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WATER RESOURCES DEVELOPM
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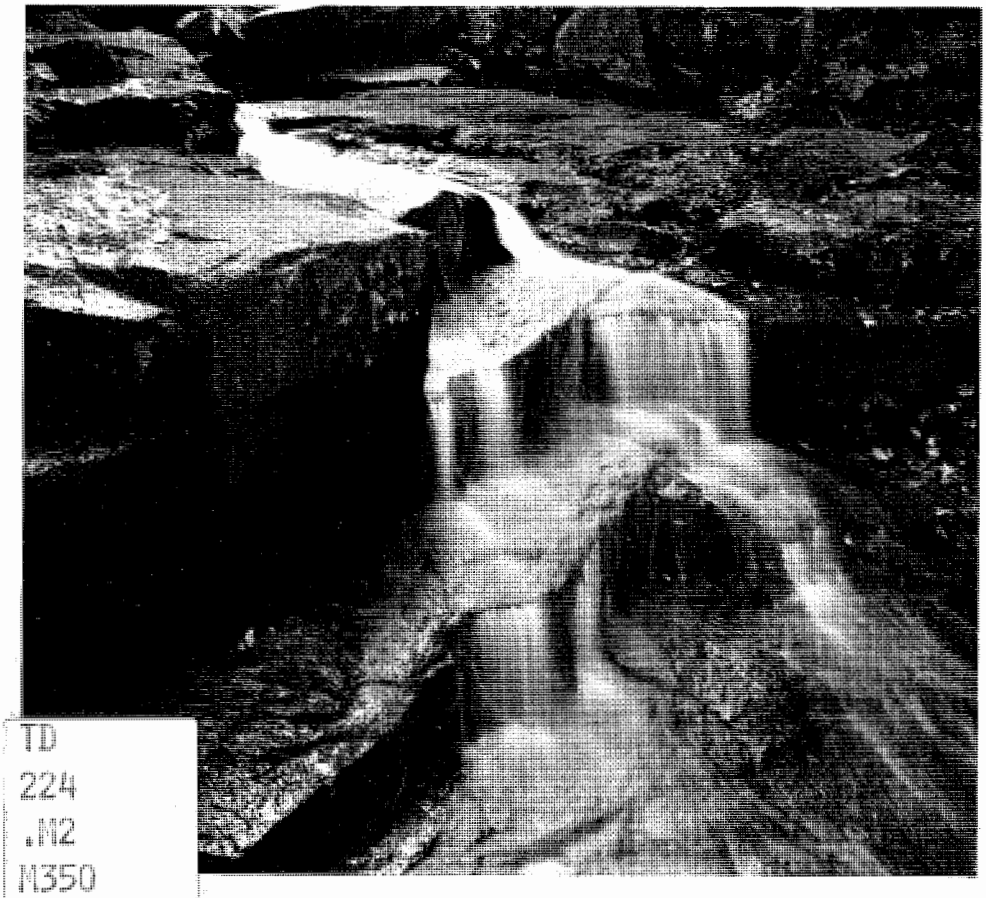
Management of Water and Related Land Resources in the State of Maine



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March 1975

State Planning Office
Executive Department
State of Maine

New England
River Basins
Commission

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Agriculture
Civil Emergency Preparedness
Commerce and Industry
Conservation
Environmental Protection
Finance and Administration
Health and Welfare
Inland Fisheries and Game
Marine Resources
Transportation

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To The Governor, the Legislature and the People of Maine

I am pleased to transmit this Report on the Management of Water and Related Land Resources in the State of Maine. The Report is a product of the Maine Guide Plan Program, a jointly funded planning partnership of the State Planning Office and the New England River Basins Commission initiated by formal agreement on December 2, 1971. The broad objectives of the Guide Plan Program are to provide a preliminary plan for the wise management of water and related land resources designed to achieve broad social goals through balancing economic development and environmental conservation. We believe that the Report will aid significantly in our gaining a better perspective of Maine's vital natural resources.

The results of our efforts to date serve to bring to the attention of all concerned the need for:

- a formal organizational mechanism for the development and coordination of overall land and water resource policies;
- the adoption of comprehensive planning processes relating to water and land resources;
- cooperation with neighboring states and other jurisdictions concerning regional issues; and
- a unified and positive influence on the future course of national water and related land resources policies.

The reason why State institutional arrangements are so important is the pervasive nature of the water and land resources issues. The State's economy hinges on the allocation and conservation of these resources. To insure a continued pattern of well-being, we need to improve the coordination of all the State functions related to water and land resources. Grand and sweeping schemes are not only costly but unnecessary. We simply need to intregrate the specific expertise the State already possesses and focus on the solution of today's complex problems.

Sincerely,

Alan D. Goodwin

Alan D. Goodwin
Acting Director

March 10, 1975

Management of Water and Related Land Resources in the State of Maine

Prepared by The State Planning Office and The New England River Basins Commission

SUMMARY

In the western states, where water is scarce and supply falls behind demand, state government recognized early that normal settlement and development depended upon successful management of water. Large and powerful water resources departments were created for determining the broad usage of what was clearly recognized as a limited resource, especially since early allocations were made predominantly for agricultural use. Comprehensive planning developed, integrating all potential and actual uses of water into a balanced allocation for the most efficient and beneficial development of the state.

Similarly, in water-rich areas where development has reached an advanced level, comprehensive water resources management practices have been developed to resolve conflicts among strongly competitive users of water to insure economic stability. An extreme example of this is the Ruhr Valley in West Germany, in which 10 million people live and 90 percent of the nation's heavy industry is located. Perhaps the most important governing body in the valley is the Water Resources Board, including representatives from all classes of water users. The Board succeeds in its task because it must succeed -- everyone understands that if water management fails, the people must abandon the valley and live elsewhere.

In contrast, water-rich and lightly settled Maine, until recently, had little need to develop a capability for comprehensive water resources management. The abundance of water has, in part, delayed the development of an integrated approach to water resources planning and management. This situation is changing rapidly and conflicts between users of the State's water resources are becoming readily apparent. For example, early uses of Maine's major rivers included transporting of logs, production of hydroelectric power and disposal of wastes. Public interest in rivers for other uses, such as recreation, was diminished because of conditions resulting from such operations, and currently it is with great difficulty and cost that these conditions are ameliorated to accomodate additional uses. Water companies have tended to abandon rivers as sources of domestic supply, but in the future there is the likelihood of mergers of small companies to provide water for larger regions forcing possibly a return to rivers as sources of large reliable supplies. Continued development of the State encroaches upon visual and cultural quality of landscape and upon land and water sites noted for their recreation and wildlife value.

It is the major conclusion of the Guide Plan Program that the fundamental water resources problem in Maine is institutional, rather than functional. The authority for managing Maine's water and related land resources is fragmented among at least ten individual State agencies. Each has some

degree of responsibility and authority to establish and enforce standards for the use of these resources, to undertake actions which will in one way or another affect the quality or quantity of these resources. There is no central State body responsible for establishing basic policies for the conservation and development of Maine's water and related land resources or for placing those policies within the context of the State's overall environmental, economic and social goals. There is a keenly felt need for an integrated water and related land resource planning and management program which will be consistent with broad national policy objectives, will reflect the interests of all State agencies having water-related responsibilities, and will provide guidance for action by other levels of government and the private sector. It is recommended that a natural resources management policy-making body be created. As recommended, this comprehensive policy-making body should:

1. Be the focal point within the State for overseeing natural resource programs and plans to insure that they are designed to contribute to the achievement of the broad social, economic and environmental goals established or concurred in by elected public officials;

2. Be the mechanism for developing and maintaining working linkages among State natural resource programs, and between state-local and state-regional-federal programs.

3. Provide a linkage to and help set priorities for budget decisions, in both the executive and legislative branches; and

4. Provide a mechanism for citizen participation in the process of establishing State resource management policy.

Whether or not this policy body should be established as an extended consolidation of natural resources agencies into a formal Department of Natural Resources or brought about less formally as a special cabinet committee has not been addressed in depth by this report. However, the membership of this body should include personnel from the Departments of Conservation, Environmental Protection, Inland Fisheries and Game, State Planning and Marine Resources. In addition to this regular membership, the policy body could also include in its deliberations the Departments of Agriculture for its soil and water conservation functions, Finance and Administration for its property taxation functions, Transportation for its environmental impact assessment of capital projects and regulation of water-borne transport, Health and Welfare for public water supply, and the Bureau of Civil Emergency Preparedness for flood warning and control, the federal flood insurance program and dam safety inspection.

The primary responsibility of this body should be to develop and recommend State policy positions on critical natural resource management issues. In so

doing, the policy body can spur the integration of the many functional water and related land resources planning and management programs in the State and guarantee a coherent voice for State and local view-points in the natural resources conservation and development programs of the Federal government.

The creation of a natural resources management policy-making body is the most important and comprehensive recommendation of the Guide Plan report. This conclusion was reached after detailed review of a number of important water-related subjects. The principal findings and recommendations of these investigations are presented below.

The Data Base

There is a singular lack of basic data on Maine's natural resources. The need for large-scale geographic mapping, geological surveys, soil surveys, land use and land cover inventories, hydrologic investigations and environmental quality measurements is keenly felt and now only partly met. This basic information is needed if the caretakers of the State's resources are to meet adequately the information requests of policy makers and carry out effective natural resources planning and management programs. In particular, the State is missing out on fully using the capabilities of Federal data-gathering agencies, such as the U.S. Geological Survey. Without this base of information the State cannot progress toward the development of comprehensive resource management policies and programs.

The Legal Issue

The body of Maine's water law, based on a system of riparian rights, is likely to be a hindrance in the development of programs to insure orderly future development and management of water resources. This hindrance in part relates to the involvement of the courts as a dispute-settling device since common law is court-administered, not statutory. When the law is not codified and resolution is through the judicial system, the process of solving disputes is often time-consuming, costly and may be inconsistent and contradictory.

The question of water rights is particularly critical in light of the massive public investments in water quality improvements in recent years. It is pertinent to ask whether it is appropriate to spend large amounts of public funds for the benefit of only a few riparian owners.

At least one alternative which should be investigated in Maine is the possibility of instituting a permit system in the Executive Branch of State Government to allow non-riparian use of water under certain strictly defined conditions.

A related problem is the lack of understanding of water law by resources specialists. Personnel of the Portland School of Law have contributed significantly in this regard with reports on the interface of law and resources management. It is suggested that this interface between specialists in law, administration and resource technology continue.

Water Supply

The task of supply water for domestic needs is the most important aspect of water resources management. In Maine domestic water is provided to two-thirds of the residents by 162 individual water companies. The State has recently adopted strict quality standards for potable water supplies distributed by the water companies. Considerable capital expenditures will be required during the next several years to meet these standards. However, unlike treatment of wastewater, there is not large, clearly defined Federal or State funding program to assist water companies in the accomplishment of their task. Despite the recent passage of a Federal Safe Drinking Water Act it appears clear that the burden of raising the capital necessary to meet State and Federal standards will be borne by individual water companies and, ultimately, the consumer.

The supply of water in Maine is sufficient to meet the State's needs for consumptive uses to the year 2020 and well beyond. Total supply far exceeds current demand. However, the availability of water for certain large non-consumptive uses, such as industrial process water, may be limited, particularly in the southern part of the State. The amount of usable water storage in the State could be doubled through construction of multi-purpose reservoirs proposed in previous water resources studies.

It is not unreasonable to expect that the State of Maine may be called upon in the not-too-distant future to transfer some of its abundant water resources to help meet the needs of nearby water-short basins or states. The State needs to establish policies on storage, safe yield and particularly inter-basin transfer and export in order to be prepared to take decisive steps in these areas when the need arises.

Water Quality

Maine's program to reduce water pollution substantially is moving rapidly and should succeed within a few years. Ironically, the major obstacle to progress in the program -- the delay in Federal treatment facility construction funds -- has been replaced by the thorny problem of how to use the funds effectively now that they have been released. The Guide Plan Program suggests that strict adherence to the 1977 deadline for statewide secondary wastewater treatment or the 1985 no-discharge deadline mandated in the Federal Water Pollution Control Act Amendments of 1972 is not cost-effective and that the enormous investments necessary to meet these goals may yield municipalities diminishing returns. The need for establishing carefully thought out priorities for the use of these funds is one of the most eloquent and fiscally compelling arguments for developing a more comprehensive approach to resources management and policy-making in the State.

As we begin to gain control over the most easily pinpointed sources of pollution -- municipal and industrial discharges -- it has become clear that non-point sources -- soil erosion, fertilizer and other agricultural runoff, urban stormwater runoff and road salting -- are more important contributors to water quality degradation than originally imagined. Finding solutions to these critical water quality problems will require much greater cooperation between State water wuality agencies and those agencies overseeing land use, agriculture and forestry than has been the case previously.

Finally, it should be understood that as we approach attainment of our water quality goals, demands on the use of the State's waters will intensify -- demands which may threaten the massive public investment made to achieve that high quality and hamper efforts to maintain it.

Flood Damage Reduction

The U.S. Army Corps of Engineers and the Soil Conservation Service estimate that annual property damages from flooding in Maine will double by 1985, approaching $9 million. And yet public awareness of flood risk is minimal. Moreover, there is widespread public resistance to both structural flood controls and non-structural flood damage reduction measures.

Nevertheless, the groundwork has been laid for an approach toward resolution of these problems. Improved techniques for flood warning are being developed by the National Weather Service. The U.S. Army Corps of Engineers and the Department of Agriculture's Soil Conservation Service are conducting flood hazard area identification studies. The U.S. Army Corps of Engineers is also assisting the State of Maine in the preparation of an inventory and analysis of the safety of impoundments in the State. There are programs available to reduce flood damages through the construction of structures on main stem rivers and tributaries. The State's Shoreland Zoning and Subdivision Controls Act and the National Flood Insurance Program mark a significant beginning toward the development of formal floodplain management programs. Such programs are designed to protect damageable property from flooding and to prevent indiscriminate construction of new damageable property in floodplains. It is suggested that such programs as the ones mentioned here receive stronger formal State support.

Land Use

The State has begun to compile land use inventories and to establish policies to assure the appropriate allocation of land to meet broad public goals. General land capability and specific soil suitability guides have been prepared to assist in forest and crop management and in the development of suitable nonagricultural land use management practices. A multi-purpose land capability display is being prepared for communities along the coast. Moreover, development of standardized coding and information for use in data processing is underway to expedite the correlation between land capabilities

and present and projected land uses. However, the State is lacking fundamental land activity and land cover inventories. Funding for land use planning should be directed first toward undertaking these inventories.

It is strongly recommended that general statewide policies be developed to serve as guides for land use planning and management. Such policies would then become a frame of reference against which all land use plans or proposals would be judged. They would also improve the administration of the major programs for regulating land use, since the State of Maine has been forward-looking in the development of legislation and programs to guide and mitigate the effects of the siting of major facilities. The development of these overall policies would offer a consistent basis for decision-making regarding geographically-oriented master plans for local communities, sub-state regions and statewide functional planning. Several elements of land use policy are described in the full report.

Electric Power

Conservative estimates place Maine's power needs by the year 2000 at roughly triple that of present consumption. There is an urgent need for entirely new methods to generate electric power to avoid the problems of fuel supply or costs, storage of nuclear wastes and excessive amounts of waste heat that attend the expansion of present methods. Despite impressive advances in technology, none of several new methods is expected to be developed sufficiently for large-scale production before the end of this century. Therefore, a small number of large steam generation plants powered either by nuclear energy or by fossil fuels and constructed along the coast, plus pumped storage hydroelectric plants constructed inland, form the most probable future expansion of the power generation network. There is a substantial need to improve siting procedures to insure timely location and construction of new power plants. Also it should be noted that approximately three dozen standard hydroelectric power projects were described and recommended in 1955, but not constructed because of unfavorable returns on investments. Despite significant increases in the cost of alternative energy sources, these projects, if pursued on a single-purpose basis, would likely still have unfavorable cost ratios. It may well be, however, that this situation could change if the projects were reviewed and rescoped not only to provide for power generation but also to increase safe yields for water supply, augment seasonal low river flow rates, or provide storage for flood waters.

Recreation and Wildlife

The State of Maine provides a superior setting for outdoor recreation, fishing and hunting and for the appreciation of wildlife in its natural habitat. Yet the perpetuation of this setting is not assured. As the pressure for development increases, the pressure to take wildlife habitat and prime recreation land for other uses will intensify. It is unrealistic to attempt massive land acquisitions through public investment as a principal means to

secure these valuable resources. Aside from fee simple purchase of certain areas to fulfill specific needs, the purchase of easements, cooperative agreements with landholders, and application and continued development of appropriate land use controls are alternative means to insure perpetuation of recreation, fish and wildlife resources. Public access to water-related recreational areas has generally enjoyed a priority status because of public ownership of the State's great ponds. Recognizing the large expenditure of public funds for water quality improvement in rivers and lakes to date, the Guide Plan Program recommends the application of these more cost-effective measures to insure public access to waterways improved through the expenditure of public funds.

