New England-New York Inter-Agency Committee

Sub-committee on mapping

~~Final report on~~

Status of Topographic and Geologic Mapping in the New England-New York Region

with list of maps of the region by various agencies

by L. W. Currier

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New England-New York Inter-Agency Committee

Status of Topographic and Geologic Mapping in the New England-New York Region

by

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Introduction

The purpose of this report is to summarize the status of mapping in the New England-New York region. It embodies a detailed review of the status of standard topographic mapping, a statement of the nature and extent of geologic mapping, and a listing of available base and special subject maps of the region.

A map is a representation of the features of a part of the earth's surface by means of conventional symbols. It is not in any sense a picture of an area, rather it is selective according to its purpose; thus a map may indicate one or more map elements such as land-forms, culture, hydrology, roads, etc. Consequently, many types of maps are available for the region.

Regional base maps of the Federal Interagency River Basin Committee, sub-committee on hydrology, were adopted by NENYIAC as standards for the final report. Essentially, these are outline maps with hydrologic features, and were derived originally from maps prepared by the U. S. Weather Bureau from data that appear in large measure on State maps issued by the Geological Survey. They were found to be easily adaptable to the needs of

the study and report groups. They are useful for outlining the general boundaries of drainage basins, and as location or index maps for resource data.

Many Federal and State agencies have published maps for special purposes. A list of maps relating to the region, prepared for the Map Reference Office of the New England-New York Inter-Agency Committee, is appended to this report. It is believed to include all the major special subject maps by public agencies and pertinent to the regional study. The list indicates the kinds of maps, the scales of the maps, and the publishing agencies.

For general purposes and especially for preliminary survey and planning of engineering projects, however, the topographic (contour) quadrangle maps published by the United States Geological Survey are most important. In large part they were prepared in cooperation with the several States. These maps show land-forms by means of contours and other conventional standard symbols, altitudes, established bench marks and principal triangulation points, water features, roads, civil boundaries, place names, and other major cultural features, reference grids, longitudes, and latitudes. These maps are useful also for various resource studies, particularly mineral deposits of all kinds. They serve as base maps for general geologic mapping, and the geologic maps so prepared provide fundamental terrane data for all purposes that involve geologic data.

This report on mapping, therefore, is concerned chiefly with the status of topographic and geologic mapping of the region.

Aerial photographs, on the other hand, are not maps. For very flat country they may assume some of the characteristics of maps, and, in the form

of mosaics, are used, at times, as maps. The functions of the sub-committee on mapping were not extended to include the cataloging of aerial photographs, but the offices of the sub-committee were used at times to assist in the procurement of such photographs. Aerial photographs are useful in the preparation of maps by tracing specific features, such as roads, streams and other bodies of water, forested areas, and other features. They have recently been used to great advantage, for example, in preliminary location studies for major highways. Modern techniques in cartography employ aerial photographs in large measure for the compilation of contour maps, thus eliminating much of the routine field mapping by plane table, and greatly facilitating the production of topographic base maps. The usefulness of aerial photographs for specific purposes, however, is conditioned by several factors such as the height at which they were taken, and the time of year. Approximately 90 percent of the region has been flown at various times and under various conditions and auspices (including governmental and commercial), the unflown areas being parts of northern and western Maine, northern New Hampshire and northeastern Vermont. The following index maps showing the status of aerial photography and aerial mosaics are available from the U. S. Geological Survey, Washington 25, D. C.

-Status of aerial photography. Shows all areas known to have been photographed by or for Federal, State, and commercial agencies, and indicates the agencies now holding the primary photography.

-Aerial mosaics of the United States. Shows all areas for which aerial mosaics or photo-maps are known to have been compiled by or for Federal, State, and commercial agencies, and indicates agencies holding mosaic negatives.

Part I

Status of topographic mapping

Standard topographic maps

Topographic (contour) maps of the U. S. Geological Survey have been published at various scales and with various contour intervals. The earlier series have a scale of 1:62,500 (approximately 1 inch to the mile) and a contour interval of 20 feet. In recent years scales of 1:31,680 (2 inches to the mile), and 1:24,000 have been used. Quadrangles covering 15 minutes of latitude and longitude (so-called "15-minute quadrangles") are published at the scale of 1:62,500; those covering 7½ minutes of latitude and longitude (so-called "7½-minute quadrangles") are generally published at scales of either 1:31,680 or 1:24,000. In past years some maps covering 30 minutes of latitude and longitude at a scale of 1:125,000 were published earlier for parts of New York and New England, but these maps are considered of sub-standard grade and few of them are available. The scale for topographic maps of standard grade is ordinarily not smaller than 1:62,500.

