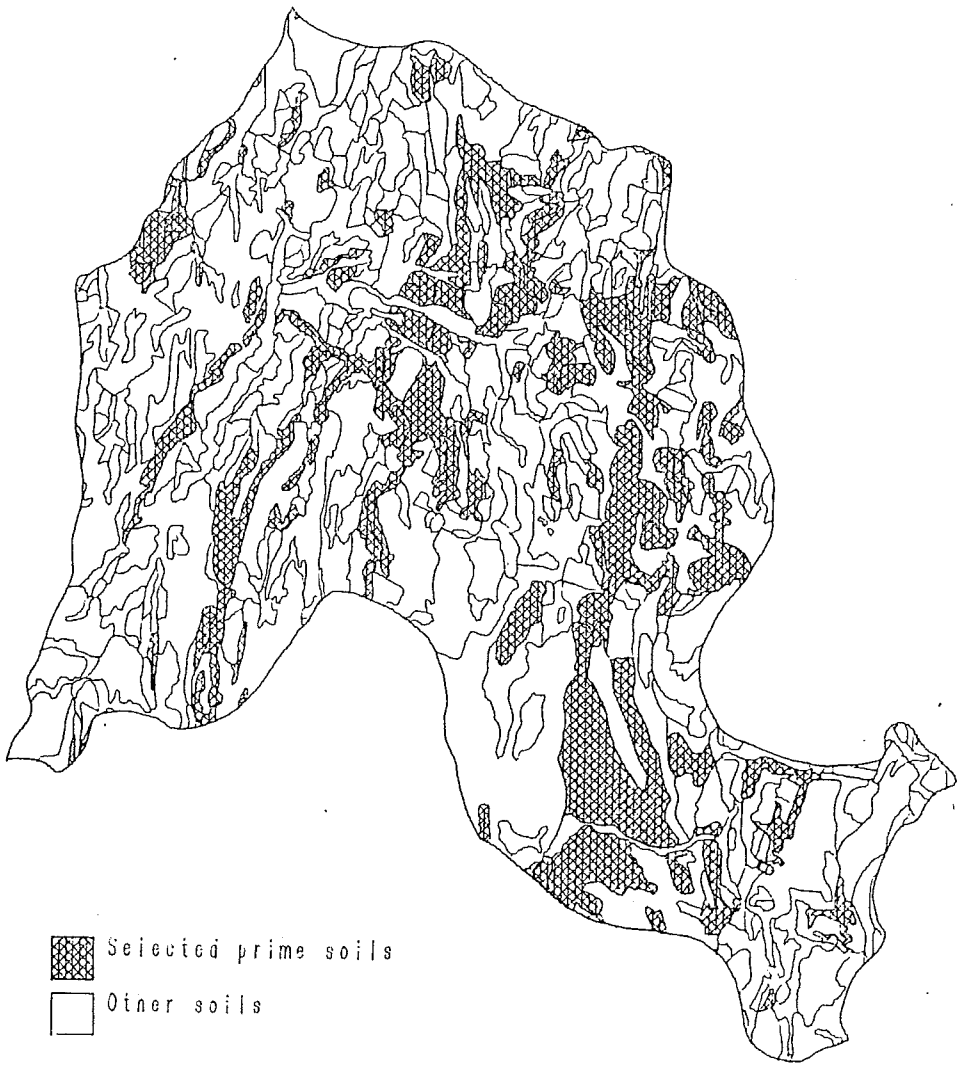


Table 8. Summary of Selected Subset of Prime Agricultural Soils

Soil Type		Franklin Co. (Acres)	Stevens Brook Watershed (Acres)
CpB	Copake Fine Sandy Loam 2-8% slopes	1,307.9	251
GeB	Georgia Stony Loam 3-8% slopes	5,072.1	1,008
LoB	Lordstown Loam 3-8% slopes	2,322.4	20
SaB	St. Albans Slaty Loam 3-8% slopes	2,436.6	729
StB	Stowe Stony Fine Sandy Loam 3-8% slopes	743.6	--
	Total	11,882.6	2,008

Figure 8. Map of Selected Prime Agricultural Soils for the Stevens Brook Watershed.