* * * * *

The State of Maine enjoys an unusual abundance of water and related land resources. And in that abundance lies responsibility and opportunity -- responsibility to insure the availability of those resources to present and future generations and the opportunity to take decisive steps now to develop integrated state policies for the balanced conservation and prudent development of these valuable resources. The responsibility is enormous and the opportunity is unlikely to linger.

Joel Cowger

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Tom Jones/Maine Times

INTRODUCTION

With over 5000 lakes and ponds, covering fully 7 percent of the surface of the State, there is no question that Maine's water resources are abundant. If we assume a mean depth of 22 feet for the average lake or pond, the water volume approximates 10 trillion gallons. In addition, half of the average 42 inches of precipitation falling on Maine each year finds its way to the State's rivers and streams for an average daily runoff of one million gallons per square mile -- 33 billion gallons statewide.

The magnitude of these numbers is staggering; one would certainly not characterize Maine as water-short. The water is always there, as close as the tap or the nearest stream. And it is logical to assume that it will always be there -- cheap, accessible, pure. Logical, but not accurate.

During the 1961-1965 drought in the northeastern states, the delivery of water to homes was severely threatened in some major cities. While awareness of the value of water increased during this period, the bulk of the concern was carried by water company officials. The attitude and water use habits of the general public did not appreciably change, and Maine's abundant water resources continued to be taken for granted.

Natural events are by no means the only threat to the State's water resources. As the dense press of people and commerce known as the Northeast Megalopolis moves northward from Boston through Portland and Lewiston, the pressure for new development will place tremendous demands on Maine's water and related land resources. The need for truly comprehensive management of these resources has never been greater, nor has the opportunity.

The Guide Plan Program

In January, 1972, the State of Maine and the New England River Basins Commission established the Maine Guide Plan Program, a jointly funded planning partnership designed to produce a perspective for the establishment of far-reaching water and related land resources policies in the State of Maine. In many ways the Guide Plan Program is the product of a realization on the part of both the Federal and State Government that there was a need for significant changes in the way water and related land resources were managed. Both levels of government come to this conclusion in 1967.

In that year, the Advisory Council on Outdoor Recreation and Natural Resources of the State of Maine released a report[1] calling for "a complete inventory of the water resources of Maine and a thorough analysis of all our State's water needs..." The Council advised that "water resources development should be considered as but one integral part of the overall economic picture of the State." And, in a manner almost predictive of the

[1] Maine's Water Resources. 1967. Office of the Coordinator, Comprehensive Plan. State of Maine.

difficult economic bind we find ourselves in today, the Council noted that "comprehensive water planning will help us get greater returns for the dollars we spend by coordinating our efforts and setting forth broader objectives than can be achieved by the unilateral attempts of any single agency."

Also in 1967, the President, at the request of the New England Governors, issued an Executive Order creating the New England River Basins Commission under the authority of the Water Resources Planning Act of 1965. Under the Act, the Commission is responsible for, among other things, coordinating water and related land resources planning throughout New England, and recommending long range priorities for meeting the region's most important information, planning and resource management needs. In Maine this means the Commission can assist the State in making decisions on resource development, give it a stronger voice in Federal resource programs, and provide a forum for the discussion and solution of specific resource allocation problems.

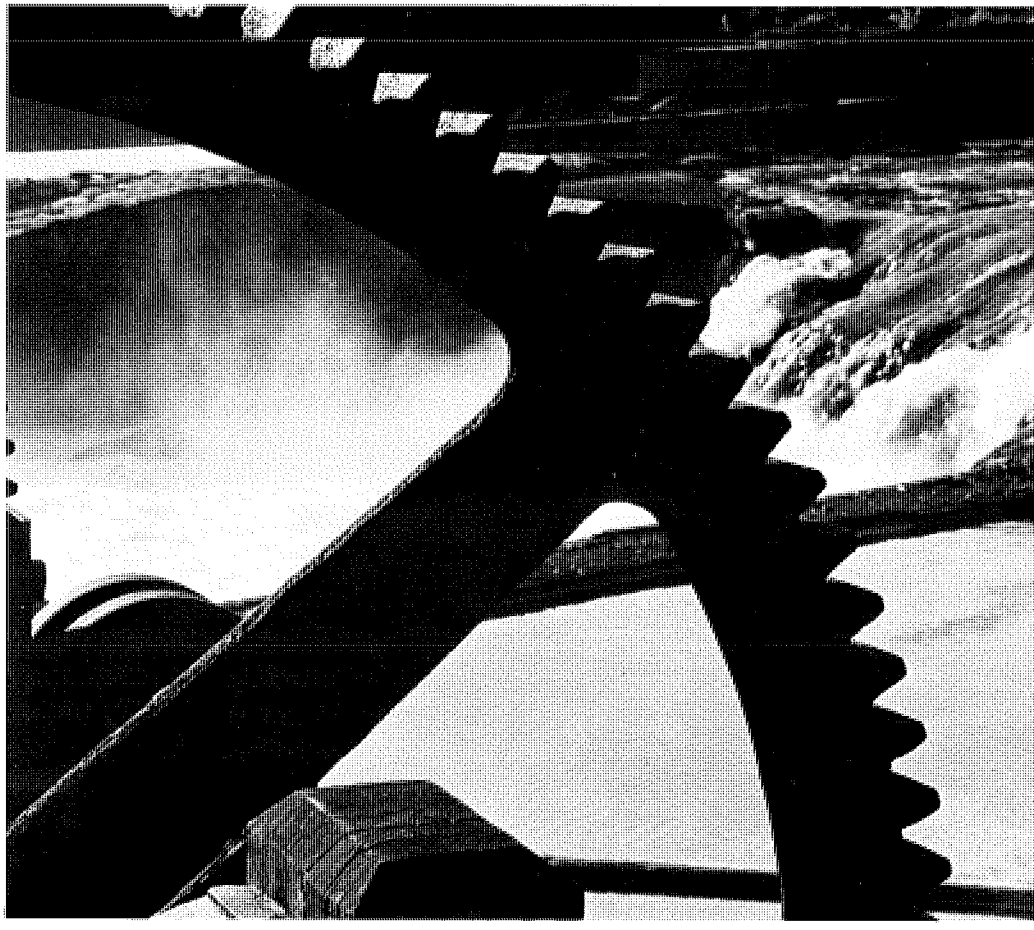
The initiation of the Maine Guide Plan Program was an eventual result of these two parallel developments. After research and study, and in response to new requirements in Congressional legislation, the State developed a broad framework approach within which natural resources management policies and subsequently developed comprehensive river basins plans could be discussed and evaluated. The consideration that there would be a new Governor and a new session of the Legislature beginning in 1975 provided a desirable target date for completion of the project.

A Developing Strategy for Water Resources Management in Maine

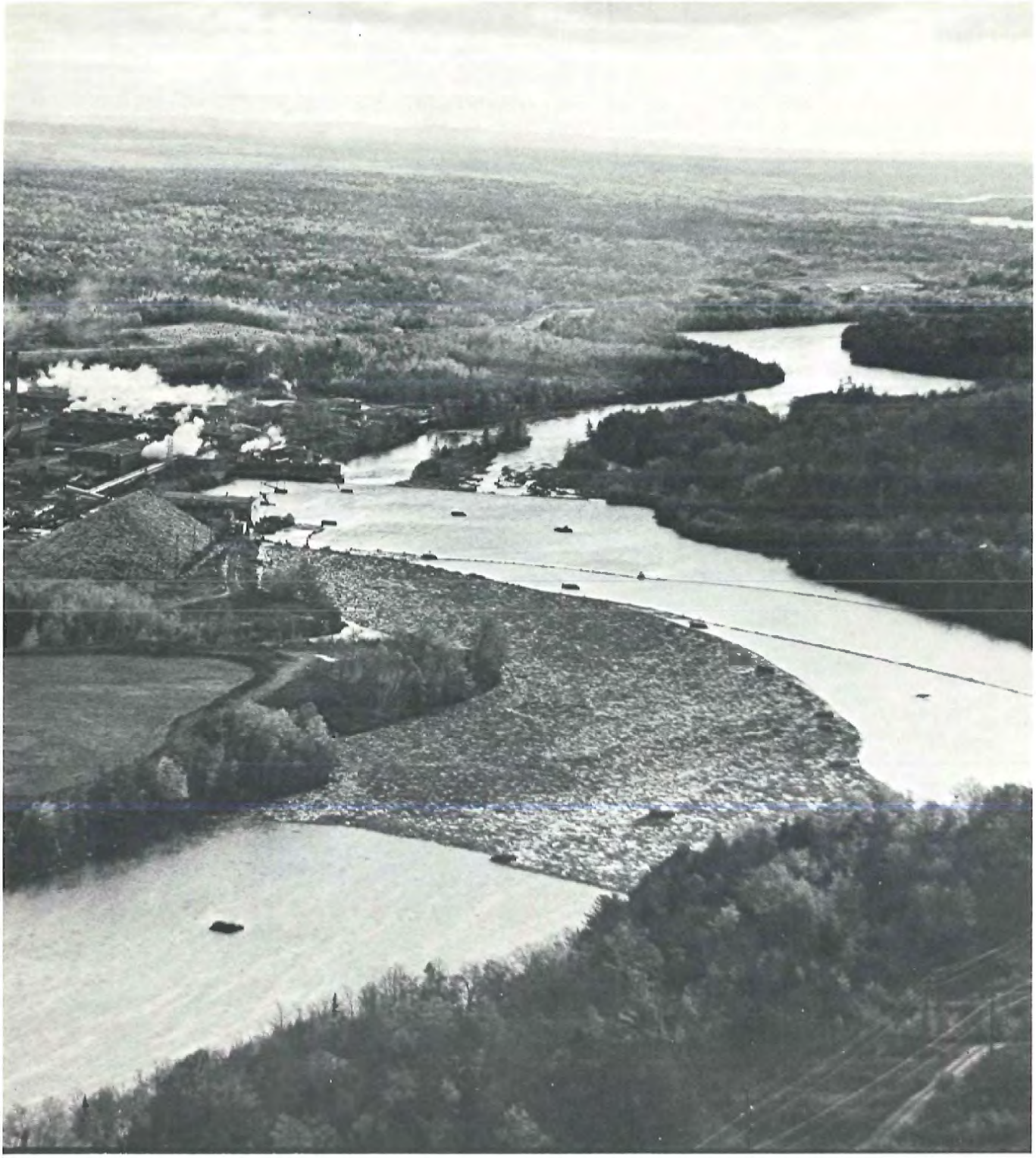
Maine's recent decisive actions in the areas of water quality improvement, land use control, major facility siting and coastal resources management have been responsive to both the needs of the State and the emerging national program to improve comprehensive natural resources planning and management. This national strategy recognizes the state as the dominant level of government, gives the state primary responsibility for natural resources management within the framework of national policies, and provides financial assistance to carry out these responsibilities. This strategy is explicit in Title III of the Federal Water Resources Planning Act of 1965 (P.L. 89-80), in the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) and in the Coastal Zone Management Act of 1972 (P.L. 92-582). These are examples of the linkages which have already been forged between the states and the Federal government.

The relationships of the State to the New England River Basins Commission, the New England Interstate Water Pollution Control Commission, the Governor's Conference and the New England Regional Commission are indicative of Maine's desire to become a more integral part of the national and regional strategy.

It is clear that we are not at the beginning. We have made much progress nationally, regionally and especially within the State of Maine. It is important at this critical time that we strengthen our water-related institutional arrangements, create balanced water resources policies, develop a comprehensive planning process and employ these tools in the development of broad-based comprehensive planning for all elements of Maine's future. These complex tasks are proposed in order that we may proceed more quickly and more effectively toward cooperative, integrated management methods before population and development pressures greatly increase competition and conflicts for our increasingly scarce water and related land resources.



Tom Jones/Maine Times



A Background of National and Regional Water Resources Planning

SECTION 1

There is evident, over the past twenty years, an evolving strategy at the national level with regard to water and related land resources planning. Generalized survey research has been accomplished on a nationwide scale and framework studies have been executed on a regional scale. The underlying purpose of such planning has been to establish a broad perspective and overall direction to natural resources management. Against this broad backdrop of general information, the states have the opportunity to develop more detailed analyses concerning their specific natural resource amenities. It is helpful at this point to present briefly the national and regional viewpoints and summary reports so that Maine's priorities and options may be more clearly defined.

The New England-New York Interagency Committee (NENYIAC)

In 1949 the New England-New York Interagency Committee was formed to prepare comprehensive water and related land resource plans for the river basin areas of New England and New York. This area ranged from the United States portion of the Saint John River Basin in Maine to the Hudson River Basin and that portion of Vermont and New York draining into the Great Lakes and the Saint Lawrence River.

The Committee was composed of representatives from each state and from the Federal Departments of the Army; Agriculture; Health, Education and Welfare; Commerce; Interior; Labor and the Federal Power Commission. Their multi-volumed report was published in March of 1955.[1]

The scope of the project was comprehensive and projected water resources needs and devices to satisfy needs through 1975. A great deal of emphasis was placed upon development of hydroelectric power plants and thirty-eight projects were recommended for the river basins in Maine, including the New Hampshire portions of three basins.

The year 1975 is here and only two of these projects have been completed. Recommendations were made to improve water quality in rivers at costs that seem unrealistically low today for a program that will be completed several years later than 1975.

Essentially the report was published as mimeographed copies of a typed master and given fairly limited circulation. Copies are now difficult to find and many people in resources work are unaware of it. Nonetheless, it was a prototype of a comprehensive water and related land resources planning re-

[1] The Resources of the New England-New York Region. 1955. The New England-New York Interagency Committee. New York. (Maine State Library No. 333.72 N42).

port and it brought attention to many little-understood concepts of the interaction of the various elements of river basins as water was subjected to multiple uses within each basin. The fact that the report is now out-of-date points up the need for revision and the formulation of a new planning process by the next generation.

The Water Resources Planning Act

For practical purposes a national program for comprehensive water resources planning and appropriate interaction with, and support for, continuation, development and creation of state programs was begun with the passage of the Water Resources Planning Act of 1965, also known as Public Law 89-90 It became the policy of Congress to encourage the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal government, states, localities and private enterprise with the cooperation of all affected Federal agencies, states, local governments, individuals, corporations, business enterprises and others concerned.

The Act created the U.S. Water Resources Council, an independent executive agency composed of the Secretaries of Interior; Agriculture; Army; Health, Education and Welfare; Housing and Urban Development, Commerce; and Transportation, plus the Chairman of the Federal Power Commission; Administrator of the Environmental Protection Agency; the Attorney General; Director, Office of Management and Budget; Chairman, Council on Environmental Quality; and the Chairmen of River Basins Commissions. Among the major duties of the Council are:

1. National Assessment. The Council is responsible for the preparation of a national assessment to determine the adequacy of supplies of water necessary to meet the water requirements for each water resources region in the United States. The first assessment[1] was published in 1968 and the second is due in late 1978.

2. Evaluation of water resources plans and programs. This is a continuous function and relates especially to Federal programs in water and related land resources.

3. Principles, Standards and Procedures. The Council was charged with developing appropriate principles, standards and procedures for the formulation of water and related land resources plans for regions or river basins. After considerable work and much consultation and discussion with many agencies over a period of several years, the

[1] The Nation's Water Resources. 1968. United States Water Resources Council, Washington, D.C.

Council published its final report in 1973.[1] These matters are quite complex and are properly addressed to the experts in planning for water resources projects. Of interest to general readers is the breadth and depth of the principles, standards and procedures which, if properly followed, make the planning process costly, but comprehensive. Accounts must be displayed to show benefits and costs for a range of alternate plans affecting all people and agencies in areas subject to planning. Also the discount rate or the interest on capital costs of a project must be established in accordance with the concept that the Government's investment decisions are related to the cost of Federal borrowing.

River Basins Commissions

Another feature of the Water Resources Act enables the establishment of river basin commissions with powers to coordinate Federal water resources plans and to prepare comprehensive coordinated joint plans for their regions. Partial funding of commissions occurs through the Act. The commissions serve as a link between the Federal government and states and among states in matters concerning water resources planning. Within two years after passage of the Act, the New England River Basins Commission was formed. It is possible to speculate that the existence and report of the former New England-New York Interagency Committee brought the matter of water resources planning to the attention of key officials and provided background interest, desire and agreement to reestablish a similar organization on a formal continuing basis once enabling legislation and funding were provided.

Another title in the Act provides financial assistance directly to states for participation in water and related land resources planning. Such funding is intended to provide linkage among the Council, the river basins commissions, and the states for the coordination of Federal, regional and state comprehensive planning in water resources.

Comprehensive planning may take one or more forms as it is applied to solving areawide problems. These are spoken of as various "levels" of policy and plan formation. Initial work takes the form of framework or assessment studies and is termed as Level A. These studies evaluate on a broad basis the need for conservation, development and utilization of water and land resources. They identify regions or basins with complex problems which may require more detailed investigations or analyses. They may recommend specific implementation plans in areas not thought to require further study. Level A studies are designed to determine the extent of water and land problems; to indicate the general approaches that appear appropriate for their solution; and to identify specific geographic areas where regional, river basin, or implementation studies may be needed.