Indexes (index maps) to topographic mapping, by States, are available from the U. S. Geological Survey, Map Information Office, Washington 25, D. C.

The contour interval differs according to the scale of the map and the relief of the area. In general, the 15-minute quadrangle maps (1:62,500) have a contour interval of 20 feet; most of the 7½ minute quadrangle maps have a contour interval of 10 feet.

The following general status maps are also available:

- Status of topographic mapping, A. Shows areas covered by topographic and planimetric maps at the scale 1 inch = 1 mile or larger, as produced by the Geological Survey and other Federal agencies, and indicates areas of standard, sub-standard, and deficient qualities, and areas in which work is authorized and in progress.

- Status of topographic mapping, B. Shows areas covered by topographic and planimetric maps at scales smaller than 1 inch = 1 mile, as produced by the Geological Survey and other Federal agencies, and indicates the quality of the maps, as standard, sub-standard, and deficient.

- Status of vertical control in the U. S. Shows all vertical control established and reported by Federal agencies.

- Status of horizontal control in the U. S. Shows all horizontal control established and reported by Federal agencies.

The above status maps are revised periodically and so contain data up to the dates of compilation. They are available from the U. S. Geological Survey, Map Information Office, Washington 25, D. C.

Topographic map coverage of the New England-New York Region

The following data relating to the status of topographic mapping and present program for mapping in the New England-New York region, as of March 19, 1954, were provided by the Topographic Division of the Geological Survey.

General

Practically the entire region is covered by standard topographic quadrangles in either the 15-minute, or the 7½-minute series and in some areas by both. The exception of about 5,500 square miles is in the northwestern part of Maine. About 4,000 square miles of this unmapped area is covered by 1:100,000 compilation material, and is planned for early publication as provisional 15-minute maps pending later replacement with standard mapping. This, along with the completion of other current work in Maine, will provide complete topographic coverage for the region.

The status of completed quadrangle topographic mapping in the region is indicated in ~~figure~~ plate 1. Detailed index maps by States, showing the quadrangle names, scales, and dates of mapping, are available from the U. S. Geological Survey, Map Information Office, Washington 25, D. C.

The status of mapping and the current program for each of the States follows:

Maine

Existing coverage.

All of Maine except the upper Saint John River basin (west of Little Black River), the upper part of the Allagash River basin, and the headwaters of the Penobscot River basin is covered by published Geological Survey quadrangle maps, scale 1:62,500. This coverage comprises about 85 percent of the State. In addition, 25 recent 7½-minute quadrangle (1:24,000 scale) maps cover 800 square miles in the vicinity of Eastport. Eleven 7½-minute quadrangle (1:24,000 scale) maps cover areas in southern Maine (vicinities of Portland and York), and a special map (1:24,000) covers the Arcadia National Park and vicinity. The majority of these maps are of standard quality, some are in need of minor revision, and the rest are useful but deficient in accuracy and content according to modern standards.

Present program.

The program in progress consists of (1) revision of 28 15-minute maps in the northeastern and southern parts of the State, (2) new mapping of 2 small areas near Caribou and Rockland at a scale of 1:24,000, and (3) mapping of 6 scattered 15-minute quadrangles at a scale of 1:62,500. The request for these projects originated as a part of the requirement for mapping in the

interests of National Defense; completion of this part of the program is expected in 1957.

Eight additional quadrangles have been selected for mapping at a scale of 1:62,500, in cooperation with the Maine Public Utilities Commission; completion by 1956 is planned.

In addition to its cooperative activities a State Mapping Advisory Committee was organized in December 1953 to evaluate needs for maps within the State, and to transmit annually a coordinated statement of such needs to the Geological Survey, for use in planning the Federal mapping program.

Mapping of the remaining unmapped area - 19 quadrangles (some partial) - has been authorized for early publication as 15-minute preliminary maps pending later (unscheduled) replacement by standard maps. These were requested by the NENYIAC for use in its studies relating to the Saint John River basin.

New Hampshire

Existing coverage.

Coverage of New Hampshire by 15-minute quadrangle maps at a scale of 1:62,500 is complete; however, of a total of 56 maps in this series (25 partly in adjoining States) only 3 are of standard quality. Several that were mapped prior to 1920 are in need of remapping and all others need revision.

Eight 7½-minute quadrangles in the vicinity of Dover, Portsmouth, and Exeter, and others that lie partly in New Hampshire but mostly in Massachusetts and New York have been mapped recently, some at scales of 1:24,000 and others at 1:31,680; these replace with maps of standard grade the corresponding maps of the 15-minute series mentioned above.

Present program.