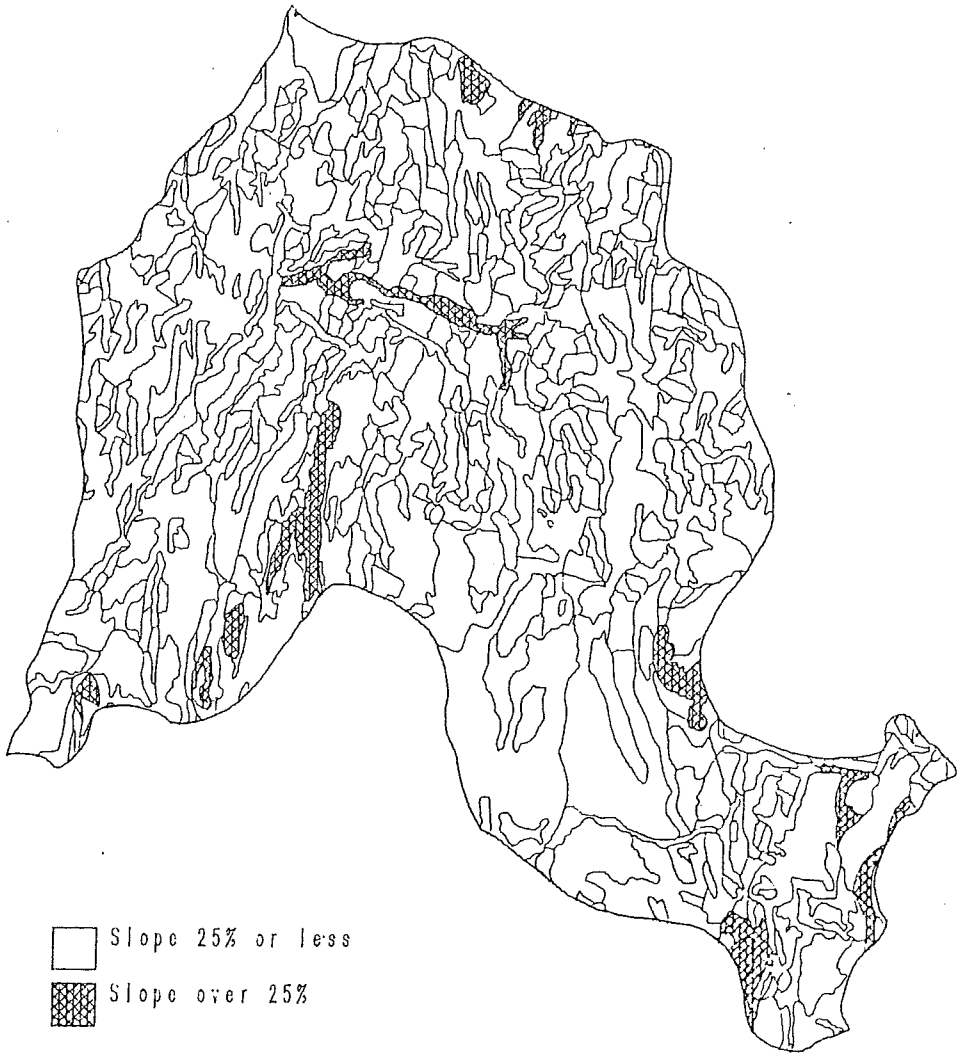


SOILS MAP OF STEVENS BROOK WATERSHED

Table 9. Acreage Summary of Soils with Slopes > 25%

Soil Type		Franklin County	Stevens Brook Watershed
BxE	Buxton Silt Loam 25-45% slope	1005.4	---
CoE	Colton Gravelly Loam Sand 25-60% slope	695.7	---
FmD	Farmington-Rock Outcrop Complex 15-60% slope	4,942.0	156
HbE	Hinesburg Loamy Fine Sand 25-60% slope	265.3	---
LrE	Lordstown-Rock Outcrop Complex 25-60% slope	1,103.0	46
MsE	Missisquoi Loamy Sand 25-60% slope	1,013.4	---
RoE	Rock Outcrop-Woodstock complex 20-60% slope	2,285.7	---
SbE	St. Albans Very Stony Loam 25-60% slope	93.2	80
SyE	Stowe Stony Soils 25-60% slope	6,045.8	37
WxE	Woodstock-Rock Outcrop Complex 25-60% slope	45,065.0	71
	Total	62,514.5	390

Figure 9. Map of soils with slopes >25% in the Stevens Brook Watershed.