[1] Water and Related Land Resources. Establishment of Principles & Standards for Planning. Federal Register Vol. 38; 174, Part III. Sept. 10, 1973.

Regional or river basin plans are termed as Level B. They are reconnaissance-level evaluations of water and land resources for a selected area. They are prepared to resolve long range problems identified by framework or assessment studies. They vary widely in scope and detail, they focus on mid-term (15-25 years) needs, they involve all levels of government in the plan formation, and they identify and recommend action plans to be pursued by the appropriate entities. Section 209 (a), Public Law 92-500, Federal Water Pollution Control Act as amended, October 18, 1972, calls for Level B plans to be completed, with the cooperation of the Water Resources Council, for all river basins in the United States by January 1, 1980. The New England River Basins Commission is the regional agency whose job it is to assist the Council in the preparation of Level B plans for New England basins.

Implementation studies are termed as Level C. They are project feasibility studies generally undertaken by a single entity for the purpose of initiating actual work. These studies are conducted to implement findings, conclusions and recommendations of either Level A or Level B studies. The identification of the more urgent elements of any issue that requires early action will guide the subsequent implementation.

The North Atlantic Region Water Resources Study (NAR)

In 1966 the U.S. Army Corps of Engineers undertook a framework or Level A study of water and related land resources for the northeastern states including all of New England, New Jersey, Delaware and those portions of New York, Pennsylvania, Maryland, West Virginia and Virginia that drain into Chesapeake Bay. Once the nation was divided into appropriate water resources regions by the Water Resources Council, this project became the first of its kind because of the magnitude of the problems caused by the large population living in this region. Data were aggregated by river basin area for each subject. The format conveys the concept of river basins and the comprehensive nature of water and related land resources. It serves as a valuable guide for consideration of problems confronting the region as a whole. It will be a significant contribution to the next issue of the National Assessment by the Water Resources Council due in 1978. If there is criticism that certain conclusions in the NAR Report are unwarranted, it should be remembered that the data base for each basin area has yet to be worked out in sufficient detail, and this certainly holds true for Maine.

The Northeast Water Supply Report (NEWS)

The great drought of 1961-1966 in the northeastern states created truly formidable problems of water supply for the great cities of the Boston-Washington megalopolis. The cumulative precipitation deficit for these years was of record magnitude and revealed clearly that water supples were inadequate to meet demand and resulted in a drastic cutback on water use. In the face of continued population increases for the region and the prospects of recurring drought, it was concluded that the water supply problem would become greater and that a general study should be undertaken to accomplish or ease its resolution.

In October of 1965, Congress passed Public Law 89-298, The Northeastern Water Supply Study Act, authorizing the U.S. Army Corps of Engineers to undertake this project. To date there have been reports drafted to cover the supply needs and devices to meet needs up to the year 2020 for the major cities of Boston, Providence, New York, Philadelphia, Baltimore and Washington. Similar reports have been published for thirty-two smaller cities including Portland, Lewiston-Auburn and Bangor in Maine. There have been allied reports covering such subjects as institutional aspects of water resources, wastewater reuse, and integrated management of water supply for various uses to conserve water in areas of very large consumption. Two projects in west central Massachusetts were recommended in November, 1974. An interim report on other projects is now being prepared. The study is scheduled for completion in June, 1976.

The National Water Commission Report[1]

In September, 1968, Public Law 90-515 was enacted to create the National Water Commission. It was the task of the Commission to review the entire subject of water and related land resources and recommend broad policies for the management of these resources. The law was passed when it was determined that there was insufficient information and policy regarding large interbasin transfers of water being proposed for the western United States.

While membership in the Commission trended toward specialists from western states familiar with western problems, there was some apprehension that there would be a bias in emphasizing water resources problems in that region. Actually, a preponderance of western commissioners pointed up the greater expertise in water resources there. These fears were groundless since the report is well balanced and even recommended an end to preponderant Federal subsidy to western water resources development in favor of more equitable cost sharing. The report is a significant contribution to the field and, aside from serving as a textbook on water resources, will likely provide guidance in formulating policy for water resources management in the near future.

The OBERS Reports

This series of reports[2] represents the major output of a program of economic measurement, analysis and projection conducted by the Bureau of Economic Analysis, formerly The Office of Business Economics (OBE) of the U.S. Department of Commerce, and the Economic Research Service (ERS) of the U.S. Department of Agriculture with assistance from its Forest Service. Hence the acronym OBERS. The program was initiated in 1964 by members of the

[1] Water Policies For The Future. 1973. National Water Commission. Washington, D.C.

[2] OBERS Projections. 1972. Regional Economic Activity in the U.S., Vol. 1, Concepts, Methodology and Summary Data, U.S. Water Resources Council, Washington, D.C. (Separate reports for Series C and E Population Projections).

then ad hoc Water Resources Council (WRC). With the establishment of the WRC by the Act of 1965, the program became an integral part of the comprehensive water resources planning program and the periodic national assessments of water and related land resources.

These reports are prepared in response to the need for basic economic data by public agencies engaged in comprehensive planning for the use, management and development of the nation's water and related resources.

The objectives of the OBERS program are the development and maintenance of

- a regional economic information system with provisions for rapid and flexible data retrieval
- near term (1980-1990), mid term (2000), and far term (2020) projections of population, economic activity, and land use
- special analytical systems designed for use in water resources and other public investment planning.

Alda Stich

Institutional Arrangements Affecting Water Resource Activities

SECTION 2

Reflecting the national picture, the State of Maine has experienced a developing strategy of water and related land resources planning. The Legislature has taken into consideration not only the general direction of Federal guidelines, but also has been sensitive to the feelings Maine people have for the need to preserve this State as a genuinely unique part of the country. Therefore, the Legislature enacted in 1971 such measures as the Site Location Law, which helped to set major policy direction in the State with regard to development and natural resources. Other major measures, such as the 1971 passage of the Governmental Reorganization bills and the matching funds appropriated for the initiation of Federal programs of resource protection, have contributed to the development of an evolving policy leading toward a comprehensive planning process. The passage of the Act creating the Commission on Maine's Future has already brought into being a committee of departmental planners representing a broad cross-section of policy concerns.

Given the steps which have already been taken leading toward the cooperative resolution of multi-disciplinary issues, it would appear appropriate to analyze those departments of State government which have a direct impact upon water and related land resource decisions. An understanding of the role of each participating group is indispensable to decision-making, especially when problems call for the bringing together of these top administrators.

Establishment of the State Planning Office

The Maine State Planning Act was passed in 1968 to establish a State Planning Office in the Executive Department, directly responsible to the Governor, the Chief elected official in the State (Title 5, MRSA, Ch. 311, Section 3301-3307). Its main function is to serve as an "advisory, consultative, coordinative and research agency. . . and be concerned with coordinating and developing the several planning responsibilities of the State Government". The operations of this office began in January, 1969.

In addition to providing a coordinative linkage for planning activities among State and Federal agencies, the Planning Office developed early a liaison function with the municipalities through the eleven regional planning commissions. State enabling legislation for establishment of regional planning commissions dates back to 1957, and some commissions were in operation before creation of the State Planning Office. Their purpose at that time was mainly service to municipalities in providing technical assistance for development of municipal planning and to organize regional planning programs. Linkage tended to develop directly with Federal granting agencies rather than with the State. With the creation of the State Planning Office, linkage of commissions with State government improved greatly and in turn assisted the matter of State cooperation with communities. The State Planning Office has assumed responsibility for grants from the U.S. Department of Housing and

Urban Development, which are passed through to the non-metropolitan regional planning commissions. In turn, the regional planning commissions assumed more functions and authority, including the A-95 clearinghouse function [1] and some Section 208 areawide management planning[2] for water quality control.

DUTIES AND RESPONSIBILITIES

1. Regional Planning and Development Districts. During 1970 and 1971 the State Planning Office, following enabling legislation, undertook a division of the State into regions comprising aggregates of minor civil divisions determined to be the most suitable for regional planning, management, and possible future government. The major criteria for delineation were as follows: river basin drainage patterns, counties, membership patterns in regional planning commissions, internal highway network, population concentrations, school administrative districts, and resident preferences. An Executive Order from Governor Curtis was issued on January 26, 1972, establishing these districts and was relayed to the Federal Office of Management and Budget, which in turn directed Federal agencies to conform to this districting in the management of their affairs. Map 1 shows these districts and compares them with minor civil divisions aggregated in the nearest fit to river basin outlines. There have been relatively few changes made since the original designation, and it is possible that future changes will trend toward fitting river basins as water resources planning and management becomes more important.

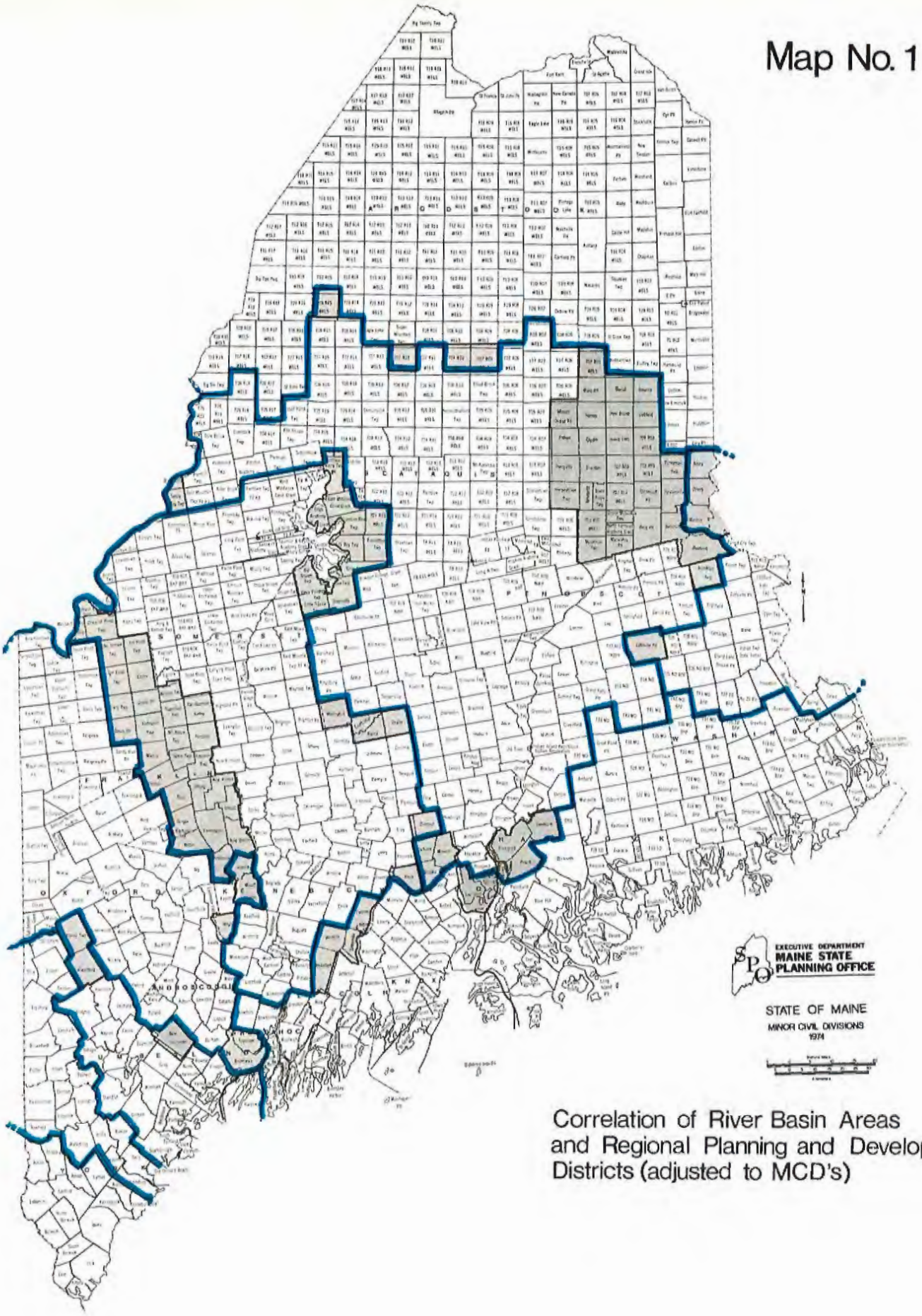
2. Government Reorganization. One of the early major tasks of the State Planning Office was to prepare recommendations to the Legislature for reorganization of the Executive Branch of the State government. The primary concept created a cabinet system of a relatively small number of major departments thereby developing more responsiveness to direction from the Governor's Office. Through work of the 105th and 106th Legislatures ending in March, 1974, most of the recommended proposals were enacted, resulting in the creation of twelve major cabinet departments[3] where there had been more than 206 departments, agencies, and commissions. With respect to natural resources, regulatory functions generally were grouped into the Department of Environmental Protection, while research, planning and management functions were combined into two new departments, Conservation and Marine Resources. The degree of reorganization recommended for natural resources agencies was not totally accomplished, as the Department of Marine Resources was given cabinet status, the Soil and Water Conservation Commission placed into the Department of

[1] Regional planning commissions have been designated by the Federal Office of Management and Budget to be a clearinghouse for local comments concerning the awarding of Federal grants.

[2] This section of the Federal Water Pollution Control Act Amendments of 1972 calls for areawide wastewater treatment planning wherein a number of communities can be assisted cooperatively by a single regional planning agency.

[3] State of Maine Governmental Reorganization. 1973. State Planning Office.

Map No. 1



Correlation of River Basin Areas and Regional Planning and Development Districts (adjusted to MCD's)

Agriculture, and the Department of Inland Fisheries and Game left untouched. An organization structure is portrayed on Chart 1.

3. State Policies Plan. The State Policies Plan was also undertaken early in the life of the Planning Office and lists the recommended major policies of each major State department. The policies are followed by general goals, specific objectives, activities, and accomplishments to fulfill these policies. Many of these are target policies and are for the consideration of everyone concerned to resolve contradictory policies, goals and objectives. The Plan is a continuing inventory process and has been issued in three editions; 1971, 1972 and May, 1974. A fourth edition is scheduled for publication concurrently with this report. The sharpness of focus in the Policies Plan has been partly dependent upon and supportive of governmental reorganization. During the process the spokesmen for the subject areas were obliged to coordinate their policy statements within the framework of the major departments created by reorganization.

4. Water Resources. The State Planning Office also became the agency to receive and administer grants from the Water Resources Council under Title III of the Water Resources Planning Act of 1965. There was established within the State Planning Office in 1969 a Division of Water Resources Planning to undertake a statewide program of comprehensive water resources planning and to seek to coordinate water-related planning programs of the line agencies of the Executive Branch of State government. The present report is the responsibility of this Division.

5. Coastal Resources. In November, 1969, the State Planning Office declared that comprehensive planning for Maine's coastal region deserved high priority and began efforts to formulate a planning process. In 1970 personnel were added to the Office to form a Division of Coastal Planning. The Division has been at work on such subjects as mapping of natural resource features, land use availability, limitations and suitabilities, water resources information, and demographic, legal and economic considerations. Most data are to be summarized in a series of atlases, each covering a segment of the coastal zone. The first atlas, for the Penobscot Bay area, was published in 1972.[1] Allied projects are underway, and other agencies engaged in resources work have given priority to the coastal zone. Soil surveys and geologic surveys of bedrock, surficial deposits and groundwater are being concentrated on the coastal zone to provide the basic information needed for proper planning and best utilization, development and management of this region where pressure conflicts are the greatest.

The coastal planning project has received great impetus by passage of the Coastal Zone Management Act of 1972, Public Law 92-583. This Act provides for a comprehensive, long range and coordinated national program in marine science. There is to be established a National Council on Marine Resources and Engineering Development and a Commission on Marine Science, Engineering and Resources. Annual grants are available to any coastal state for the purpose of assisting in the development of a management program

[1] The Penobscot Bay Resource Plan. 1972. State Planning Office.

for the land and water resources of its coastal zone, and for annual grants to any coastal state for not more than two-thirds of the costs of administering the state's management program. Maine was one of the very first states to be awarded a grant under this Act.

6. State Data Bank. Soon after the formation of the State Planning Office a policy was enunciated expressing at least the intent to establish a general informational library utilizing data processing systems. A necessary prerequisite was the formal establishment of a bureau in the Department of Finance and Administration to develop the institutional capability to administer integration of the various existing data processing systems and incorporation of new ones into a central data bank. A Central Computer Service was formally established in 1971 and a new computer installed in 1972, permitting the Department to go beyond financial accounting and begin work on establishing a State data bank.