The current program consists of (1) remapping 5 quadrangles (15-minute), (2) revision of 9 quadrangles (15-minute) in the southern part of the State, and (3) mapping of a small area east of Manchester for publication as a 7½-minute quadrangle. Completion of this program is expected by 1957.

State agencies have shown some interest in a proposed cooperative program to remap quadrangles mapped prior to 1920, and revision of all others mapped subsequent to 1920. A further interest was manifested by the creation in December, 1953, of a State Mapping Advisory Committee, whose function is to evaluate States' needs for maps, and to transmit annually a coordinated statement of such needs to the Geological Survey, for use in planning the Federal mapping program.

Vermont

Existing coverage.

Coverage of Vermont is complete for 15-minute quadrangle maps, scale 1:62,500. Those mapped prior to 1910 (7 quadrangles) are in need of remapping, and all others are in need of revision.

South of Middlebury, 13 7½-minute quadrangles (4 mostly in New York State) comprising about 500 square miles, have been mapped recently and the maps are of standard quality.

Present program.

The present program includes revision mapping of 8 15-minute quadrangles near the Canadian border and remapping of the Wallingford quadrangle, in cooperation with the State of Vermont. Completion of the revision program is expected in 1956, and remapping of the Wallingford quadrangle by 1958.

In the southern part of the State a current program includes mapping of 3 quadrangles at the scale of 1:62,500, mapping of 4 7½-minute quadrangles, and revision of one 15-minute quadrangle; completion is expected by 1957.

A project recently completed consisted of mapping two 7½-minute quadrangles and parts of six adjacent 7½-minute quadrangles, comprising the Jay Peak Special map; this was requested for a geologic study of the talc and asbestos belt.

In December 1953 the State of Vermont organized a Mapping Advisory Committee to evaluate needs for maps and to transmit annually a coordinated statement of such needs to the Geological Survey for use in planning the Federal mapping program.

Massachusetts

Existing coverage.

Coverage of Massachusetts by recent standard 7½-minute quadrangle maps (scale 1:31,680) is complete, replacing the older series of sub-standard 15-minute maps.

Present program.

The State has a continuing cooperative program with the Geological Survey for revision of rural areas approximately every 10 years, and for revision of urban areas at shorter intervals, depending upon the character and extent of expansion and growth.

According to present plans, the series of 7½-minute quadrangle maps, scale 1:31,680 (existing coverage), is to be republished on a scale of 1:24,000.

Rhode Island

Existing coverage.

Like Massachusetts, Rhode Island has complete recent coverage by 7½-minute quadrangle maps (scale 1:31,680), replacing the older series of sub-standard 15-minute quadrangle maps.

Connecticut

Existing coverage.

Except for eleven 7½-minute quadrangles in the southwestern part of the State, coverage of Connecticut by maps of this size, scale 1:31,680, is complete.

Present program.

The eleven 7½-minute quadrangles mentioned above are now being mapped in cooperation with the State Highway Department, and completion of this program is expected by 1955. Various State agencies have also expressed interest in a continuing revision program similar to that in Massachusetts. (Note: a current regular Federal program, that is, not under cooperative auspices, includes revision of about 50 quadrangles in Massachusetts, Rhode Island, and Connecticut).

New York

Existing coverage.

New York has complete coverage by 15-minute quadrangle mapping. Many of the maps, particularly in the Adirondack area, are old (pre-1920), however, and are of sub-standard grade.

Because of a demand for modern maps of larger scale and greater detail, many of the older maps have been supplemented or replaced by 7½-minute

quadrangle maps; these later maps comprise more than half of the State; about 2/3 of them were compiled by the Corps of Engineers, and the rest are standard Geological Survey maps.

Present program.

In New York mapping is in progress in the following areas:

1. Adirondack area. Mapping of 29 quadrangles (15-minute) comprising most of the Adirondack province. Completion expected by 1957.

2. Albany-Elmira-Jamestown areas. Three projects consisting of new mapping of about 80 quadrangles (7½-minute). Completion expected by 1957.

3. Auburn-Geneva area. New mapping of 35 quadrangles (7½-minute). Completion expected by 1957. This will complete a solid block extending from Buffalo and Niagara Falls to Syracuse.

4. Gouverneur area. New mapping of four 7½-minute quadrangles in the vicinity of Gouverneur, to provide base maps for a study of mineral deposits (talc, lead, and zinc). Completion expected in 1957.

(Note: additional new mapping and revision of 60 quadrangles - 7½-minute - in New York and Long Island are outside the New England-New York region).

Summary of topographic mapping authorized or in progress.