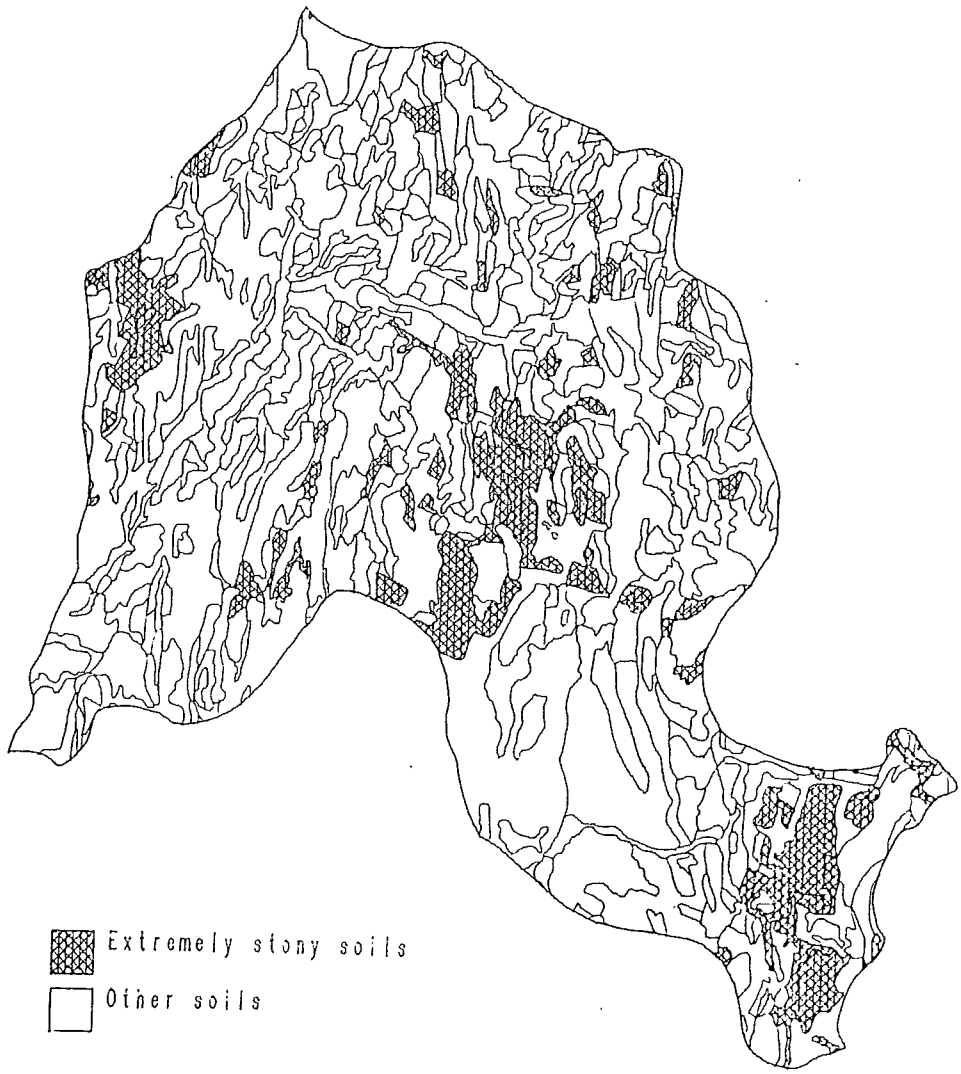


SOILS MAP OF STEVENS BROOK WATERSHED

Table 10. Acreage Summary of Extremely Stony Soils

Soil Type	Franklin County	Stevens Brook Watershed
CbA&B Cabot Extremely Stony Fine Sandy Loam	28,909.4	26
GrA&B Georgia Extremely Stony Loam	866.8	169
MnA Massena Extremely Stony Loam	3,987.3	621
PrC&D Peru Extremely Stony Fine Sandy Loam	33,762.0	270
Sb series St. Albans Vey Stony Loam	694.0	198
Sw series Stowe Extremely Stony Fine Sandy Loam	4,484.8	4
Total	72,704.3	1,288

Figure 10. Map of extremely stony soils in the Stevens Brook Watershed.