In 1969 the Departments of Inland Fisheries and Game and Sea and Shore Fisheries (the latter now the Department of Marine Resources) embarked jointly upon formulation of a comprehensive plan for fish, wildlife and marine resources management. The first project was automation of the basic files of the departments. It soon became apparent that many of these files were of general interest, and additional basic files relating to natural resources were created as needed for successful completion of the plan. Demand for use of these basic files developed quickly from other agencies, and satisfaction of these demands distracted the planning group from its appointed task. Consequently, on November 1, 1973, the State Planning Office assumed general administration of this automated system called MIDAS, the Maine Information Display and Analysis System. The nature of this system and assumption of its administration has contributed significantly to the goal of establishing a central data bank. While this system has files primarily in natural resources terms, it has the capability of indefinite expansion into other fields such as population and economic information which has already been covered by insertion of 1970 Census tapes and selected 1960 data manually placed into the system. The possibilities are enormous and several years will be required to enhance MIDAS to fulfill a role as a general data bank and management information system.

7. The Jordan Report. This report[1] was prepared for the State Planning Office in 1969 by the Edward C. Jordan Company. It places primary emphasis upon public water supplies and water pollution control facilities. The document has served as a beginning for the development of a comprehensive State water resources plan.

The inventory portion consisted of available data concerning surface, ground and coastal water resources. The major uses of these resources for water supply and waste disposal purposes are identified. The inventory was

[1] Maine Water Resources Plan, Water Supply and Sewerage Facilities, 1969. Vols. I and II. E.C. Jordan Company, Portland, Maine.

analyzed to determine the extent to which it contributed to Maine's water resources management needs.

The plan was prepared in two volumes. The first presented a perspective of statewide water resource needs. The second provided a comprehensive data base for regional and local water resources development and a framework for integrated regional planning of water supply and pollution control systems. With regard to institutional recommendations, the report called for river basin and coastal area planning to be accomplished at the State level, and for a State water resources agency to be empowered with the responsibility for developing operational plans for each basin and for the coast consistent with the needs of the State as a whole.

8. Population Analysis. The State Planning Office is the agency that interfaces with the U.S. Bureau of the Census and cooperates in the undertaking of the Census count recorded each decade. Tapes of the 1960 and 1970 Census have been acquired and placed into the data processing system for State use and analysis. A report on population projections was published in 1972 and a revised projection is scheduled for publication concurrently with this report.

9. Municipal Services. In 1973 the 105th Legislature enacted a revised version of a Shoreland Zoning and Subdivision Controls Act (Title 12, MRSA, Sections 4811-4814). The State Planning Office was assigned the tasks of designating significant rivers[1] and lakes[2] and the adjacent land subject to such controls and of developing appropriate guidelines[3] in cooperation with the Land Use Regulation Commission and Department of Environmental Protection, which agencies were charged with enforcing these controls. Municipalities were obliged to develop ordinances for controls meeting these guidelines by July 1, 1974, or allow this matter to lapse to the State. The State in turn placed a one-year moratorium on activities within the shorelands for those towns that did not enact ordinances by that date. During the year of moratorium, towns may enact ordinances and regain such zoning controls. A shoreland zoning coordinator was employed by the State Planning Office to develop standards and assist municipalities with formulation of appropriate ordinances. This will be a continuing process, presumably, until all towns and cities enact ordinances. A progress report on this matter is being published concurrently with this report.

10. Critical Areas Register. In the spring of 1974 the special session of the 106th Legislature passed an "Act Establishing a State Register of Critical Areas". The Act resulted from a determination by the Legislature that sites of unusual natural, scenic, scientific or historical significance are of an

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[1] List of Rivers Subject to Shoreland Zoning and Subdivision Controls. 1973. State Planning Office.

[2] Great Ponds in Maine. 1973. State Planning Office.

[3] Guidelines for Municipal Shoreland Zoning Ordinance. 1973. State of Maine.

overriding interest to the State in its development and preservation of land and water areas. It is now the policy of the State to encourage the preservation and utilization of these areas through land use planning, regulation and protective acquisition or management as appropriate, commensurate with controlled economic growth and development.

The initial task relative to critical areas is to develop a statewide inventory and an official, authoritative listing of the areas. The State Planning Office has been directed to prepare this inventory and listing as part of its overall responsibility for comprehensive statewide planning and the coordination of planning and conservation efforts of State and local agencies.

The Maine Critical Areas Advisory Board has been created to advise and assist in the establishment and maintenance of the register. One member is the State Planning Director or his designee. Ten additional members serve overlapping three-year terms.

Following the inventory of sites, the Critical Areas Register will be determined by the following criteria.

- The unique or exemplary natural qualities of the site.
- The intrinsic fragility of the site to alteration or destruction.
- The present or future threat of alteration or destruction.
- The economic implications of inclusion of a site into the register.

Institutional Arrangements of the Line Agencies

This sub-section contains a description of Maine's governmental activities in water and related land resources development. The major policy of each affected department is presented and, at the bureau or division level, the statutory mission is discussed and a sketch is given regarding the operations of each agency. The arrangements of governmental structures which oversee the usage and development of these resources are portrayed as they exist.

In Maine's State government organization there are ten major line agencies responsible for various water resource related programs, planning, and development. Each of these major agencies has specific charges from the Legislature to carry out certain duties. Within most of the agencies particular bureaus, divisions, or commissions have been formed or incorporated as part of the institutional arrangements of the State to further define the orientation of the tasks they are to perform. The following list depicts the ten major agencies of State government with a vital interest in water and related land resources, and indicates the bureaus, divisions, and commissions with their specific areas of concern. Chart 1 following the list indicates the formal organization and specifies the agencies with a vital interest in water and land resources management.

The State Department of Agriculture
Soil and Water Conservation Commission

The State Department of Commerce and Industry
Development Division

Division of Research and Analysis
Division of International Trade and Marketing
Promotion Division

The State Department of Conservation
Bureau of Forestry
Bureau of Geology
Bureau of Parks and Recreation
Bureau of Public Lands
Land Use Regulation Commission

The State Department of Environmental Protection
Bureau of Air Quality Control
Bureau of Land Quality Control
Bureau of Water Quality Control
Water Quality Evaluation and Planning Division
Lakes and Biological Studies Division

The State Department of Finance and Administration
Bureau of Property Taxation

The State Department of Health and Welfare
Bureau of Health
Public Water Supply Program

The State Department of Inland Fisheries and Game
Planning and Coordination Division
Wildlife Research and Management Division
Fisheries Research & Management Division
Atlantic Sea Run Salmon Commission

The State Department of Marine Resources
Research Division
Marketing and Promotion Division
Extension Division
Law Enforcement Division

The State Department of Transportation
Bureau of Planning
Environmental Services Division
Bureau of Waterways

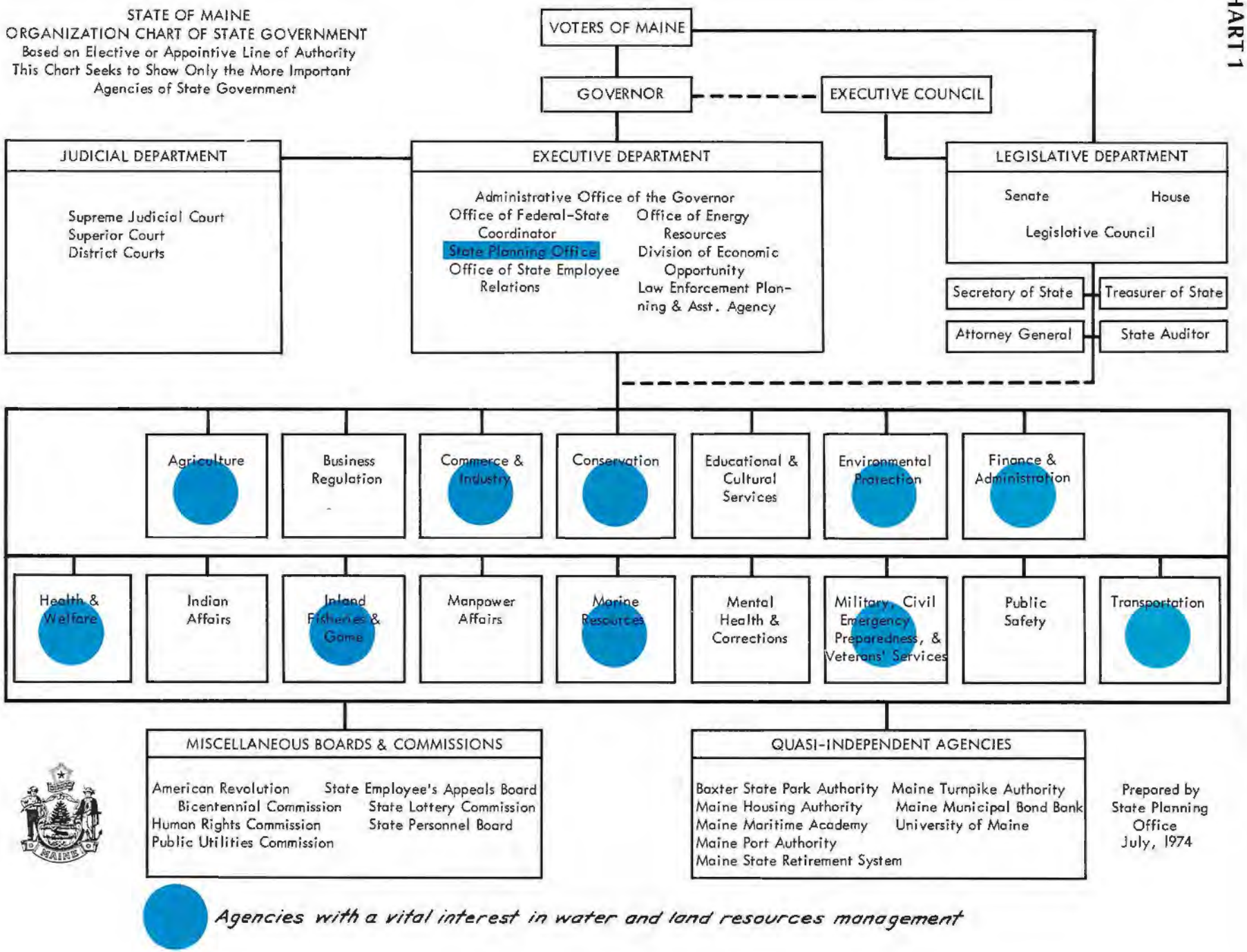
The State Department of Military, Civil Emergency Preparedness and Veterans' Services

Bureau of Civil Emergency Preparedness
Flood Warning and Control
Federal Flood Insurance Program
Dam Safety and Inspection

CHART 1

STATE OF MAINE
ORGANIZATION CHART OF STATE GOVERNMENT

Based on Elective or Appointive Line of Authority
This Chart Seeks to Show Only the More Important Agencies of State Government



Prepared by
State Planning
Office
July, 1974

Agencies with a vital interest in water and land resources management

Alda Stich

The State Department of Agriculture

Major Policy: [1]

To protect, promote and develop the social and economic well-being of all the people of the State by the conservation and improvement of the soil and crop land; advancement of the interest of husbandry and the compilation and dissemination of scientific and practical knowledge pertaining to agriculture; the promotion of agricultural products; detection, prevention control and eradication of plant, animal and poultry diseases of all kinds; and the protection of the consuming public against harmful products and practices.

SOIL AND WATER CONSERVATION DISTRICTS

It is the policy of the State to conserve soil and water resources and this policy may involve adjustments in land and water use and the development, improvement, and protection of these resources under various combinations of uses. It is the policy of the Legislature to provide for the conservation of soil and water resources through the creation of soil and water conservation districts for the control and prevention of soil erosion and to preserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wildlife and protect the tax base, the public lands and the general welfare of the people. Neither policy nor the powers or duties of the soil and water conservation districts are to infringe upon the rights of any owner of riparian lands located on a body of water or prevent the owner from using or taking water from any lake, pond, river, stream, or other water body located in the State. The soil and water conservation districts are agencies of the State and are empowered to carry out preventative and control measures and works of improvement for flood prevention or the conservation, development, utilization and disposal of water within the district. Among other duties, the districts are empowered to construct, operate and maintain such structures as may be necessary to conserve soil resources and prevent and control soil erosions. The sixteen soil and water conservation districts have an agreement with the U.S. Department of Agriculture, which provides for the technical assistance (manpower) from the Soil Conservation Service to each district.

SOIL AND WATER CONSERVATION COMMISSION

Together with the soil and water conservation districts the State has established the State Soil and Water Conservation Commission composed of eleven members. These include the dean of the College of Agriculture, the State Commissioner of Agriculture, the State Director of the Bureau of Forestry, State Commissioner of Inland Fisheries and Game, and the State Commissioner of Marine Resources; four are soil and water conservation district supervisors and the remaining two are soil conservation representatives appointed by the

[1] The major policies for each department or bureau were taken from the most recent compilation of the Maine State Policies Plan.

district supervisors. The State Conservationist of the U.S.D.A. Soil Conservation Service serves as a non-voting member of the Commission.

The powers and duties of the Commission include offering such assistance as may be appropriate to the supervisors of the soil and water conservation districts in carrying out their programs; to act as a liaison for and among the other districts and to facilitate an interchange of advice and experience between them; and to coordinate the programs of the several districts; to carry out preventative and control measures and improvement works for the control and prevention of soil erosion, to prevent floods and to conserve, develop, utilize and dispose of water; conduct surveys, investigations and research relating to the character of soil erosion and flood water and development damages, to publish the results of these surveys and disseminate whatever information would be helpful for preventative and control measures; and to construct and improve and operate whatever structures are necessary to prevent flood water and sediment damage, and to conserve, develop and utilize water impounded by such structures for irrigation, recreation, wildlife, municipal and industrial uses; and to serve as a sponsoring organization for Public Law 566, the Watershed Protection and Flood Prevention Act.

The State Department of Commerce and Industry

Major Policy:

To stimulate the creation of job opportunities and increased real per capita income in Maine by encouraging and assisting the expansion and improvement of new and existing economic activities within the State; and stimulating local economic and social development by guiding and assisting citizens in their efforts to improve the quality of life in their communities.

DEVELOPMENT

Purpose. The purpose of the Development Division is to provide direct assistance to potentially new and existing enterprises in order to encourage and facilitate the expansion and improvement of Maine's industrial operations, vacation travel facilities, foreign and domestic markets and community services.

The Responsibilities of the Development Division:

A. Information Services. To acquire, compile, maintain and disseminate detailed information pertaining to wage rates; shipping costs; transportation services; tax rates; financial assistance and incentive programs; availability of sites, building and energy; raw material resources; environmental protection laws; and other data of specific interest and value to development prospects.

B. Direct Assistance. To provide development prospects with direct assistance in determining the availability of an adequate labor supply, establishing training programs for prospective employees, preparing requests for financial assistance from public and private institutions, evaluating existing or proposed management and operating procedures, conducting on-site inspections of potential sites and facilities and similar kinds of assistance services as needed.

C. Community Betterment. To assist and encourage Maine communities, community officials and citizens and community and regional organizations in their efforts to improve all aspects of existing economic activities, social services and environmental conditions and to implement a specific program designed to stimulate local awareness, involvement and accomplishment of community projects directed at these public goals.

RESEARCH AND ANALYSIS

Purpose. The purpose of the Research and Analysis Division is to provide investigative and evaluative capabilities and support to the Department for the purpose of identifying and describing economic and community development activities and opportunities and potentials for the creation of new enterprises and the expansion of proven existing businesses and activities.

The Responsibilities of the Research and Analysis Division:

A. Information Services. To acquire, compile, maintain and disseminate socio-economic data and information pertaining to the State and useful to the conceptualization, definition, evaluation, development and/or implementation of new or improved economic systems of activities within the State.

B. Economic Research. To monitor the overall economy of the State by the collection, assembly and synthesis of specific data pertaining to the production and consumption of goods and services in the State and develop and establish methods and techniques for assessing and projecting the anticipated impact of proposed developments, economic situations and trends and governmental incentive programs and fiscal policies.

C. Economic Analysis. To conduct or sponsor various kinds of analytical examinations of specific opportunities and/or problem situations peculiar to individual sectors of Maine's industry and economy with a view toward the broader utilization of the State's natural, human and community resources and the development of new and improved methods and techniques which would tend to improve the economic condition of these sectors.

D. Reports. To assist in the preparation of special or periodic reports, position papers, impact assessments or projections concerning special economic development situations or trends as they may occur or in response to specific requests from the Governor or any other state agency. Also, assist in the preparing of new legislation to improve the business and investment climate in the State and/or create new and expanded job opportunities.

INTERNATIONAL TRADE AND MARKETING

Purpose. The purpose of the International Trade and Marketing Division is to assist existing Maine industry to locate and expand markets for their products and services and to encourage the investment of foreign capital in an industrial facility or participating venture in Maine.

The Responsibilities of the International Trade and Marketing Division:

A. Information Services. To provide comprehensive informational services, in the form of trade statistics and reports, export directories, bulletins, newsletters, reference lists, seminars, conferences and personal contacts, to Maine industry and their existing and potential customers concerning marketing, purchasing and investment opportunities in the State.

B. Market Development. To assist Maine industry to develop new international and domestic markets for their products and services by sponsoring, conducting and participating in overseas trade missions and exhibitions, conducting special marketing promotion programs, explaining exporting procedures and requirements, providing translation assistance when possible and serving as an overall advisor on marketing affairs of interest to Maine businessmen.