The index map, ~~figure~~ plate 2, shows the areas for which mapping, remapping, or revision has been authorized or is in progress, as of March 19, 1954.

Part II

Status of geologic mapping

Definition

A geologic map indicates the lithologic nature, distribution, stratigraphic sequence, and data relating to the structure of the geologic formations of an area. Such maps are useful as basic data for any studies in which terrane data relating to the rocks and soils are involved.

Like other maps, a geologic map is selective as to the kinds of data presented, and the accuracy and details of representation are circumscribed by the scale of the map, the completeness of available information and the intended purposes. Thus it may be designed to show basic data of a broad, general nature, to show features particularly related to economic geology (mineral deposits), water resources, engineering geology, etc., or to show features in the major fields of geologic science, as bedrock geology, surficial geology, structural geology, etc.

For presenting geologic data of a general basic nature fundamental to all applications of the science bedrock and surficial maps are most comprehensively useful; they may be considered as general purpose maps.

Bedrock maps indicate the nature, distribution, structure, and stratigraphic relations of the consolidated, bedrock, formations, which everywhere underlie the surface mantle of unconsolidated materials (the "soils" in a broad sense). Exposures, or outcrops, of bedrock appear here and there through the mantle materials, and from them, supplemented by such subsurface data as may be available through drillings, excavations, geophysical tests, etc., the distribution and structures of various formations may be

interpreted. It is clear, therefore, that in proportion to the degree to which the formations are exposed to observation their boundaries (contacts), variations, structures, and relationships to each other may be more or less closely defined and mapped. Broadly, the bedrock geologic map shows the formations as they might be seen if the overlying mantle materials were scraped away.

Surficial geologic maps indicate the nature and distribution of the unconsolidated materials, such as alluvium, clay, sand and gravel, glacial till, and others; actual exposures of bedrock are also shown on many surficial maps, which greatly enhances their value for engineering and other scientific uses. In many parts of the country surficial geologic maps have relatively little value as compared to bedrock maps. In the New England-New York region, on the other hand, they are of great value and for many engineering projects they are far more useful than the bedrock maps. This fact arises from the geologic history of the region.

During the "Ice Age" - a major recent event in geologic history - the New England-New York region was transgressed several times by ice sheets from the north. The thick ice covered the entire region, overriding mountains and occupying valleys. As it progressed southward, the ice scraped up and carried along with it for some distance the pre-existing soil mantle and it also abraded and plucked blocks of the underlying bedrock. Much of this material was spread out under the ice as till - a heterogeneous and unsorted mixture of debris that ranges in texture from clay sizes to boulders. Some of the material was embodied within the ice, and became freed subsequently as the ice melted back. The glacial melt-waters, coursing chiefly along valleys, and partly along remnant blocks of ice, sorted and redeposited

some of the debris as gravel, sand, silt, and clay, along the valley floors and walls and in temporary lakes that later were drained. Post-glacial erosion has, in many places, cut into these glacial deposits, and some of the larger streams have formed alluvial flood plains upon the glacial till and outwash materials. The ubiquitous layer of till is of greatly variable thickness and covers or obscures the underlying bedrock over most of the region, making it difficult to predict accurately both the depths to bedrock, the locations of formation boundaries, and, for many places, even the nature of the hidden bedrock formations. Where the meltwaters sorted and deposited gravel, sand, et al, the depths to the original valley floors and even the courses of the original stream channels are commonly obscured.

For many engineering operations it is important to know the depths to, and the configuration of, the buried bedrock surface (which cannot be adequately interpreted from the present topographic features), the nature of the unconsolidated materials, and the variability in textures and thicknesses of these deposits. Surficial geologic maps of this region are essentially maps of glacial geology, and thus provide basic geologic data pertinent to foundation studies, sources of granular construction materials, the locating and interpreting of borings, and the sources of ground water supplies. Data from such maps are often supplemented by seismic and other geophysical tests to translate the basic geologic data into terms of engineering needs.

In Massachusetts, for example, surficial geologic maps are prepared for proposed highway locations. From them the kinds of materials that compose the sub-grade, and also those that will be penetrated in cuts are deduced; supplementary seismic tests are made in selected places (also

determined from the map) where shallow bedrock might be expected, to determine the depths to bedrock and the profile of the bedrock surface. In addition, the maps indicate nearby sources of suitable fill materials. For bridge sites the subsurface materials and bedrock surface are determined by seismic tests, but the key to subsurface interpretations is furnished by the surficial geologic maps.

For a complete survey of mineral resources of the region, both surficial and bedrock geologic maps are needed.