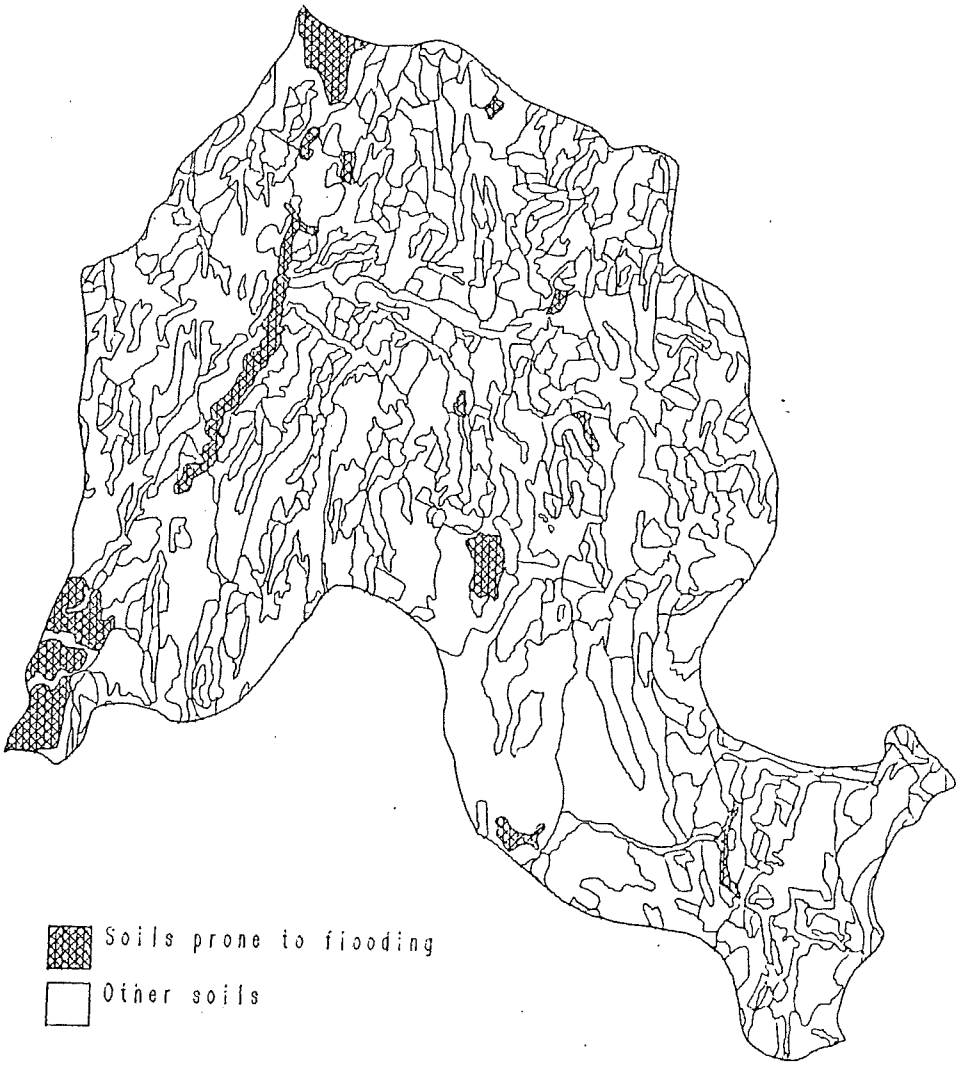


SOILS MAP OF STEVENS BROOK WATERSHED

Table 11. Acreage Summary of Soils That are Prone to Flood.

Soil Type	Franklin County	Stevens Brook Watershed
Ce Carlisle Muck	5,116.1	184
Ha Hadley Silt Loam	668.6	---
Marsh	1,642.6	---
Le Limerick Silt Loam	5,303.3	6
Od Ondawa Varian Silt Loam	1,795.9	---
Pu Podunk Variant Silt Loam	1,270.7	43
Ru Rumney Variant Silt Loam	4,974.4	72
Tm Terrio Medisaprists	3,211.6	84
Wa Wallkill Silt Loam	954.0	---
Wt Winooski Silt Loam	1,554.0	---
Total	26,491.2	389

Figure 11. Map of soils prone to flood in the Stevens Brook Watershed.



SOILS MAP OF STEVENS BROOK WATERSHED

Table 12. Calculation of Erosion Potential.

Potential erosion ranges are based on:

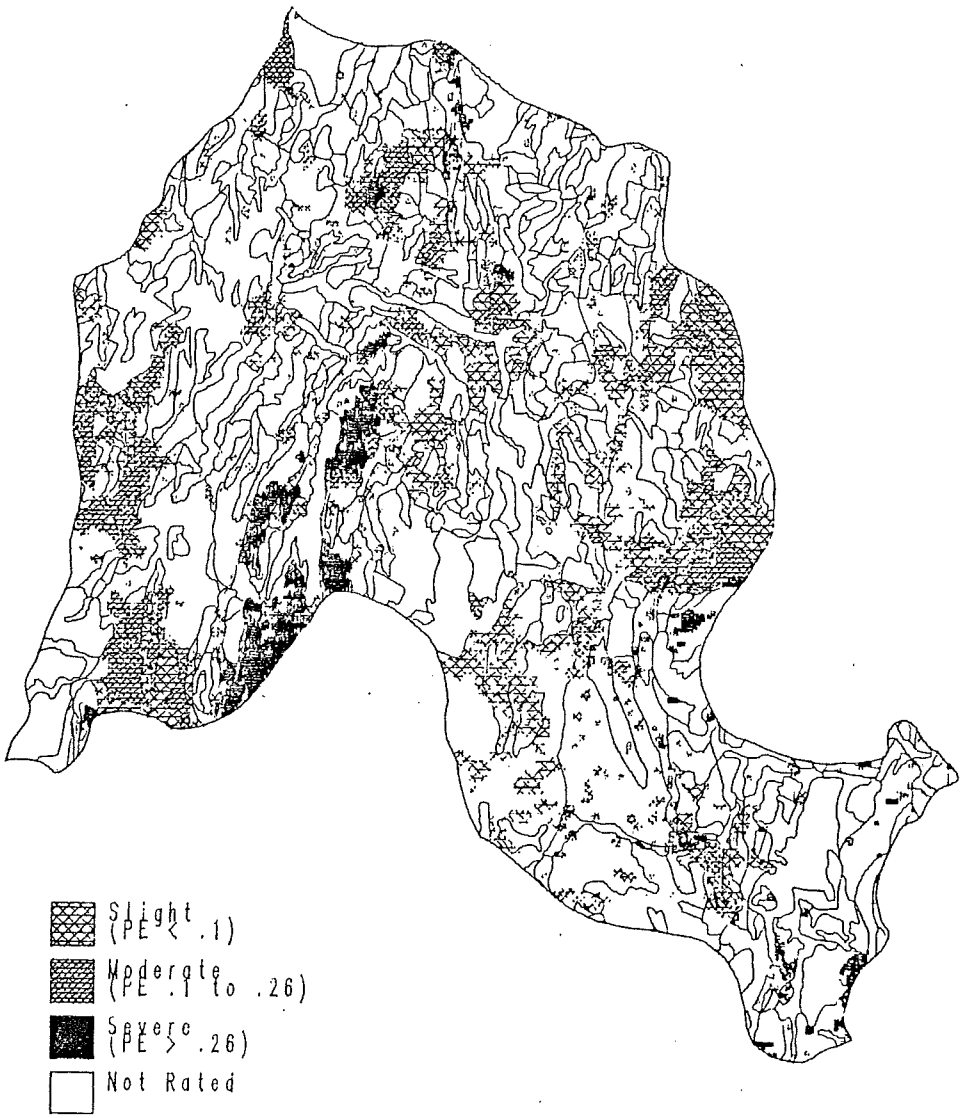
Potential erosion (PE) = K X LS where
K = soil erodibility factor
LS = slope length factor for estimating soil losses

The resulting erosion ranges are:
PE < .1 - slight
PE .1-.26 - moderate
PE > .26 - severe

Erosion Potential by Cover Type for Stevens Brook Watershed

Land Cover Type	Potential Erosion Ranges			
	Slight (PE < .1)	Moderate (PE .1-.26)	Severe (PE > .26)	Not Rated
	Acres	Acres	Acres	Acres
Hay and alfalfa	459	244	62	103
Bare soil and cornfields	591	415	254	341
Grassland and abandoned fields	744	488	293	429
Total	1795	1147	609	874

Figure 12. Map of Erosion Potential for Selected Land Use.



POTENTIAL EROSION RANGES FOR HAY, ALFALFA, BARE SOIL AND CORN FIELDS IN STEVENS BROOK WATERSHED

Table 13. Calculation of Runoff Curve Number for Stevens Brook Watershed.

Description	Hydrologic Soil Group			
	A	B	C	D
Cultivated - (bare soils, corn field)	67	76	83	86
Pasture or range	52	69	79	84
Meadow (hay, alfalfa)	30	58	71	78
Woods or Forest	25	55	70	77
Urban	74	84	90	92