C. Reverse Investment. To expose by direct contact, overseas trade missions, special publications, liaison with Federal agencies and any other appropriate methods, potentially profitable investment opportunities in Maine to encourage foreign firms to establish plants or operations in Maine or to establish joint ventures or licensing agreements with existing Maine firms.

D. Coordination. To serve as the primary focal point and coordinating agent for all trade expansion and reverse investment activities and programs conducted by the State governmental agencies and participating private organizations and associations.

PROMOTION

Purpose. The purpose of the Promotion Division is to engage in creative marketing of the State with respect to its indigenous attributes, resources and traditions in order to further the development and enhancement of its economic, social and environmental qualities.

The Responsibilities of the Promotion Division:

A. Information Services. To provide comprehensive information services to the general public, both resident and nonresident and including tourists, in response to requests for descriptions or data pertaining to industrial, commercial, agricultural, recreational, cultural, economic, educational, governmental, demographic or natural resources, facilities, attractions, opportunities and advantages of the State.

B. Publicity. To set forth and display the resources, facilities, attractions, opportunities and advantages of the State by utilizing such techniques as advertisements, displays, posters, films, billboards, exhibits, news releases or other appropriate means which would serve to provide suitable publicity concerning the qualities of the State.

C. Public Relations. To further enhance the exposure of the State by encouraging, assisting, participating or sponsoring various activities or techniques such as shows, fairs, exhibitions, festivals, seminars, writers' tours, feature articles, lectures and awards which would increase public awareness of the resources, facilities, attractions, opportunities and advantages of the State.

D. Publications. To be responsible for the design, layout, composition, graphic arts, printing and distribution of all brochures, pamphlets, booklets, and reports issued by the Department, including the publication of an informative and promotional periodical designed to objectively describe the characteristics and potential of the State and recent development activities and trends throughout the State.

The State Department of Conservation

Major Policy:

To encourage the wise use of the scenic, mineral and forest resources of the State of Maine, and to ensure that coordinated planning for the future allocation of lands for recreational, forest production, mining and other public and private uses is effectively accomplished, and to provide for the effective management of public lands in the State of Maine.

BUREAU OF FORESTRY (MAINE FOREST SERVICE)

The Maine Forest Service is a diverse, decentralized Bureau having responsibility in three major areas; forest fire protection, forest management and insect and disease control (Entomology).

The Division of Forest Fire Control

The Division of Forest Fire Control is responsible for the protection of Maine's forests and damage due to forest fire. This includes prevention, presuppression and suppression activities such as damage appraisal, forest fire detection, public education, law enforcement, operation of forest campsites, maintenance of equipment, training and other related duties.

The Forest Management Division

The Forest Management Division has the primary goal of providing technical assistance and advice to small woodland owners, wood processors, loggers and others, on matters of forest management, including: harvesting, reforestation, timber stand improvement, wood products utilization and marketing, planning and forest taxation. They also cooperate with the U.S. Forest Service on several Federal programs. A forest nursery is operated under the general guidance of this Division.

The Division of Entomology

The Division of Entomology (Insect and Disease Control) carries out a variety of detection, control, research and public information programs relative to insect and disease problems of shade and forest trees. An extensive survey system provides for early detection of potential insect problems. Special control programs on white pine blister rust, spruce budworm, Dutch Elm disease, and other problems are conducted. Close liaison is maintained with municipalities especially relating to shade tree planting and management.

The Bureau of Forestry maintains statistical records on a variety of forest oriented activities such as forest fires, forest resources, timber products harvested, insect and disease populations, tree plantations and stumpage prices.

Several publications are compiled and distributed annually to keep those interested abreast of current trends.

BUREAU OF GEOLOGY (MAINE GEOLOGICAL SURVEY)

The Bureau of Geology is a part of the Department of Conservation and administers the programs of the Maine Geological Survey and provides administrative and fiscal assistance to the Maine Mining Bureau. It is the purpose of the Bureau to gather, compile, and analyze information of bedrock and surficial features, groundwater hydrology, and coastal marine geology of the State and to present this information on printed maps and in reports for professional geologists and engineers doing environmental, construction, and mining work, and to the general public. The professional staff performs geologic mapping for specific projects in Maine and provides basic geologic information and the location and the environment of mineral deposits; initiates

and develops research projects in the field of economic geology and basic geology necessary to advance total geologic knowledge of the State; and conducts whatever investigations are thought necessary of the natural and physical resources in order to provide information on the physical environment. These investigations include marine geology studies; environmental geology studies, hydrogeology studies, and geology studies for the benefit of industry and plant location.

Current work projects include a study of the St. George Estuary and Muscongus Bay, variations in beach and dune morphology in the Popham area, mapping of coastal marine geologic environments along the entire coast, hydrogeologic studies of Knox, Lincoln, Sagadahoc, Cumberland, Hancock and Waldo Counties, a study of the saltwater-freshwater interface in part of Harpswell, and mapping and studies of surficial and bedrock geology throughout the State.

BUREAU OF PARKS AND RECREATION

Title 12, MRSA, Sections 601-608 delineates the general provisions of the Bureau of Parks and Recreation of the Department of Conservation. The Bureau has jurisdiction, custody and control over all State parks and memorials and other parks which are under the control and management of the State, with the exception of Baxter State Park.

With consent of the Governor and Council, the Bureau of Parks and Recreation may acquire on behalf of the State, land or any interests therein and the exclusive rights and privileges to the use and enjoyment of portions of these lands. Also the Bureau is charged by Legislature to study and ascertain as nearly as possible and report to the Governor and the Council concerning the State's actual and potential outdoor recreation resources and facilities; the needs of the people of the State and out-of-state visitors for such recreational resources and facilities; the kinds of resources and facilities best suited to and required for such recreational needs; the extent to which recreational needs are being currently met whether by publicly owned or privately owned facilities; the location and probable costs of acquisition, development and operation of parks, which if acquired, developed and operated under the law would satisfy such needs, and study generally the several public purposes for these parks.

Also the responsibility of the Bureau of Parks and Recreation, The Maine Trails System consists of recreational trails, primitive trails and facilities. The recreational trails are designed to provide a variety of recreational opportunities including recreation by foot, horseback, and other types of transportation. The primitive trails provide for the appreciation of natural and primitive areas and for the conservation of significant scenic, historic, natural or cultural qualities of the area through which the trails pass and offer primarily the experience of solitude and self-reliance in natural or near natural surroundings. These trails are developed mainly for foot traffic including hiking, snowshoeing and skiing, and the Appalachian Trail is

included in this primitive category of the Maine Trails System. The facilities related to the Trails System include campsites, shelters, and related public use and management facilities. The Department of Conservation appoints a Maine Trails System Advisory Committee whose members represent various interested parties for the purpose of advising on matters related to the Maine Trails System.

The Bureau of Parks and Recreation also administers the Allagash Wilderness Waterway, which was established for the preservation, protection and development of the natural scenic beauty and unique character of this waterway, its wildlife habitat and its wilderness recreational resources.

BUREAU OF PUBLIC LANDS

This Bureau has jurisdiction over the public reserved lots as defined in Title 12 MRSA Section 504. In every township there is reserved by act of the Legislature, one thousand acres of land for the benefit of that township, average in quality, situation and value as to timber and minerals. In many of the unorganized townships these one thousand acres have not been located and may be selected by the director of the Bureau of Public Lands.

The Bureau of Public Lands has supervision and control of all lands owned by the State including the public domain, unconveyed islands in great ponds and in the sea, tidal lands below mean low water, unconveyed land beneath great ponds and lands acquired for storehouse sites relative to departmental facilities and the Bureau may make such recommendations as it thinks wise to the Legislature for the exchange or the sale of these public lands where appropriate giving proper descriptions and appraisals.

Management Objectives

The Bureau of Public Lands will manage the public lands in its jurisdiction for the equitable and long range benefit of the people and land of Maine. Its management plans will provide for the protection, enhancement, and wise utilization of the natural resources associated with the public lands, and for the economic well-being of Maine's citizens.

A fundamental consideration, however, is that the public lands cannot be all things to all people. Management must be flexible, reflecting changing public needs while retaining a commitment to protect and enhance the resource itself. It will be necessary to place limits and guidelines on resource use to maintain the productive capacity of the land. In establishing these guidelines the Bureau of Public Lands will make every effort to be responsive to changing public needs for land use. In turn, effective management of the public lands will require public trust in the judgment, skill, and goodwill of the land administrators.

The Bureau of Public Lands has established these management objectives:

Environmental Quality. To maintain the environmental integrity of the land resource by pursuing high standards of land use and resource management.

Inventory. To obtain and maintain an accurate, up-to-date inventory of the various resources associated with the public lands.

Soil Management. To protect, manage, and enhance the soil resources of the public lands.

Water Management. To protect and enhance water quality for water supply, fish and wildlife requirements, and recreational use.

Resource Protection. To protect the resource from destructive agents with due consideration for other values.

Recreational Management. To provide a variety of high quality recreational opportunities on an equitable basis, emphasizing the characteristics of the natural environment.

Fish and Wildlife Management. To provide habitat that will sustain a variety of fish and wildlife.

Economic Opportunities. To provide an increased variety of sound economic opportunities for the people of Maine.

Timber Management. To grow and harvest trees for a regulated, sustained yield of timber products.

Agriculture. To maintain and increase the productivity of public agricultural lands for the production of forage, grains, and other crops.

Minerals Management. To provide for the sound development and productive use of mineral resources on the public lands.

Research. To promote research in the management and use of the natural resources on the public lands.

Special Use. To develop fair and equitable standards for evaluating public land uses not specifically covered in existing policy.

Interagency Cooperation. To promote cooperation between agencies which have particular interest in the resources of the public lands, to eliminate duplication, to minimize conflict, and to make use of the expertise developed by each agency.

Public Involvement. To encourage public involvement and comment that will lead to responsive land and resource management decisions.

These objectives constitute the framework within which individual management plans will be tailored to the characteristics and requirements of each public land parcel.

Currently the Bureau is studying in detail the Machias River Basin in order to develop potential alternative uses for public lots and a basis for public lot management. The study is being done in cooperation with the Audubon Society and related State agencies and is scheduled for publication in December, 1974.

LAND USE REGULATION COMMISSION

Title 12 MRSA Chapter 206-A delineates the general provisions of the Maine Land Use Regulation Commission. The Commission is charged by the Legislature to extend the principles of sound planning, zoning and subdivision control to the unorganized and deorganized[1] townships of the State; to preserve public health, safety and general welfare; to prevent inappropriate residential, recreational, commercial and industrial uses detrimental to the proper use or value of these areas; to prevent the intermixing of incompatible industrial commercial, residential and recreational activities; to prevent the development of substandard structures, or structures located unduly proximate to waters or roads; to prevent despoliation, pollution and inappropriate use of the water in these areas; and to preserve ecological and natural values.

In addition, the Legislature declares it to be in the public interest to encourage the well planned and well managed multiple use of land and resources and to encourage the appropriate use of these lands by the residents of Maine and visitors in pursuit of outdoor recreation activities such as hunting, fishing, boating, hiking and camping.

The Commission consists of seven members, the Commissioner of the Department of Conservation and six public members appointed by the Governor. Of those six, four are to be knowledgeable in at least one of each of the following areas; commerce and industry, fisheries and wildlife, forestry, and conservation.

Among its other duties, the Commission determines the boundaries of areas within the unorganized and deorganized portions of the State that fall into land use districts and designates each area in one of the following major district classifications; protection, management or development. Protection districts are those areas where development would jeopardize significant natural, recreational and historical resources such as floodplains, precipitous slopes, wildlife habitat, shorelands, recreational, historic, and scenic areas, and other areas critical to the ecology of the region or State. Management districts include areas which are appropriate for commercial forest product

[1] A township which has abandoned its form of government, reverting to essentially the same status as an unorganized township.

or agricultural uses and for which plans for development are not presently formulated nor additional development anticipated. Development districts include areas discernable as having relatively homogeneous patterns of intensive residential, recreational, commercial or industrial use or commercial removal of minerals or other natural resources and areas appropriate for designation as development districts when measured against the purpose, intent and provisions of the law.

The Commission also prepares land use standards for the use of air, land and water, encourages the most appropriate use of water resources consistent with a comprehensive land use plan, protects public health by the reduction of water pollution and considers the availability and capability of the natural resources base including soils and sufficient healthful supplies of water.

One of the major responsibilities of the Land Use Regulation Commission is the development of a comprehensive land use plan. On January 1, 1975, the Commission will submit to the Governor an official comprehensive land use plan for the unorganized and deorganized townships of the State. The comprehensive land use policies reflect a broad approach to land use decision making and in the area of water use they will relate to such things as water quality, aquifer recharge for groundwater, the uses of water for recreation, wildlife habitat, industrial consumption, and culinary water, and land uses near surface water, and uses on surface water dependent upon a developing classification system.

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The State Department of Environmental Protection

Major Policy:

To protect and improve the quality of our environment and the resources which constitute it, and to improve the public's opportunity to enjoy and exist healthily in the environment, by controlling the despoliation of our resources and directing growth and development along planned lines which will preserve for all time an ecologically sound and aesthetically pleasing balance of naturally-occuring resources.

BUREAU OF AIR QUALITY CONTROL

By Title 38, MRSA, the Legislature has called for the establishment of ambient air quality standards. Such standards are for the regulating and limiting of the amounts and types of air contaminants in the air outside of buildings and such ancillary structures as stacks or ducts. The Legislature has also called for the establishment of emission standards, regulating the amount and type of contaminants emitted into the ambient air. Such emission standards are designed to prevent air pollution and to achieve and maintain the ambient air quality standards. These standards are set in relation to five designated air quality regions statewide. These regions, which include the entire State, are: Metropolitan Portland, Central Maine, Downeast, Aroostook, and Northwest Maine.

The Bureau, through its field activities in the Enforcement Division, enforces the ambient air standards, the emission standards, and the regulations as set forth by the Board of Environmental Protection. Such field activities include plant investigations, special air monitoring, stack sampling, and visual emission evaluations. The Division of Air Quality Services reviews the standards and carries out long range planning for the achievement of these standards through its monitoring network and its liaison with other concerned agencies at all levels of government. The Division of Industrial Services reviews all air pollution abatement plans, both publicly and privately developed. It carries on a technical assistance and inspection program to assist plant operations and to insure proper operation of the abatement facilities. It also recommends appropriate licensing of all polluters to the Board, and conducts surveillance of all sites to insure compliance.

There are two regional offices in operation to facilitate this work - one in Portland and one in Bangor.

BUREAU OF LAND QUALITY CONTROL

By Title 38 and various chapters of Titles 10 and 12, the Legislature has called for the development, management, and enforcement of controls regarding the uses of land. The Bureau is responsible for the following Acts, Laws, and Programs.

The Wetlands Act, which states, in brief, that no one shall remove, fill, dredge, or otherwise alter any coastal wetland, or drain or deposit sanitary sewage into or on any such wetland without first obtaining a valid permit. The zoning of a wetland as a protection area tends to conserve water supplies, wildlife, and fresh water, estuarine, and marine fisheries.

The Mining Rehabilitation Act encourages the proper development of Maine's mineral resources. It states that where mining operations are conducted, affected lands are to be reclaimed and placed in productive use. Such use includes planting of trees, seedling grasses and legumes for grazing, planting of harvest crops, the enhancement of wildlife and aquatic habitat, and for the conservation, development, and management of all appropriate uses for the protection of the natural resources of the areas to protect the people, as well as the natural beauty and environmental values.

The Site Location Law controls the location of those developments which might otherwise substantially affect a local environment by insuring that such developments will be located in a manner which will have a minimum adverse impact on the natural surroundings. The Legislature has found that the economic and social well-being of the people depends on the location of all manner of developments with respect to the natural environment, that many developments, due to their size or nature, cause irreparable damage to the people and their surroundings, that the location of such developments is simply too important to be left only to the determination of the owners of the developments, and that certain discretion must be vested in a public authority to regulate the developments which may, by their location, substantially affect the environment.

The Shoreland Zoning Law aids in the fulfillment of the State's role as trustee of its navigable waters. By this law, the Legislature has declared that shoreland areas, defined as land within 250 feet of the normal high water mark of any navigable pond, lake, river or body of salt water, are subject to zoning and subdivision controls.[1] The purpose of the controls is to promote safe and healthful conditions for people, to prevent and control water pollution, to protect spawning grounds, fish, aquatic life, bird and other wildlife habitat, control building sites, conserve shore cover, and the natural beauty of the landscape.

The Great Ponds Act calls for the Board of Environmental Protection to regulate by the issuance of permits the construction and maintenance of causeways, bridges, marinas, wharves, and permanent structures, or the deposit of fill in or the dredging of Great Ponds. The permit demonstrates that the proposed activity will not unreasonably interfere with existing recreational, navigational, scenic, or aesthetic uses, nor otherwise harm natural environs of a Great Pond or its tributary rivers, nor cause soil erosion, nor interfere

[1] There is a list of rivers published by the State Planning Office which are subject to this law. The upstream limits of these rivers have been defined for specific definition of lands covered by law.

with the natural flow of any waters, nor create unreasonable noise or traffic, nor harm any fish or wildlife habitat, nor lower the quality of any waters.