Base maps for geologic mapping

Suitable base maps are needed for geologic mapping. For this purpose the standard topographic (contour) maps are most suitable, for the topography and land forms commonly reflect in large measure the lithologic nature and general structural features of the formations.

All purpose geologic maps furnish the consulting engineering geologist with the basic regional data that are needed for special site studies. The bases for bedrock maps should be on a scale not smaller than 1:62,500. For surficial geologic mapping, a scale of 1:24,000, or 1:31,680 is desirable.

As pointed out above, most of the region is well provided with suitable base maps for general geologic mapping, but areas designated above as deficient or sub-standard in topographic mapping need revision or remapping to provide suitable bases for standard geologic mapping.

Present coverage

The following table shows the approximate coverage of the region by published bedrock and surficial geologic maps at a scale of 1:62,500 or larger.

	Square miles	Percent (approximate)
Subregion A	33,000	-
Bedrock	620	1.9
Surficial	none	-
Subregion B	26,000	-
Bedrock	5,030	19.4
Surficial	980	3.8
Subregion C	14,100	-
Bedrock	5,070	35.9
Surficial	215	1.5
Subregion D	15,000	-
Bedrock	4,740	31.6
Surficial	520	3.5
Subregion E	12,200	-
Bedrock	5,200	42.6
Surficial	860	7.0
Entire region)	100,300	-
Bedrock) Totals	20,660	20.6
Surficial)	2,575	

The index maps (~~figures~~ plates 3 to 7 incl.) show the coverage of the subregions by published geologic maps. In addition, the Geological Survey publishes periodically a map showing the status of geologic mapping by the Geological Survey in the United States. It also publishes index maps by States, showing published geologic maps of all types and by all agencies on a scale larger than 1:2,500,000, and a list of publications in which such maps appear. These index maps are designated as follows, and are to be

obtained from the U. S. Geological Survey, Map Information Office, Washington 25, D. C.:

- Status of geologic mapping in the United States
- Geologic map index of Maine
- Geologic map index of New Hampshire and Vermont
- Geologic map index of Massachusetts, Rhode Island and Connecticut
- Geologic map index of New York.

These maps are revised from time to time.

In addition to published maps, many areas in the region have been mapped by Federal and other agencies but the maps have not yet been published. Some of these are in process of publication, some are in the compilation stage, and some exist as unpublished theses in college libraries. The index maps, ~~fig.~~ plates 8 to 12 incl., indicate the status of unpublished geologic maps compiled from questionnaires returned to the sub-committee on mapping. It is believed that these indexes are nearly complete as of the indicated date. The original returns of the questionnaire show details as to type, purpose, source, and availability of unpublished mapping, and are deposited in the files of the sub-committee.

On the basis of data available, total coverage by geologic mapping, published and unpublished, for the region is

	Quadrangles	Percent (approximate)
Bedrock	169	33
Surficial	51	10

It is to be noted that the States of Massachusetts and Rhode Island are engaged in continuing cooperative geologic mapping programs with the U. S. Geological Survey, for the complete bedrock and surficial mapping of these

State. Some of the quadrangle maps have been published already in the geologic quadrangle map series of the Geological Survey, some others are in process of publication, and some are in process of compilation. All these maps are on a scale of 1:31,680. It is estimated that the recent geologic quadrangle mapping coverage of these two States - published and unpublished - is as follows:

	Bedrock	Surficial
	percent	percent
Massachusetts	23	35
Rhode Island	48	43

Estimate of man-years needed to complete geologic mapping of the region.

The rate of geologic mapping varies widely according to the scale and accuracy of the base map, ruggedness and accessibility of the terrain, the complexity of the geology, and the personal factor. It is difficult, therefore, to arrive at a reasonably realistic evaluation of the time in man-years required to complete the basic geologic mapping of the region. The estimate given below is a broad approximation based on recent experience in various areas. The rates of mapping used in this calculation do not apply to geologic mapping for special purposes such as specific mineral areas or sites for engineering structures, where larger-scaled maps and greater detail are needed. In other words, the estimate is for basic all-purpose mapping which would serve as fundamental background data for the more detailed site studies of mines, local mineral deposits, dam sites, and other special projects.

In general, the scale of the base map controls the amount of geologic detail that may be plotted adequately. For some areas the field methods available for general mapping may not justify a scale larger than approximately one inch to the mile and it would be misleading as to accuracy and amount of observable geologic data to choose a larger scale. Commonly special area mapping, such as for individual mineral deposits or sites for structures is supplemented by subsurface techniques such as borings, geophysical tests, and plane tabling - techniques that are not ordinarily available for general quadrangle mapping. However, regular quadrangle mapping is a general prerequisite for the more detailed studies and should normally precede such studies. General mapping furnishes the regional background of lithology, structure, and stratigraphy, by which the data obtained by other techniques may be interpreted. It is recommended, therefore, that, for purposes of regional resources studies and engineering applications, basic mapping by quadrangles should be completed ultimately for the region.