STEVENS BROOK RCN ACREAGE SUMMARY

RCN	ACREAGE
25	288.99
55	2,487.16
70	3,469.42
74	22.68
77	1,469.80
84	430.50
90	805.18
92	343.04

RCN AVERAGE IS: 68.9

Figure 13. Map of Runoff Curve Numbers for Stevens Brook Watershed

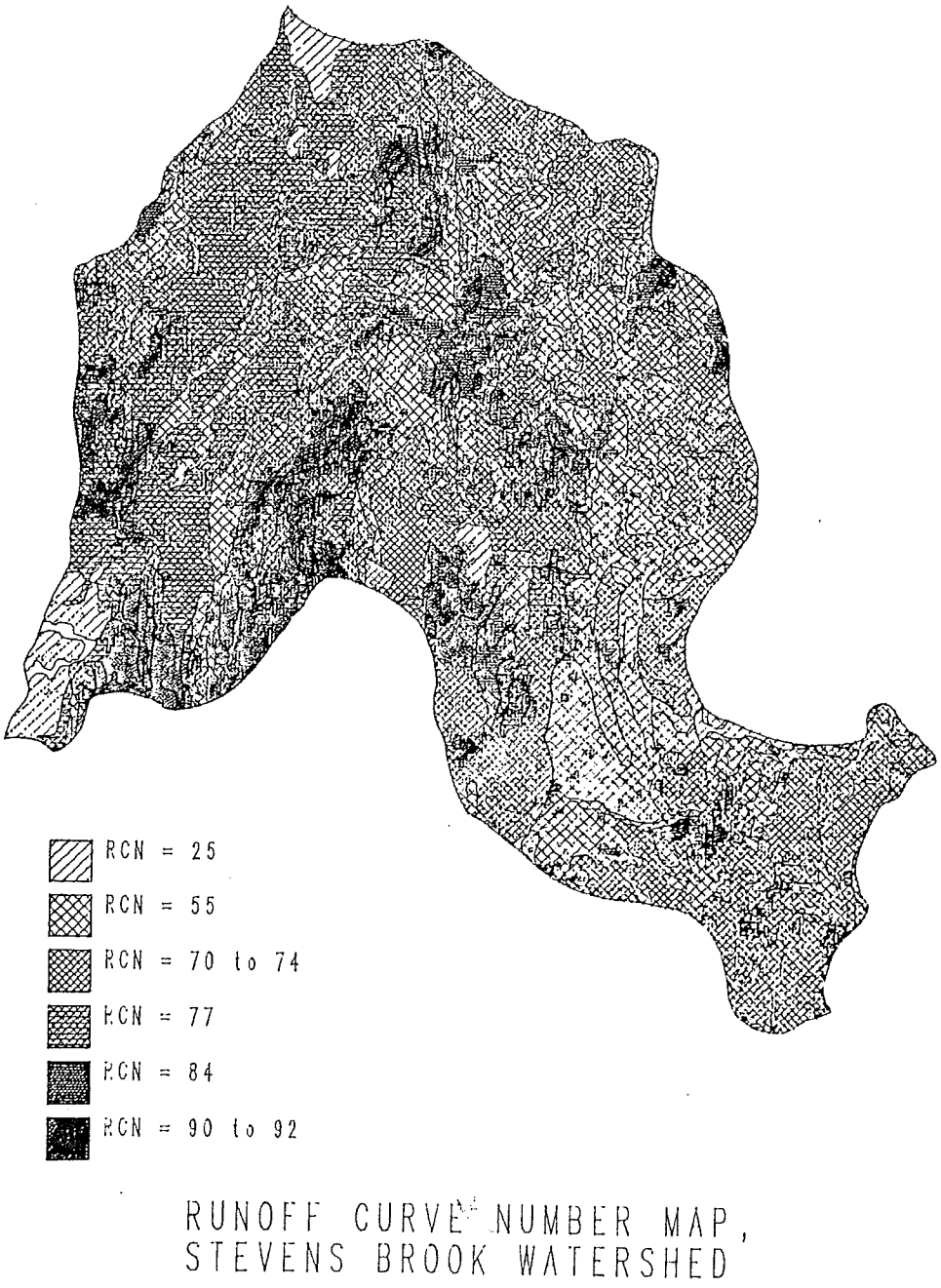


Figure 14. Map of a 500 ft. stream buffer for the Stevens Brook Watershed highlighting high potential soils