The Solid Waste Management Program is a charge from the Legislature, consistent with its responsibility to protect the people of Maine, to enhance the quality of the environment, to conserve our natural resources, and to prevent air and water pollution, to encourage solid waste programs which will reduce the volume of solid waste production, improve efforts to reuse and recover valuable resources currently being wasted, and in a manner which will not degrade the environment.

The Legislature also declares that the most economic, efficient, and environmentally sound method of waste disposal is of the highest priority. Municipalities today are generating increasing amounts of solid waste with no systematic or consistent methods being used to reduce the volume of waste or to soundly dispose of it. Failure to plan properly for future solid waste may further deplete already taxed natural resources and aggravate environmental and public health problems resulting from present inadequate practices of resource recovery and solid waste disposal.

Regarding site characteristics and approval of locations for potential waste disposal, the Department recognizes that because the surficial geology of Maine is both complex and varied, a single set of physical conditions cannot be described for a plot of land which would be applicable throughout Maine for safe and economical waste disposal. Differences in the amount and type of waste to be disposed at a particular site increase the complexity of selecting appropriate standards. Because it is desirable to keep the waste material dry and to keep it away from groundwater, the following set of general physical conditions is described by the Department to be adequate for the protection of ground and surface water resources, provided that the facility is well designed and operated.

1) The surficial material soils, underlying the refuse to a depth of at least five feet, is to be well-graded, granular material and relatively free of cobbles.

2) All refuse shall be placed at least five feet above groundwater.

3) The site should be moderately sloped, up to about fifteen percent.

4) The site boundary shall not lie closer to a classified body of water than 300 feet.

5) The site boundary shall not lie closer to the nearest residence or potable water supply than 1,000 feet.

According to the provisions of the Public Dumps, Septic Tank and Cesspool Waste Act, each municipality is to provide for the disposal of all waste,

refuse, effluent, sludge, or other material from septic tanks and cesspools. The location, operation, and maintenance of any facility or site used for this purpose, other than a sewage treatment plant, is subject to the approval of the Department in order to insure that disposal of wastes at such sites will not contaminate any bodies of water, water supplies, groundwater, or constitute a hazard to any person.

The Minimum Lot Size Law was enacted by the Legislature to protect, among other reasons, the area water supplies and the quality of land and water resources generally. The law states basically that a lot of land which is not served by a sewer system shall not be used for single family residential purposes unless it contains at least 20,000 square feet; and if the lot abuts a public road, lake, pond, river, stream or seashore, it must have a minimum frontage of 100 feet. A lot of less than 20,000 feet may be used for such residential purposes upon approval by the Department of Health and Welfare based on adequate percolation tests, soil type, soil observation holes, and with the recommendations of a registered engineer and soils scientist, provided that the municipality or the Board of Environmental Protection has no more stringent regulations to apply to the lot.

The Bureau of Land Quality Control is administratively divided into these three divisions:

The Division of Review and Planning prepares the standards and guidelines for shoreland zoning, wetlands control, mining rehabilitation, site location, Great Ponds, and minimum lot size laws. This Division also processes the applications for permits and approvals of these laws, makes recommendations to the Board of Environmental Protection for such permits or approvals, and provides the general program planning for the Bureau.

The Division of Enforcement is responsible for the policing of all the Bureau's laws and regulations, follows up on complaints, and sees to it that the policies of the Bureau are adhered to according to the action of the Legislature.

The Division of Solid Waste Management is responsible for the development of an environmentally sound and healthful solid waste disposal program. This Division coordinates this program with the Air and Water Bureaus and other public and private agencies and groups, and is responsible also for the licensing and proper disposal of specific materials such as septic tank sludge.

BUREAU OF WATER QUALITY CONTROL

This is the largest of the Bureaus within the Department of Environmental Protection, encompassing seven divisions of water related services. The concern for water quality extends from the urban centers of the State to its most remote rural areas, and includes lakes, streams, rivers, groundwater, and

the sea. The duties and responsibilities of each of these divisions are closely related to each other and more often than not the accomplishment of State and Federal laws involves work processes which render descriptions on a division base, at best, limited.

The Division of Water Quality Evaluation and Planning is responsible for all basic planning, areawide planning, and other related activities. Also it is responsible for determining the current quality of all waters within the State. This is carried on through a widespread monitoring system. The DEP water quality monitoring program for the fiscal year beginning in July of 1974 includes three types of monitoring: source, trend, and intensive.

Source monitoring involves the taking of samples from the effluent of every industrial plant which has an operational waste treatment facility and which has been licensed under the National Pollutant Discharge Elimination System (NPDES). The system is explained in section 402 of the Federal Water Pollution Control Act Amendments of 1972. The samples are analyzed for a wide range of pollutants at laboratories located in Augusta, Farmington, Scarborough, and at remote locations via a mobile lab to determine if the waste treatment facility is in compliance with license conditions. Samples are also taken from municipal wastewater treatment facilities and tests are made to determine to what extent pollutants exist in the water. The samples are brought to labs in Augusta, Farmington, Scarborough, and Presque Isle. Areas from Bangor to the south and east are served by the mobile lab. The Division of Municipal Services handles these samples and also those of State and Federal treatment plant installations. The Licensing & Enforcement Division is responsible for all enforcement actions which may arise. Samples from oil handling terminals are analyzed for oil and grease and the results are reported to the Oil Conveyance Division, which is responsible for licensing the terminals.

Trend monitoring involves taking water samples at monthly intervals from fixed locations. There is in Maine a network of locations for data gathering on water quality which is part of a nationwide network established by the Federal Environmental Protection Agency and referred to as the National Water Quality Surveillance System (NWQSS). The DEP's Primary Monitoring Network (PMN) includes the NWQSS stations (Map 20). These monitoring stations, and new ones being established, test the water for such things as temperature, Ph (the relative amounts of acid or alkalinity), dissolved oxygen, total coliform and fecal coliform bacteria, turbidity, biochemical oxygen demand (BOD), which briefly is the demand for oxygen from the water which any pollutant may require, and nutrients, which cause the rapid growth of plant life and hasten the eutrophication, or aging process, of water bodies.

Intensive monitoring involves the taking of samples relating to specific sources of pollution and usually as a result of complaints most of which occur during the summer months. These usually involve lakes and are handled by the Lakes Division staff. The Water Quality Evaluation and Planning Division evaluates stream segments for the impact of present pollution, assimilative capacity, and excess capacity the stream might have and still maintain its current classification.

Classification

The Division of Water Quality Evaluation and Planning also recommends water quality standards for the classification of fresh surface waters which are noted only generally below.

A - Good for recreational purposes including bathing, and for public water supplies after disinfection.

B - 1 Good for recreation purposes, including water contact recreation, and for use as a potable water supply after adequate treatment, and good for fish and wildlife habitat.

B - 2 Same generally as B - 1, with technical differences of dissolved oxygen, total and fecal coliform bacteria.

C - No water contact sports allowed, good for boating and fishing, fish and wildlife habitat; must be treated adequately for swimming to be allowed, or for use as drinking water.

D - This classification assigned only where a higher one cannot be attained after utilizing the best practicable treatment or control of sewage or other wastes. These waters may be used for power generation, navigation, and for industrial process water after necessary treatment.

There are five standards for the classification of tidal waters:

SA - Suitable for water contact recreation and for fishing; also for the propogation and harvesting of shellfish, and as a fish and wildlife habitat.

SB - 1 Same as SA, with technical differences of dissolved oxygen, total and fecal coliform bacteria.

SB - 2 Same as SB - 1, with added technical differences, and also suitable for industrial cooling and process uses.

SC - No water contact sports, but suitable for boating and fishing, also may be used for the propogation of indigenous shellfish to be harvested for depuration purposes (which means that such shellfish must be flushed with a higher quality water before they are suitable for human consumption), suitable also as a fish and wildlife habitat, and for industrial cooling and process uses.

SD - This classification assigned only where a higher one cannot be attained after utilizing the best practicable treatment or control of pollutants. Waters may be used for power generation, navigation, industrial cooling, process uses, and for the migration of fish.

All fresh and tidal waters of the State have been classified by the DEP and a list may be secured from the Department.

The Division of Industrial Services reviews and improves industrial abatement and facility plans, and provides technical assistance in the operation of wastewater treatment plants. The Division maintains current data regarding the best practicable technology for the treatment of certain exotic wastes. It evaluates requests from industries for tax exemption certificates based on costs and timing of waste abatement facility construction and operation. It also establishes allowable industrial waste discharge quantities of various substances relative to the capacity of receiving waters.

The Division of Municipal Services deals solely with municipal treatment and abatement problems. The Division reviews and approves treatment facility plans and offers advice in preparing abatement plans. It also administers State and Federal construction and planning grants, provides inspections and technical aid to municipalities, and evaluates requests for tax exemption certification.

The Division of Oil Conveyance Services maintains an ongoing program of terminal and facility inspection and licensing; it establishes spill management programs for the prevention of oil contamination and for clean-up operations; it also manages license revenues and processes all oil spill damage claims.

The Division of Lakes and Biological Studies administers the Great Ponds Program as outlined in Title 38, MRSA. It also carries on the water quality monitoring of Maine's lakes and provides biological laboratory support for the DEP's other water quality evaluation studies.

The Division of Licensing and Enforcement processes all applications for waste discharge licenses and prepares recommendations on such licenses for the Board of Environmental Protection. It is responsible for the enforcement of all water laws and regulations, and follows up on any complaints.

The Division of Laboratory and Field Studies provides lab services for the central and field offices, carries on the mobile lab operations, and executes special studies and investigations for the Water Bureau.

The Presque Isle Regional Water Bureau Office provides for a wide range of water quality control services in Aroostook and adjacent counties.

The Board of Environmental Protection consists of ten members appointed by the Governor with the advice and consent of the Council and one ex officio member. Two represent manufacturing interests, two represent municipalities, two represent the public generally, two represent the conservation interests, and two are knowledgeable in matters relating to air pollution. The Commissioner of the Department sits as the ex officio member.

It is the duty of the Board to control the pollution of the air, the waters, and the coastal flats, and to prevent the diminishing of the natural environment of the State. The Board makes recommendations to the Legislature regarding the classification of the State's waters based on reasonable standards of quality and use. The Board also makes recommendations to the Legislature on measures designed to control the pollution of the air, land, and waters for the benefit of the people of Maine. The Board is authorized to conduct a continuous planning process in cooperation with appropriate Federal, State, regional and municipal agencies, consistent with the requirements of the Federal Water Pollution Control Act, as amended.

The Federal Water Pollution Control Act Amendments of 1972 contain five planning sections of specific import to the State of Maine and directly related to water and related land resource management.

Section 102(c) (1,2) Comprehensive Basin Planning

This section has not been funded to date. The Environmental Protection Agency may make a 50% grant to the State, at the request of the Governor, to develop an effective, comprehensive water quality control plan. The agency will receive the grant over a three-year period and must adequately represent appropriate State, interstate, and local interests. The agency's comprehensive pollution control plans for the basins, according to this Law, must:

a) be consistent with any applicable water quality standards, effluent limitations, thermal discharge regulations, etc.;

b) recommend wastewater treatment works that will provide the most effective and economical means of collection, storage, treatment, and elimination of pollutants; and recommend means to encourage municipal and industrial use;

c) recommend maintenance and improvement of the water quality of the basin; and recommend methods of adequately financing those facilities as may be necessary to implement the plan; and,

d) be developed in cooperation with, and consistent with, any comprehensive plans prepared by the Water Resources Council, any areawide waste management plans developed pursuant to Section 208 of this Act, and any State plan developed pursuant to Section 303 of this Act.

Section 201: Municipal Facilities Planning

This section has not been funded to date. It calls for specific and innovative planning at the local level to insure a cost effective and environmentally sound approach and result. The waste treatment plans are to provide for:

a) the best practicable waste treatment technology before any discharge into the receiving waters;

b) treatment on an areawide basis of all point and non-point sources of pollution;

c) waste treatment management which results in the construction of revenue producing facilities which in turn provide for:

1) recycling of potential sewage pollutants through the production of agriculture, silviculture, and aquaculture products;

2) confined and contained disposal of pollutants not recycled;

3) the reclamation of wastewater; and for

4) the ultimate disposal of sludge in a manner which will not result in environmental hazards.

The planning and management of the waste treatment operation should combine open space and recreation considerations, and should be designed and operated to produce revenues in excess of capital, operation, and maintenance costs. Such excess revenues should be used in financing other environmental improvements.

Section 208: Areawide Planning

This section calls for areawide (sub-state regions) wastewater treatment management planning wherein a number of communities with severe water quality control problems can cooperate and us a single regional planning agency. A number of areas in Maine have applied for funding under this section: Greater Portland, Southern Maine, Northern Maine, the Androscoggin Valley (Lewiston-Auburn) and Southern Kennebec Valley (Augusta-Cobbossee). As of December, 1974, all have been approved by EPA. The requested funding for these was approximately $2 million. The planning process will be a maximum of two years at which time the completed plans and names of the implementing agencies will be submitted to the U.S. Environmental Protection Agency for approval. Land use considerations and other non-structural alternatives are integral parts of Section 208 planning.

Section 209: Basin Planning

This section calls for the Water Resources Council to prepare Level B plans for all major basins in the United States and have them completed not later than January of 1980. A Level B plan is a reconnaissance-level evaluation of water and land resources for a selected area, i.e., the Penobscot, Androscoggin, or Kennebec river basins (Map 9). The level B plan is more detailed than the Level A, or framework studies (NENYIAC or NAR reports). The scope of the Level B plan is less broad, addresses itself specifically to the complex, long range problems only identified in the Level A studies, and focuses on the felt needs of the next 15 to 25 years. It articulates and recommends action to be taken by Federal, State, and local entities. Alternate plans are presented and trade offs among alternatives are analyzed.

The Level B plan identifies the most urgent elements requiring early action in any river basin and guides subsequent implementation studies.

The Level C plan is the implementation study. Such plans are generally undertaken by a single entity of government to implement the findings of the Level A and B plans.

Section 303(e): State Continuing Planning Process

This section calls for the State to prepare water quality management plans for all basins by June of 1975. These plans will be based upon monitoring and surveillance, water quality standards, maximum daily loads, point and non-point sources, effluent limitations, and all other water quality factors. The first round of plans will be completed by July 1, 1975, for all river basins in Maine.

Section 314: Clean Lakes

This section calls for the State to identify and classify according to eutrophic conditions all publicly owned fresh water lakes; to establish procedures to control sources of pollution of these lakes; and to prepare methods, in conjunction with appropriate Federal agencies, to restore the quality of such lakes. To date this section has not been funded.

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The State Department of Finance and Administration

Major Policy:

To assure the maximum attainable effectiveness of operations from available resources throughout State government by the development, implementation, and refinement of sound management practices.

BUREAU OF PROPERTY TAXATION

This Bureau is responsible for the direction, supervision, and control of the administration of all property tax laws of the State. It performs the assessing function in the unorganized territory of the State, and a general supervision and rendering of assistance to the organized municipalities. Among its other duties, the Bureau certifies to the Secretary of State the equalized just value of all real and personal property throughout the State. The real property tax is applied to real estate which includes all lands in the State together with the water power, shore privileges and rights, forests, and mineral deposits. Therefore, the taxation of certain lands, such as forests, and the manner in which the lands are assessed and the laws interpreted, has a distinct bearing on the uses to which lands are put.

The Tree Growth Tax Law

Title 36 MRSA Section 571 et seq., declares that it is in the public interest to tax all forest lands according to their productivity and thereby to encourage their operation on a sustained yield basis. It is further declared to be in the public interest to encourage forest landowners to retain and improve their holdings of forest lands on the tax rolls, and to promote better forest management by appropriate tax measures in order to protect this unique economic and recreational resource.

This Law was enacted for the purpose of taxing forest lands generally suitable for the planting, culture, and continuous growth of forest products on the basis of their potential for annual wood production.

The Farm and Open Space Land Law

Title 36 MRSA, Section 585 et seq., declares that it is in the public interest to encourage the preservation of farmland and open space in order to maintain a readily available source of food and farm products close to the metropolitan areas, to conserve the State's natural resources, and to provide for the welfare and happiness of the people. It is further declared to be in the public interest to prevent the forced conversion of farm and open space land to more intensive uses as the result of economic pressures caused by the assessment thereof for purposes of property taxation at values incompatible with their preservation as farm and open space land. To further emphasize the impact of this law, the necessity, in the public interest, of the enactment of the law, was deemed a matter of legislative determination.

The Law states further that any municipality may accept or acquire scenic easements or development rights for the preservation of agricultural farmland or open space. The present true and actual value of any land so classified as farm or open space land is to be based upon its current use.