Recent experience in Massachusetts and Rhode Island has demonstrated that for much of the region surficial mapping should be done on a scale as large as 1:31,680, or two inches to the mile, because the observable details of surface geology and the common techniques of field mapping not only permit this degree of accuracy but in large measure require such scale for adequate representation. Basic bedrock mapping, however, can commonly be represented on a scale of 1:62,500, or approximately one inch to the mile.

The ruggedness and accessibility of the terrain in many places, particularly in the mountainous and heavily forested areas, impose a practical restriction on routine mapping. Some areas, such as in the wilds of northern Maine or the Adirondacks, are nearly devoid of access roads or

even trails, and mapping in such areas may be several times slower than in the lower and more open areas of western and southern New York and central and southern New England.

Different parts of the region vary considerably in the complexity of geologic units that should be mapped. In part this is due to the need for closer and more detailed discrimination of lithologic and stratigraphic units in some areas, or to more complicated structural features that require greater study in the field. These conditions clearly increase the time required to map a unit of area.

The personal factor is particularly difficult to evaluate. A geologist's progress in mapping is conditioned not only by the factors described above, but also by his background and experience. Continued experience in a region naturally facilitates his work and increases his rate of accomplishment, through broader experience and greater familiarity with the types of problems that are characteristic of the region. For most of New England and most of the Adirondacks, the geologist needs experience in mapping metamorphic rocks and glacial features. Some geologists are capable of doing both by reason of varied training and experience; others may be limited to one or the other of these fields.

Experience in Massachusetts and Rhode Island has indicated that an experienced geologist can map a 7½-minute quadrangle and prepare an adequate map and report in a year, allowing 4 to 6 months for field work. Rarely can a field season be extended efficiently beyond 6 months in the more favorable areas, and the field season will be appreciably shorter than 6 months in the less favorable areas.

The estimation of man-years needed to complete geologic mapping of the region is based upon the use of experienced geologists. The expense of maintaining a geologist (salary and expenses) in the field and office for a year ranges probably from $6000 to $8000; collateral costs and supervisory services would increase this range, so that, under economic conditions comparable to the present the range would be from $8000 to $10,000 per man-year. It is further estimated that, as an average for the region it will take 4 man-years to prepare adequate maps and reports for a standard 15-minute quadrangle.

Approximately 513 quadrangle areas[1/] (15-minute) are involved in the New England-New York region. It is estimated (see above) that about 33 percent of the region has been mapped for bedrock geology and about 10 percent for surficial geology, including both published and unpublished maps. At 4 man-years each, totals of approximately 1380 man-years for bedrock mapping and 1850 man-years for surficial mapping are indicated to complete geologic mapping of the region. The total cost of field mapping at $10,000 per man-year is thus estimated to be $32,300,000. Allowing for necessary supervision and laboratory services, the gross approximate estimate, exclusive of publication, is $45,000,000. At an average cost of $4000 each for preparation and printing of the 806 quadrangle geologic maps (344 bedrock and 462 surficial) approximately $3,300,000 should be added, bringing the total cost to complete geologic mapping and publication to approximately $48,300,000.

Although this estimate is only a broad approximation, it nevertheless indicates the order of magnitude of the task to be done. It is estimated

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1/ The expression "quadrangle area" is used because many quadrangles lie partly outside the region, and the equivalent of these in complete quadrangles has been estimated.

that at the present rate of geologic mapping, about 75 years will be required to cover the region. If history can be a guide, long before that time has passed, needs for new types of geologic data will have arisen, and maps being made today will be considered inadequate as to some types of basic data. Thus, without a greatly expanded rate of geologic mapping, only a small portion of the area can be expected to receive attention within the next few decades, and the rest of the region must remain inadequately appraised of its geologic resources.

It is important, therefore, that the rate of geologic mapping be increased as rapidly as practicable and that at the same time priorities be established in accordance with the most urgent needs. To establish such priorities is not considered to be within the province of this report, but, in general, the greater needs for geologic mapping lie in the fields of mineral resources, ground water resources, and engineering (sites; construction materials). Priorities can be established only by comparing needs in terms of the regional and national economy.

Part III

Conclusions and recommendations

Topographic mapping.

The status of topographic mapping for the region is, on the whole, very satisfactory. With completion of present projects and plans, most of the region will have coverage by topographic maps of standard grade, or maps requiring only minor revision to bring them to standard grade. Many of the sub-standard maps are still useful, however, although deficient in accuracy and content.