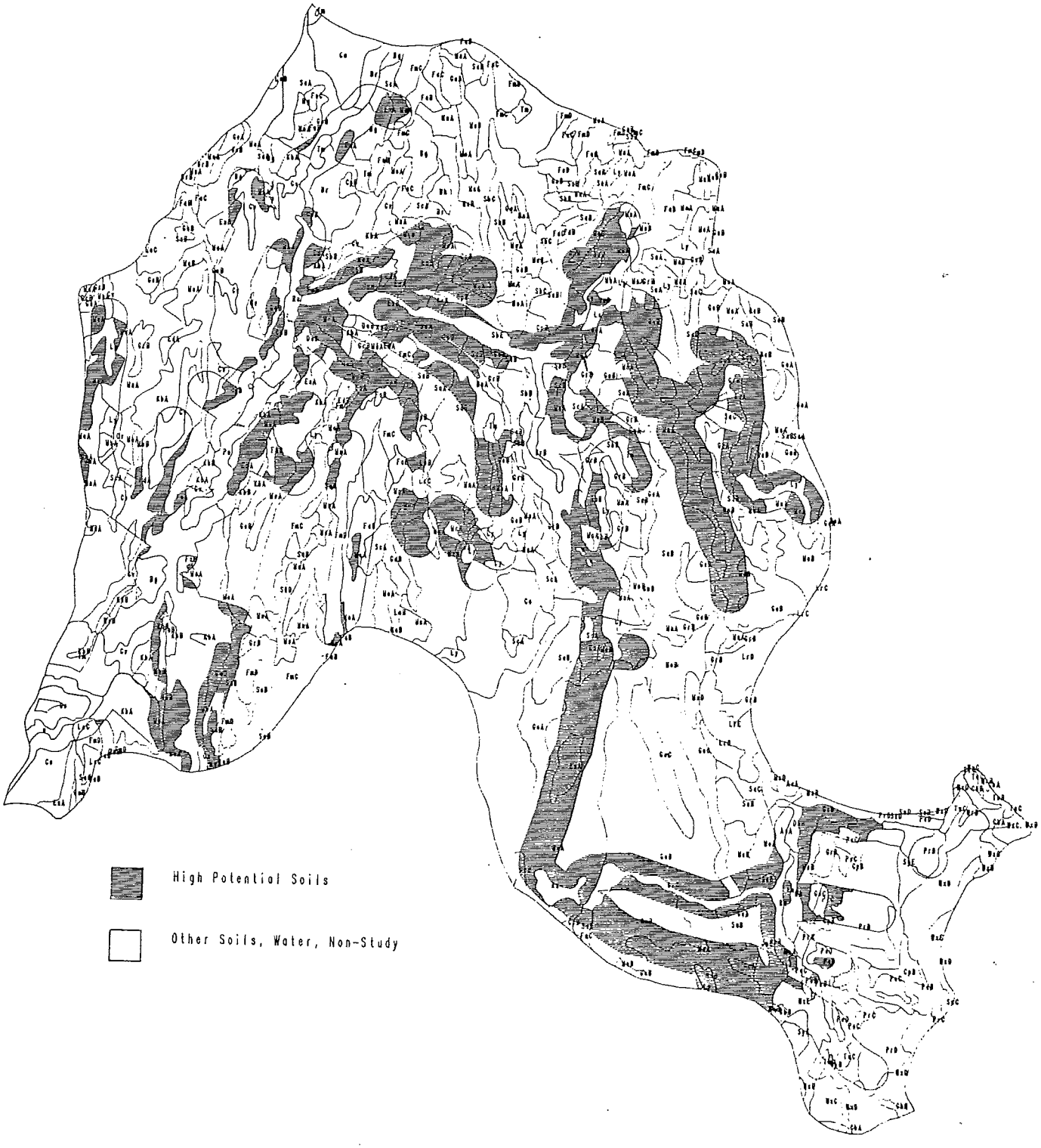


Figure 15. LANDSAT THEMATIC MAPPER SUBSCENE COVERING ST ALBANS, VERMONT

LAND COVER CLASSIFICATION

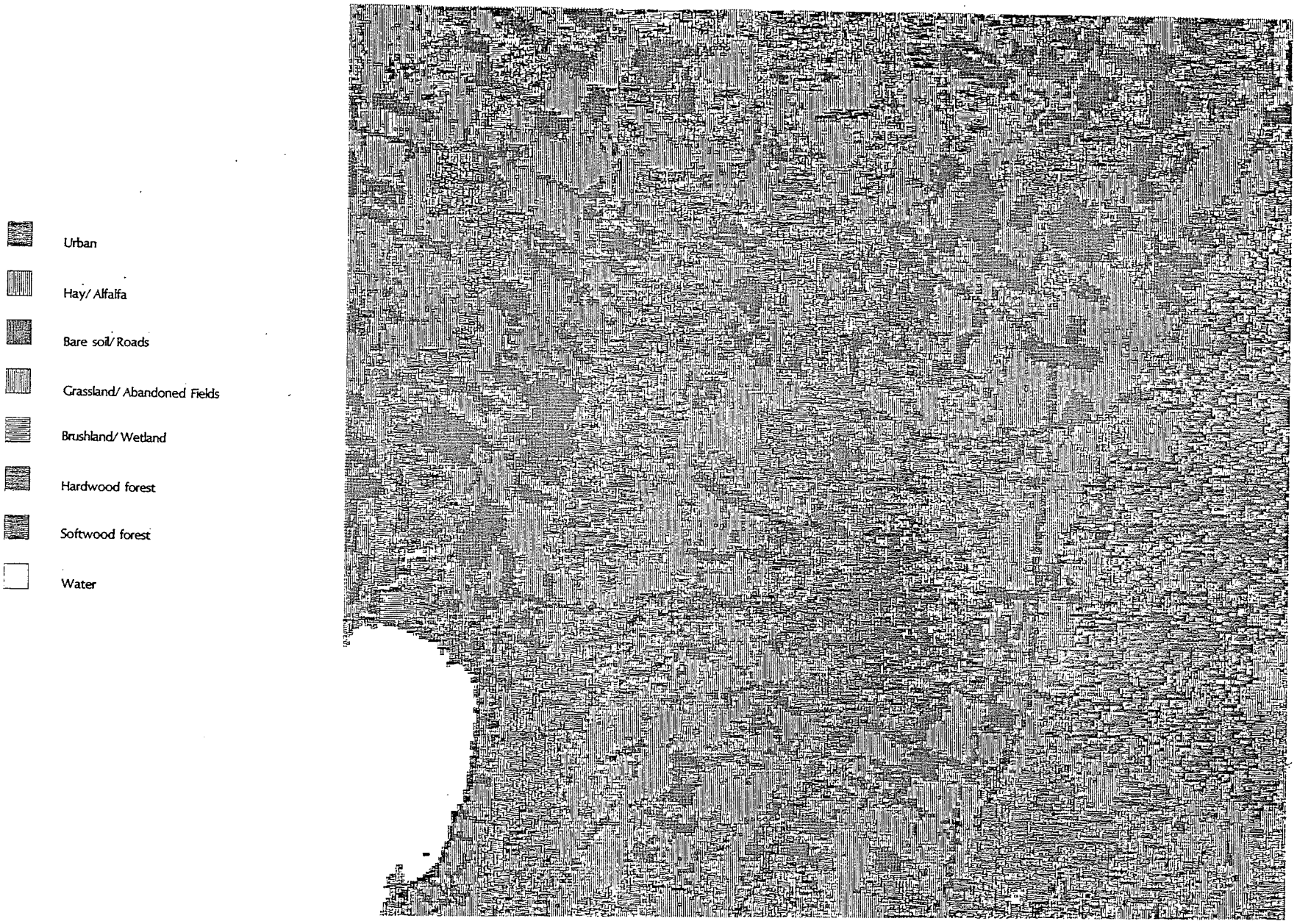