Any change in use, disqualifying land for classification as either farm or open space land, except in cases of eminent domain, causes a penalty to be assessed in addition to the annual tax. The penalty would be equal to the amount of taxes which would have been assessed on a highest and best use basis for the entire time period, less the taxes already paid under a farm or open space classification, plus 8% interest on the difference.

The State Department of Health and Welfare

Major Policy:

To maximize the human capabilities of the people of the State of Maine by developing, organizing, and applying the health, medical, and social services for the prevention or amelioration of conditions disadvantageous to the achievement of individual, group, or community potentials.

BUREAU OF HEALTH

The Public Water Supply Program

This Program is charged with the responsibility of insuring an adequate quantity and quality of drinking water for the people of Maine who reside within the service areas of the State's water supply companies. There are in Maine 162 water companies (see Table 15). The Water Supply Program is concerned with drinking water, its storage, both in natural surroundings and in man-made containers, its source, either surface or sub-surface, and its transfer from place to place through the distribution system.

The Program is also concerned with swimming beaches and public pools relative to the maintenance of high standards of health and sanitation. The Department inspects public bathing beaches, bathing areas in quasi-public camps or resorts where members of the public reside as guests, and public eating and drinking places.

The Department administers the State Plumbing Code, maintains laboratories for the testing of water for public or private consumption or for such uses as agriculture irrigation. It also inspects and regulates small scale public distribution systems where just a few homes or camps tap a joint supply, and it regulates those who distribute bottled spring water.

Regarding the sources of water for public consumption, the Department has adopted regulations pursuant to Title 22 MRSA, Sections 2431-38. Accordingly, all sources of water are to be treated for physical, chemical, and bacteriological reduction to provide a finished water that will meet accepted water quality standards. Point sources such as wells are to be protected by ownership or control of the surrounding land area within 600 feet of the source, and in special cases a greater radius may be required.

In order to protect the public water systems, periodic inspections are to be made to identify and remedy health hazards; all existing and new standpipes, tanks, reservoirs, and water storage facilities are to be covered and the water treated as necessary.

To insure the best practicable water quality, periodic testing is to occur at all treatment facilities according to predetermined standards; these tests will specifically concentrate on bacteriological quality, physical characteristics, chemical quality, radiological quality, and the detection of hazardous substances.

Whenever any new installations, improvements, or additions are proposed to any portion of a water system such as the source of supply, pumping and treating facilities, the distrubtion or storage system, etc., specific plans are to be submitted to the Department for approval and no construction will commence without such approval.

The State Department of Inland Fisheries and Game

Major Policy:

To insure that all species of fish, wildlife and living aquatic resources are perpetuated to be used and enjoyed now and for the foreseeable future: to maintain these resources for their intrinsic and ecological value as well as their direct benefits to man: to provide an economic contribution from these resources in the best interests of the people of the State of Maine: to provide diversified recreational use of these resources: and to provide scientific and educational use of these resources.

DIVISION OF PLANNING AND COORDINATION

The Division is responsible for coordinating the development and implementation of State inland fish, Atlantic salmon, wildlife management and environmental programs in order to provide for the maintenance of fish and wildlife population levels.

Since the acceptance of MIDAS as a State Inventory System, which was developed by the Departments of Inland Fisheries and Game, Marine Resources and the State Planning Office, the Division has concentrated on the summarization of land use, wildlife use and abundance data and coordination of the development of fish and wildlife species management plans. These plans provide an evaluation of present and future conditions relating to the use and abundance of fish and wildlife resources, as well as defining species management objectives and departmental programs. This will support the development of a land use framework that adequately provides for the perpetuation of fish and wildlife habitat. This will also assure that the needs of the fish and wildlife resources are appropriately integrated with the needs and goals for other uses of Maine's land and water and are adequately voiced in future State planning.

This Division administers the Stream Alteration Act for the Department and also coordinates investigatory, planning, advisory and/or law enforcement activities which have been developed in cooperation with other State and Federal agencies. These activities have resulted in the protection of valuable fish and wildlife habitat.

DIVISION OF FISHERIES AND WILDLIFE

These Divisions develop the basic recommendations and framework for the Department's fish and wildlife research and management programs aimed at perpetuating and enhancing the State's fish and wildlife resources and are also responsible for the implementation of these programs upon approval by the Commissioner. The most up to date techniques and materials are utilized in support of these programs.

The Department has taken a new avenue of approach to fish and wildlife habitat protection through commitments to certain of Maine's new environmental laws and the agencies that administer them. For many years, the biological divisions have expended a great amount of effort assessing the environmental impact of land use practices and development proposals as they have a direct influence on the kind and amounts, as well as the present distribution and future distribution of fish and wildlife resources of the State.

WARDEN SERVICE

The purpose of this section is for the enforcing of fish and game, boat, litter, snowmobile and environmental laws Statewide; searching for lost persons; assisting in stocking and inventorying fish and wildlife; investigating hunting, boating and snowmobile accidents as well as motor vehicle accidents involving deer and moose; controlling beaver and crop damage by animals; rendering first aid and non-emergency assistance to the public; and the conducting of programs in hunting and snowmobile safety.

OTHER DIVISIONS

The Department also maintains a Hatchery Division which maintains eight fish hatcheries, one each in Augusta, Casco, Deblois, Gray, Enfield, Phillips, New Gloucester, and Grand Lake Stream; and two rearing stations, one each in Embden and Palermo; a Division of Snowmobile Safety and Registration; a Division of Watercraft Safety and Registration; a Realty Division which is responsible for surveying, appraising, negotiating, title searching, and purchasing of uplands, wetlands, and water rights and dams; an Engineering Division which is charged with the responsibility for design and the supervision of the construction of roads, dams, fishways and buildings; and an Information and Education Division which is maintained to keep the public aware of Department programs.

THE ATLANTIC SEA RUN SALMON COMMISSION

In the 1974 special session of the Maine Legislature an Act was passed to incorporate the Atlantic Sea Run Salmon Commission into the Department of Inland Fisheries and Game. This Act, however, did not alter the mandate of

the Commission. It is still charged with the regulation, conservation and restoration of Atlantic salmon to the rivers of Maine.

The State Department of Marine Resources

Major Policy:

To protect and enhance Maine's living marine resources so that conservation management programs will produce the greatest benefits for the people of Maine.

RESEARCH IN THE COASTAL WATERS

The Department is established to conserve and develop marine and estuarine resources and to conduct and sponsor scientific research; to promote and develop the Maine coastal fisheries industry; to advise agencies of State, local, and Federal government concerned with development or activity in coastal waters; and to implement, administer, and enforce the State's laws relating to these areas.

Relative to the conservation and development of marine, estuarine and anadromous resources, the Department is responsible for the following work.

1) Assisting the fishing industry by providing technical, biological, managerial, or other assistance.

2) Conducting educational programs and distributing information.

3) Serving as the primary State agency for providing promotional and marketing assistance for the commercial fisheries.

4) Establishing and enforcing standards of fish and fisheries inspection.

5) Engaging in all aspects of marine and anadromous fish research.

6) Authorizing cultivation of marine and anadromous species in coastal waters.

7) Leasing areas of coastal waters and lands beneath to others for cultivation.

8) Maintaining records of all its operations.

9) Consulting with and assisting the Department of Inland Fisheries and Game and the Atlantic Sea Run Salmon Commission in the Maine Atlantic Salmon Restoration Program.

10) Managing and developing all other anadromous fish resources.

Protection of the Resource. With regard to the ecology and habitats supporting marine fisheries, the Department is responsible for:

1) enforcing parts of the Wetlands Control Law relative to the filling, dredging, draining, depositing, altering, or removal of materials in coastal wetlands;

2) advising appropriate Federal and State agencies on the ecological effects of altering coastal wetlands; and

3) consulting with, advising and cooperating with the State Planning Office, the Department of Environmental Protection, the Department of Inland Fisheries and Game, the Department of Conservation, and other agencies as necessary to carry out its duties.

The Department may examine coastal waters and flats and close contaminated or polluted shores, waters, or flats when the results of the examination show that clams, quahogs, oysters, mussels, or other marine mollusks are contaminated or polluted. The classification of shellfish growing areas is based on water quality standards under the U.S. Pure Food and Drug Administration's National Shellfish Certification Program. The Department may make whatever regulations are necessary to assure the conservation of renewable marine resources in any coastal waters or flats of the State.

The Department may also authorize persons or concerns to take shellfish from polluted flats or waters for depuration (the flushing of shellfish with a higher quality of water to render them suitable for human consumption). The depurated shellfish may then be offered for sale according to law.

The State Department of Transportation

Major Policy:

To more effectively serve Maine's citizens and visitors by developing a program for an adequate transportation system on land, water, and in the air based on safety and efficiency to meet social, economic, and environmental needs.

The Department came into being in 1972 as a result of the enactment of Chapter 498 of the Public Laws of 1971 by the 105th Maine Legislature. The activities of the Departments of Highway, Airways, and Waterways were thereby combined. Responsibilities of the Department now provide for:

- the planning, construction, maintaining, and operation of the State Highway System,

- the planning and improving of airports and marine transportation facilities, and,

- the assisting of planning and improving other modes of transportation including buses, rails, trucks, and watercraft.

BUREAU OF WATERWAYS

This Bureau is charged with fostering the development of the maritime activities of the State. It provides for the building of public wharves and the establishment of adequate port facilities including the responsibility for harbor development and the making of surveys and plans for the use of port facilities. The Bureau promotes the advancement of waterborne commerce for ports in Maine and keeps informed as to the present and future requirements of ocean shipping. It consults with port communities and districts which may desire local maritime and port development.

The Bureau operates the Maine State Pier, handles shipping at four shed locations on the pier, and maintains over 200,000 square feet of covered cargo area. In addition the Department owns six wharves in Portland which it leases to the Casco Bay Lines for passenger, freight, and vehicle service. The Department operates five passenger and vehicle ferry boats serving Vinalhaven, North Haven, Islesboro, Swans Island, and Long Island Plantation.

The Bureau of Waterways works with local interests along the coast of Maine in the development of rivers and harbors, including dredging, breakwaters, and navigational aids.

The Department maintains liaison with the Maine Turnpike Authority, The Maine Port Authority and the Maine-New Hampshire Interstate Bridge Authority. In this effort the Department recognizes that there are a variety of relationships between the economic, commercial, and public service aspects of transportation and the need to conserve the State's water resources.

Within the Bureau of Planning, which touches upon nearly all phases of the transfer of people, goods, and services, there has been recently created a Division of Environmental Services. The general responsibilities of this Division are: to guide Department policy regarding plans, programs and operations and their impact on the environment; to review Department activities and make recommendations to modify activities to ensure all aspects of the environment are considered and protected to the extent reasonably practical; and to offer advice to the divisions of the Department regarding environmental considerations.

The State Department of Military, Civil Emergency Preparedness, and Veterans' Services

BUREAU OF CIVIL EMERGENCY PREPAREDNESS

Major Policy:

To provide the assistance and guidance so that State agencies, counties and other political subdivisions shall have plans to prevent loss of life and property, alleviate suffering and assist in recovery in case of disasters. To assist all political subdivisions before, during and after any disaster, upon request. To train county and town CEP officials in disaster handling techniques.

This Bureau is charged with the development of the State comprehensive disaster preparedness and assistance plan as outlined in PL 93-288, the Disaster Relief Act of 1974. Within the Act, emergency or major disaster is defined to mean any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe. Such a plan is to include necessary stream flow data for the purpose of reducing flood associated damage to property. In accordance with Section 202 of the Act, disaster warning systems may include installation of rain and river gages at selected locations statewide.

FLOOD INSURANCE

The Bureau has been empowered as the contact agency for the National Flood Insurance Program as administered federally by the U.S. Department of Housing and Urban Development.

DAMS AND RESERVOIRS

A Bureau engineer has been appointed under Title 38, MRSA, Sections 811 et seq., to inspect any dam or reservoir in the State upon petition and report to the Governor. In the event of conditions unsafe or dangerous to the lives or property of persons, alterations are to be made, or the retained water may be discharged under the direction of the engineer.

The Bureau is also authorized to control dams and stream flow whenever it is determined in the judgment of the Bureau that life or property may be endangered.

Following this discussion and brief description of each State Department and Bureau closely associated with policy making in the area of water and related land resources, it is appropriate to discuss the activities of one Federal agency which is vitally interested in water resources and maintains a field office in Augusta.

The Federal Department of the Interior, United States Geological Survey, Water Resources Division

As the Nation's largest water resources investigating agency, the U.S. Geological Survey, through its Water Resources Division, is responsible for appraising the quantity and quality of the Nation's water resources and for research on hydrologic problems related to the occurrence and distribution of both surface and groundwater. Since 1894, Survey data have been a basic source for resolving many water disputes; neither a regulatory agency nor a development agency, the Survey has evolved as an independent scientific agency concerned only with gathering and interpreting water facts.

The overall program of the Survey can be separated into three components when considered in terms of sources of support:

(1) A FEDERAL PROGRAM component (funded by direct appropriation to the Survey) which provides a nationwide base of water data for planning and management. It also deals with specific national water problems; and provides for needed research and development on hydrologic principles, techniques, equipment, and methodology. This amounts to about 25 percent of the total effort.

(2) An OTHER FEDERAL AGENCY PROGRAM (funded by transfer from other Federal agencies) which provides the information needed by the action agencies in the planning, management, and operation of their programs. About 25 agencies are involved. This amounts to about 17 percent of the total program.

(3) A FEDERAL-STATE COOPERATIVE PROGRAM (funded on a matching basis between the Survey, and State and local agencies) which accounts for the remaining 58 percent of the program and provides data and information of mutual Federal and State concern for planning, development, regulation, and conservation of the Nation's water resources. Over 480 State and local agencies participate.

The field office in Augusta is a part of the latter component. The Survey maintains a cooperative agreement currently with the Public Utilities Commission of the State of Maine. The Survey cooperates with the Commission on a fifty percent cost-sharing program for investigating the location and quantity of water available generally for multiple uses. Data are also collected on the physical and chemical qualities of the State's water. Surface water studies consist mainly of operation and maintenance of stream gaging stations; groundwater analyses represents a major portion of the research program. Also data are collected on snow depth and its water equivalent. Results of these programs are published periodically and distributed to other agencies.

One of the purposes of the Survey is to complete special studies for the State. These include a study of small drainage area precipitation and runoff concluded in cooperation with the State Department of Transportation for culvert design purposes. A reconnaissance-level study is currently being initiated with the Lakes and Biological Studies Division, Bureau of Water Quality Control, State Department of Environmental Protection for the purpose of ascertaining the general water quality of forty-three selected lakes through the analysis of chemical, physiographic, and geologic characteristics.

Alda Stich

Comments on State Level Water-Related Institutional Arrangements

It is evident from a cursory reading of this section that many people from extremely diverse disciplines are currently involved with the future of Maine's water. While it is agreed that there is great need for all of these varied and specific disciplines and that their application to the water resource from their unique viewpoint is indispensable, it is also felt that the problem of a total perspective must be faced.

In the light of today's increasingly interrelated problems, this report asks such questions as, who is going to make decisions regarding the sources of water supply for Mainers; regarding water export when and if that becomes an issue; regarding the management of vast land and water resources in the Penobscot Basin currently under study by the Federal government; regarding the questions of public power versus free-flowing water and open, usable land; regarding the issue of inland pollution of fresh water and its cumulative effect on the tidal waters of the gulf of Maine; regarding clear-cutting and flooding, large-scale development and groundwater recharge; regarding dam ownership and fishing for recreation and minimum low flows; regarding vacation-land and fluctuating lake levels and hydropower; regarding irrigation and eutrophication, regarding crisis solutions and the need for long range survey data; regarding the promotion of Maine's economy and the restoration of anadromous fisheries; and a host of other compound questions. There appears to be no end to the complexity of water and related land use issues. More and more we are learning of the multi-faceted nature of the natural resource problems we perceive. Yet our approach, tied inextricably to our governmental divisions by departments and bureaus, tends to be unilateral, or at least not as formally multi-lateral as the problems often require. The integration of these single-purpose groups in meeting multiple concerns too often depends too much upon individual motivation and too frequently operates at the informal level.

Before the reorganization of State government, a sort of informal system yielded some results. On a formal basis, however, the reorganization of State government has brought together many diverse but related areas of concern in a formal institutional arrangement. Additional changes such as a Department of Natural Resources and a standing Cabinet Subcommittee on Water and Related Land Resources, along with other adaptations of the new cabinet system of State government, should be considered.

TYPES OF RESPONSIBILITY

It may be useful to categorize the institutional arrangements by the types of responsibility they reflect.

Policy and Coordinative Responsibility

The State Planning Office has the general responsibility for a variety of planning related functions of the Executive Department and maintains an overview of water and related land resource planning through its Water Resources Division. The State Planning Office is also charged with the responsibility of coordinating the comprehensive physical planning process for the State, and of coordinating policy development in all areas with the Commission on Maine's Future.

Regulatory Responsibility

The Department of Environmental Protection is generally charged with regulatory air, land, and water quality and use. Nearly every aspect of this function statewide is housed in the DEP.