As of March 1954, the regional coverage by topographic quadrangle maps, scale 1:62,500 or larger, is approximately as follows:

27 percent by maps of standard quality

27 percent by maps of standard quality but in need of revision

28 percent by maps that are useful but deficient in accuracy and content

8 percent by sub-standard maps in need of complete remapping but included in work authorized or in progress

4 percent by sub-standard maps not included in work authorized or in progress

6 percent unmapped (includes 2.8 authorized or in progress)

100

From the viewpoint of regional resources studies and developments, the unmapped area of northern Maine is of first order priority, but subordinate to military and security needs.

All sub-standard topographic maps of the region should be brought up to standard quality.

Areas where special studies of mineral deposits are planned should have coverage by modern maps of standard quality.

Geologic mapping.

The geologic quadrangle map is the standard unit for basic all-purpose use. The scale should be not smaller than 1:62,500.

For some areas surficial geologic maps should be prepared on a scale of 1:31,680 or 1:24,000, for the delineation of the smaller land-forms is a valuable feature of the principal surficial deposits, such as gravel and sand, for constructional and fill purposes, for special industrial sands, and for clay materials. Such detail in mapping is also important in the study of ground water resources, and in the preliminary studies of major engineering projects; it has been found particularly useful in the planning and construction of highways.

As indicated in foregoing sections, only 21 percent of the region has adequate coverage by bedrock geologic maps, and 2 percent by adequate surficial geologic maps. To complete the geologic mapping of the region is a desirable long range objective, but one that will not be realized within 75 years without a greatly expanded rate of geologic mapping. It is recommended that the rate of geologic mapping be increased as rapidly as limiting factors such as the availability of trained personnel will permit. Priorities should be established for geologic mapping in areas of projected mineral studies or engineering projects. All areas destined to be submerged in reservoirs should be mapped to determine general geologic features and potential mineral deposits.

Appendix - regional maps

List of maps of the New England-New York region, as compiled for the temporary map reference office of New England-New York Inter-Agency Committee, August 1, 1951, with minor revisions as of July 1, 1954.

A. State base maps

I By State agencies. Various scales. Available for each State.

a) State maps showing minor civil divisions.

b) State and county highway maps.

II By U. S. Geological Survey

a) Scale 1:1,000,000

Massachusetts-Rhode Island-Connecticut
New Hampshire - Vermont
New York
Maine

b) Scale 1:500,00

New Hampshire - Vermont (also with 200 ft. contours)
Massachusetts - Rhode Island - Connecticut (also with 200 ft. contours)
Maine
New York

c) Scale 1:250,000

Massachusetts - Rhode Island (with contours, 100 ft. interval)

d) Scale 1:125,000

Connecticut

III Transportation maps by Public Roads Administration

(scale 1:250,000). By States

B. Topographic Maps

I Army Map Service, Corps of Engineers; scale 1:250,000 (new series). (For sale by U. S. Geological Survey, Washington 25, D. C.)

By quadrangles as follows:

Quebec, Jackman, Ogdensburg, Lake Champlain, Lewiston, Bangor, Presque Isle, Eastport, Buffalo, Rochester, Utica, Glens Falls, Portland, Bath, Millinocket, Cape Vincent, Elmira, Binghampton, Albany, Boston, Scranton, Newark, New York, Hartford, Providence.

II (a) U. S. Geological Survey standard quadrangle topographic (contour) maps. Some with green overprint for woodland. Some shaded relief. Various scales, chiefly 1:62,500, 1:31,680, 1:24,000. Various contour intervals, chiefly 20 ft. and 10 ft. In part, older series of sub-standard grade in need of revision or remapping. Index maps, by States, available from U. S. Geological Survey, Washington 25, D. C.

(b) U. S. Geological Survey. Special areas. Various scales. Niagara gorge, Niagara River and vicinity, Arcadia National Park, Palisades Interstate Park.

(c) U. S. Geological Survey. State base maps overprinted with highways and contours in colors. Some with shaded relief. Scale, 1:500,000; contour interval, 200 feet. New Hampshire-Vermont; Massachusetts-Rhode Island-Connecticut.

(d) By U. S. Coast and Geodetic Survey; scale 1:10,000 Cape Cod Canal; Buzzards Bay; Provincetown.

C. Special subject maps

I Aeronautical maps

(a) Sectional aeronautical charts, U. S. Coast and Geodetic Survey. Scale 1:500,000 (with 500 ft. contour interval shading). Aroostook, Boston, Burlington, Albany, Detroit, Lewiston, New York.