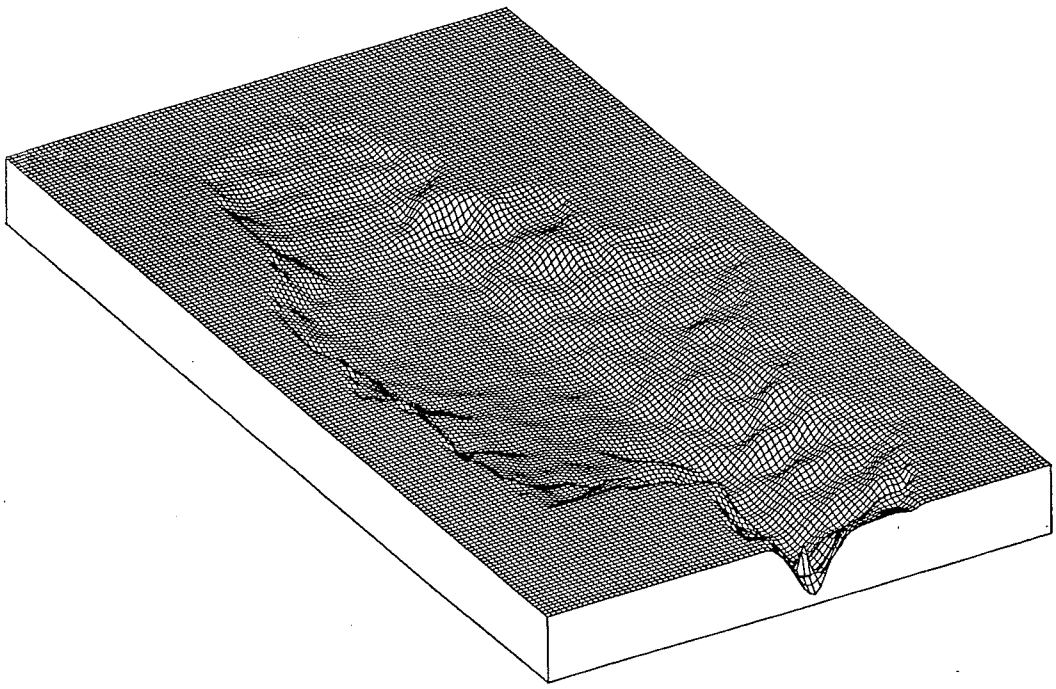


Figure 16. Perspective Map of the Bottom of Shelburne Bay on Lake Champlain.



SHELBURNE BAY, LAKE CHAMPLAIN (PRODUCED BY THE SCHOOL OF NATURAL RESOURCES, U\