(b) Local aeronautical charts (scale 1:250,000; 250 ft. contours)

(c) World aeronautical charts (scale 1:1,000,000; 1000 ft. contours) Boston, Hudson River, Lake Erie, New York, Nova Scotia, St. Lawrence River.

(d) Aero planning chart. U. S. Coast and Geodetic Survey; scale 1:3,000,000; contour interval 2,000 ft.

(e) Aero planning chart. U. S. Coast and Geodetic Survey; scale 1:5,000,000; contour interval 2,000 ft.

II U. S. Dept. of Agriculture

(a) Soil maps (by counties)

(b) Basic land resource areas (developed primarily on physical factors)

(c) Land utilization projects (in which Soil Conservation Service has managerial or other responsibilities)

(d) Soil Conservation Service: Forest regions; Shelter; Belt project; Farm Woodland

(e) Soil conservation district maps and zone map

(f) Soil conservation regional and State headquarters

(g) Problem areas in soil conservation

(h) Responsibility of U.S.D.A. agencies for surveys under flood control legislation.

(i) Preliminary survey of major areas requiring outside agricultural labor

(j) Activities map of U.S.D.A.

(k) Land resources, unit map of northeastern United States.

(l) Generalized types of farming.

(m) Land use adjustment areas.

(n) Areas characterized by major forest types.

(o) Explanation of soil map symbols.

(p) Erosion and land use conditions.

(q) Schuyler County, New York area.

(r) Presque Isle, Maine, project.

(s) Principal drainage areas.

III Principal generating systems and transmission lines covered by REA distribution lines

(a) New England region.

(b) New York and Philadelphia area.

(c) U. S. oil and gas fields and principal pipe lines; scale 1:2,500,000. (U. S. Geological Survey)

IV Lake Survey maps; Corps of Engineers

Various scales; with contours along shore belts.

Chart no.	Area	Scale
11 - 18	St. Lawrence River	1:30,000
21 - 25	Lake Ontario	1:80,000
31 & 32	Lake Erie	1:30,000
113 - 117	St. Lawrence River	1:15,000
171 - 174	Lake Champlain	1:40,000
175	Burlington Harbor, Vermont	1:10,000
181 - 187	N. Y. Canals (181-185, 1:40,000; 186, insets 1:10,000; 187, 1:60,000, insets 1:10,000)	
211	East End of Lake Ontario	1:30,000; insets 1:5,000
225	Oswego Harbor	1:10,000
234	Sodus Bay, N. Y.	1:10,000
238	Rochester Harbor, N. Y.	1:10,000
256	Lower Niagara River	1:30,000
312	Upper Niagara River	1:30,000
314	Buffalo Harbor	1:40,000

V Intracoastal waterways: coast and harbor maps by U. S. Coast and Geodetic Survey.
(Show culture along shore belts. Various scales).
105 maps for the region; list available from U.S.C & G.S.

D. U.S. base maps

I U. S. Geological Survey, planimetric maps.

(a) U. S. base map, outline, scale 1:11,875,000.

(b) U. S. base map, outline, scale 1:7,000,000.

(c) U. S. base map (with contours), scale 1:7,000,000.

(d) U. S. base map, outline, scale 1:2,500,000.

(e) U. S., shaded relief, scale 1:7,000,000.

(f) U. S., shaded relief, scale 1:3,168,000 (1 inch = 50 miles)

(g) U. S., physical division, scale 1:7,000,000.

II U. S. Coast and Geodetic Survey

(a) Base map, Lambert conformal conic projection: scale 1:3,000,000; contour interval 2000 ft.

(b) Isogonic map; scale 1:500,000; contour interval 2000 ft.

E. Miscellaneous maps

I International map of the World series: U. S. Geological Survey

(a) North K-17 (Lake Erie), scale 1:1,000,000.

(b) North K-19 (Boston), scale 1:1,000,000.

II Radio direction finding. Scale 1:2,000,000; contour interval 1,000 ft.

III Route charts (U. S. Coast and Geodetic Survey) scale 1:2,000,000.

F. Index maps

(U. S. Geological Survey, Map Information Office, Washington 25, D. C.)

I Indexes to quadrangle topographic mapping

(a) Maine

(b) New Hampshire and Vermont

(c) Massachusetts, Connecticut, and Rhode Island

(d) New York

II Status of topographic mapping (U.S.)

III Status of horizontal controls (U.S.)

IV Status of vertical controls (U.S.)

V Index of aerial photography (U. S.)

VI Index of aerial photograph mosaics (U.S.)

VII Status of geologic mapping (U.S.)

VIII Index to geologic mapping (by States; available for each State)