Management Responsibility

The Department of Conservation has been given management responsibility in the areas of forestry; surficial, bedrock, hydro, and estuarine geology; all forms of recreation and the development of park areas; unorganized territories in relation to land use; and specifically regarding the Public Lands statewide.

General Responsibility for a Specific Water-Related Functional Area

The Department of Marine Resources is specifically concerned about the well-being of water and land resources in or adjacent to the Gulf of Maine.

The Department of Inland Fisheries and Game is specifically concerned about the effects of land and water use on fresh water and anadromous fisheries and wildlife resources.

Specific Responsibility Within a Generally Non-Water-Related Functional Area

The Department of Transportation affects water resources both directly and indirectly by its activities and has organized to identify, consider, and modify these impacts both at the program and project levels.

The Department of Agriculture is concerned with water and related land resources specifically as they relate to soil conditions, erosion, and the proper use of Maine's land.

The Department of Finance and Administration has an indirect, but distinct impact on land use and therefore the water resources through its application of the law and taxing practices on specific parcels of land.

The Department of Health and Welfare maintains a Public Water Supply Program and is concerned with source of supply, distribution, analysis, and the operation of the many water companies.

The Bureau of Civil Emergency Preparedness is charged with developing a disaster control plan relating to flooding, is administering the flood insurance program, and inspects and takes emergency action regarding dams and water storage.

General Responsibility For The Use of Water and Land In a Related Area.

The Department of Commerce and Industry is concerned with the economic well-being of the State and promotes its land and water resources generally to this end.

Water-Related Federal and Regional Agencies

Department of Agriculture
- Forest Service
- Soil Conservation Service

Army Corps of Engineers
- New England Division

Atlantic States Marine Fisheries Commission

Atomic Energy Commission
- New York Operations Office
- Office of Environmental Affairs

Department of Commerce
- National Oceanic and Atmospheric Administration
- National Weather Service
- Coastal Zone Management

Environmental Protection Agency
- Air and Water Division
  - Water Branch

Federal Power Commission
- River Basins and Licensed Projects

Department of Health, Education and Welfare

Department of Housing and Urban Development

International Joint Commission

Interstate Sanitation Commission

Department of the Interior
- Bureau of Outdoor Recreation
- Bureau of Mines
- National Park Service
- U.S. Geological Survey

Department of Transportation
- Federal Highway Administration

New England Regional Commission

New England Interstate Water Pollution Control Commission

United States Coast Guard
- Navigation Branch

Water Resources Council
- New England River Basins Commission

Alda Stich

The Water and Related Land Resources of Maine

SECTION 3

This section presents a description of the water and land resources of Maine for general reference with emphasis upon the fundamental, water-related land areas, the river basins. Institutional research activities on water and land are described showing the extent of basic water and land information as background for water and related land resources planning and management.

WATER

THE CLIMATE OF MAINE

A fundamental cornerstone in water resources is the study and evaluation of climate. Climate is defined as an average course or condition of the weather at a place over a period of years as exhibited by temperature, wind velocity and precipitation. Weather is the condition of the air over any place at a given time or during a specified period of time. It is difficult to be objective in describing Maine's weather and resulting climate because it is so variable and changeable, the State being close to the Canadian Maritime region, through which most of the weather generated in North America passes. Weather and climate are much on the minds of New Englanders because of such changeability, and the tendency of residents to "fight" extreme conditions psychologically and complain about them strikes people from other regions at least with amusement. An excellent summary of Maine's climate in objective terms is available.[1]

Weather information is recorded at 70 stations throughout the State in a cooperative program by many agencies and individuals for the National Weather Service of the National Oceanic and Atmospheric Administration. At most of these stations temperature and precipitation are recorded while at several only wind velocity, humidity and evaporation rates are measured. Snowfall and snow depth are recorded at a number of stations during the winter. These data are published in periodic reports entitled, "Climatological Data, New England" by the Environmental Data Service.

Climate varies along a fairly steep gradient from the southern coast to the mountains in the Rangeley area. Map 2 shows climatic zones as compiled by the U.S. Department of Agriculture. The zones are set off by average low temperature readings expected and serve as a guide for introducing ornamental plant materials, whose hardiness tolerance is known. This index shows better than others the variability of Maine's climate, and nowhere in the United States except localized mountain areas of the western states are zones so narrow as the area from Biddeford-Saco to Rangeley.

[1] Climate in Maine. May 1972. Robert E. Lautzenheiser. Environmental Data Service, National Oceanic and Atmospheric Administration, U.S. Dept. of Commerce.

The mean temperature ranges throughout the State are shown graphically on Map 3. These values as shown on Table 1 indicate that northern and western Maine experience winters comparable to northern Minnesota and North Dakota only within the continental 48 states and that summers are cooler than anywhere except the immediate north Pacific coast. On average there are 0-7 days that the temperature reaches +90°F in contrast with 15-30 days in southern New England, 60 days at Saint Louis and more in the southern and southwestern states. The coldest temperature ever recorded in Maine was -48°F on January 19, 1925 at Van Buren while the warmest was +105°F on July 10, 1911 at Bridgton. It must be remembered that temperatures are recorded at approved weather stations under definite conditions to minimize distorting radiation effects so that argumentation over more extreme temperatures recorded elsewhere is lacking in objectivity.

TABLE 1 *MONTHLY NORMALS* BY CLIMATOLOGICAL DIVISIONS*

Stations	Temperature (°F) Minimum	Maximum	Annual Average	Precipitation (In.) Minimum	Maximum	Annual Average
Northern Division						
Caribou	10.5 Jan	64.5 Jul	38.4	2.02 Feb.	4.07 Jun	36.31
Millinocket	15.8 Jan	67.9 Jul	42.5	2.84 Feb	4.11 Nov	41.95
Greenville	13.3 Jan	64.9 Jul	39.8	2.82 Feb	4.14 Jul	43.34
Southern Interior						
Woodland	17.7 Jan	68.0 Jul	43.1	3.02 Aug	4.83 Nov	43.85
Old Town	19.2 Jan	68.1 Jul	44.3	2.72 Aug	4.15 Nov	40.64
Waterville	19.6 Jan	69.8 Jul	45.3	2.57 Feb	4.09 Nov	38.91
Lewiston	20.7 Jan	70.0 Jul	45.6	2.76 Aug	4.46 Nov	43.58
Coastal Division						
Eastport	22.9 Jan	61.9 Aug	43.0	2.86 Aug	4.48 Nov	42.67
Bar Harbor	23.8 Jan	66.9 Jul	45.4	3.10 Jul	5.25 Nov	48.17
Portland	21.8 Jan	68.1 Jul	45.0	2.42 Aug	4.37 Jan	42.85

*For the period 1931 - 1960.

Source: Climatography of the U.S. No. 60-17
U.S. Dept. of Commerce, NOAA, May 1972.

HYDROLOGY

The measurement and recording of precipitation leads to the science of hydrology, the basic information source for water and related land resources study and planning. Hydrology is defined as the study of the occurrence and movement of water in liquid, vapor or solid form on, above or below the earth's surface. Since measurement can be made only at spot locations of phenomena that are two-and-three dimensional and because water movements are subject to continuous variations, the science is a complex one requiring elaboration of methods, measurement and their interpretation through statistical analysis.

The most generalized fact of hydrology is the water cycle during which water evaporates from the ocean, falls on the land and flows back into the ocean. Various phases of the water cycle are listed as follows:

1. Evaporation into the air from the

    a. ocean
    b. inland surface water
    c. surface objects
    d. transpiration through vegetation
    e. sublimation from ice
    f. escape of steam from heated underground water
    g. respiration of living organisms
    h. combustion of organic substances

2. Precipitation from air as

    a. rainfall
    b. snowfall
    c. condensation directly onto surface objects

3. Runoff of precipitation as

    a. surface flow
    b. underground flow

The turnover of the cycle may be of very short duration or be suspended indefinitely when water percolates deep into bedrock and is not returned to the surface until wells are drilled to mine it or until it is released through the course of geological time by the alteration (uplift or metamorphism) and erosion of bedrock formation.

All points of the hydrologic cycle receive attention by hydrologists who attempt to determine the qualitative course of the cycle over the various regions of the planet and the quantitative relationships among these cycle components. Some are very minor in their contribution to the cycles and are studied only by researchers devoted to the pure science of hydrology. Among the important factors, precipitation is measured on a daily basis by 57 of the recording and reporting stations in Maine of the National Weather Service network. In season snowfall and snowfall depth are measured by 18 stations on a daily basis. Evaporation and wind velocity are measured by only a few stations.

Measurement and analysis of surface runoff from rainfall and snowmelt are conducted by the Water Resources Division of the U.S. Geological Survey. This most important phase of hydrology began about ninety years ago when streamflow of the Presumpscot River was characterized in order to design hydro-electric power plants. The survey program began early this century and has enlarged steadily up to the present time.

Streamflow rates are measured by the installation of gages on rivers and streams. Gages do not measure flow directly but stream height instead from which flow rates are calculated. For this reason gaging stations must be selected with care in order to get a good correlation of stream height with flow. Even, relatively steep banks are desired for framing a regular trapezoidal stream cross section to obtain this measure of correlation. At some power plants stream flow is estimated or calculated by summing up flow through turbines and spillways, the most notable station providing river flow information being at Skowhegan on the Kennebec River. At the end of 1973 there were 61 survey streamflow gaging stations in Maine plus six in New Hampshire on streams that flow into Maine, and one additional station to measure the height of Moosehead Lake (Map 4). These stations record continuously, and daily mean flows are published annually in a report "Water Resources Data for Maine", Geological Survey, U.S. Department of Interior.

From such basic field information, desired streamflow characteristics are developed analytically. Beginning with the age of electricity during the late 1800's, engineers sought the potential worth of rivers and streams to generate electric power. They wanted to determine the total amount of water that passed each year over certain waterfalls (power plant sites) or at prospective dam sites to provide storage with which to regulate and even out flow throughout the year. In this way plants could be sized properly to fit the water supply. The great flood in March, 1936, caused a shift in emphasis to study flooding characteristics of the major rivers and streams. In recent times with renewed emphasis on water quality questions have been asked about minimum streamflow rates and their probability of occurrence. The survey program has been able to supply a great deal of information about streamflow rates for each of these three phases of application to solve water-related problems. Through analysis of streamflow rates taken year after year, averages are calculated, followed by a measure of probability of deviation from these averages. The longer a station is in operation the more reliable such analysis of variance becomes. By correlation of streamflow rates with the watershed area above each station, a measure of the runoff per unit area of the watershed can be calculated. In addition, from detailed comparison of geographically similar and unregulated gaged and ungaged watersheds, reliable estimates of streamflow characteristics can be developed for the latter.

In 1950 a special project was initiated to prepare summary maps of the water cycle in New England and eastern New York. A report was published in 1955[1]. The factors studied were percipitation, runoff, water loss and lake surface evaporation; maps summarizing results of these studies were published.

Regarding precipitation, the factors of topography and streamflow data were taken into account along with observed precipitation at weather stations to derive a closer reading of average annual precipitation rates for given areas.

[1] Hydrology Atlas No. 7. Annual Runoff Precipitation in the New England-New York Area. 1955. C. E. Knox and T. J. Nordenson. Geological Survey, U.S. Dept. Interior.

By subtracting runoff from precipitation, water loss was derived and plotted. In addition, evaporation studies from lake surface water were conducted and these values plotted. It is interesting to note that they are about equal, and compared with the remainder of the United States such losses are in the lowermost range. Because of the present scarcity of copies of this Atlas and the great value of its summary information, the maps for precipitation, runoff, evaporation and water loss in Maine are reproduced in this report as Maps 5, 6 and 7.

GROUNDWATER

Some of the water in the "water loss" part of the equation, Precipitation - Runoff = Water Loss, soaks into the ground and is defined as groundwater. The amount of water penetrating into the ground varies from season to season. In winter with temperatures below freezing and frost present in soils, there is little addition. In summer with high temperature and evaporation rates, most precipitation is returned directly to air through direct evaporation or through transpiration of actively growing vegetation, with little if any water soaking in to become groundwater. During spring and fall most addition to groundwater occurs when the conditions posed in winter and summer are minimized. It is the task of the hydrologist to locate and describe the occurrence of groundwater and characterize the movements of water to and from groundwater reservoirs.

The Maine District Office of the U.S. Geological Survey conducts regional surveys to determine groundwater occurrence in surficial deposits and bedrock. Data on wells are compiled and tabulated, and maps of the major surficial deposit formations are prepared, emphasizing those bearing large quantities of groundwater. Surveys for the areas of major habitations have been published (Map 15) and the program is projected to continue.

In 1972, the Bureau of Geology, Department of Conservation, began investigations on groundwater in bedrock formations. This survey has concentrated on the coastal counties through compilation of information about hundreds of private wells drilled into bedrock. The report for Knox County[1] is the first in a series of county atlas reports summarizing information on groundwater, bedrock and surficial deposits.

The accumulation of water "stored" on the ground through snowfall each winter poses additional problems for hydrologists and planners. Since damaging floods occur in Maine often through a combination of very rapid melt of snow during warm rainy spells, field data have been gathered about snowfall to develop generalized information useful for predicting floods among other things. The monthly reports of the Maine District Office of U.S.G.S. give snow-depths and the amount of water stored expressed in inches at stations during

[1] Physical Resources of Knox County, Maine. 1974. Compiled by W. Bradford Caswell, Maine Geological Survey, Maine Department of Conservation.

the winter. Map 8 shows the average water content of snow throughout the State on March 1, a time when snowpack is usually at a maximum.[1]

A HYDROLOGIC DESCRIPTION OF THE STATE

Major River Basins. The relationship of water to land is best defined by relating an area of land and the drainage pattern of water over it. In inland areas surface drainage is confluent, with small intermittent brooks merging into permanent brooks and in turn into larger streams and rivers, which drain into the ocean. A land area with a common drainage outlet is called a river basin. The term "watershed" is synonymous but its usage is usually confined to small drainage areas. Therefore, with respect to water and related land use, division of land area of the State into river basins is the most appropriate. Map 9 portrays the major river basins of the State that have been used traditionally in reports on water resources. Table 2 depicts the various coding systems used to describe these basins and the coast[2].

About 90% of the land area drains into the ocean at eight points, and much of the remaining coastal area is drained by a dozen or so major streams. Toward the immediate coastline, drainage becomes divergent so that classification of land by drainage becomes meaningless. These large numbers of small drainage areas are therefore aggregated as a coastal zone. A cursory observation of a major drainage basin map reveals that there is a discrepency between river basin lines and political boundaries such as State, county, and municipal borders. Land and water resources planners would prefer that political boundaries followed drainage lines, but this does not occur often despite the fact that early settlement was confined by river basin divides and inland transportation of materials was limited to boats. It is interesting to note that a hundred mile stretch of the international border from northern New Hampshire to T5 R20 in Somerset County follows the drainage divider between the New England rivers and the St. Lawrence River. As land and water resources planning becomes more important in the future, regional geographic designations according to drainage basin areas will receive more emphasis and consideration as a basis for solving social, political, and economic problems. For this reason the geographic outlines of the Regional Planning and Development Districts developed by the State Planning Office in 1971 followed major basin outlines fairly closely (see Map 1).

Minor River Basins. It seemed appropriate for the purposes of this study to sub-divide the coastal drainage areas into three; the first, or Eastern, from Passamaquoddy Bay to Penobscot Bay; the second, or Mid-Coastal, from Penobscot Bay to Merrymeeting Bay; and the third, or Southern, from Merrymeeting Bay to the Piscataqua River, the latter including four distinct land areas divided by the Androscoggin, Presumpscot and Saco Rivers.

[1] Average Water Content of Snowpack in Maine. 1972. G. S. Hayes. Atlas HA 452. U.S. Geological Survey.

[2] Map 10 portrays the NERBC coding graphically, and illustrates the extent of interstate and international basins; Chart 2 depicts the relative ratios of population within the various basins.

Map 11 shows the minor river basins. Minor river basins are simply a subdivision of the major river and coastal basins for some specific purpose. Such areas generally have a minimum size of about fifty square miles and a maximum of about 500 square miles. The 1:250,000 scale map in the Water Resources Division of the State Planning Office offer a topographic division into 64 drainage areas with a maximum size of about 2,500 square miles as shown on Map 11.

BASIN CODING

TABLE 2

BASIN NAME	MAINE MAP NO. 9	NENYIAC	NAR	NERBC
Saint John	A	A 1	A 1 a,b	1
Saint Croix	B	A 2	A 5 a	5 a
Penobscot	C	A 3	A 2	2
Kennebec	D	A 4	A 3	3
Androscoggin	E	A 5	A 4 a,b	4
Presumpscot	F	A 6	B 6 a	6 a
Saco	G	A 7	B 6 b	6 b
Piscataqua	H	B 9	B 6 c	6 c
Maine Coastal Area				
Eastern		A 8 a	A 5 b	5 b
Mid Coastal		A 8 b	A 5 b	5 b
Southern		A 8 c,d,e	B 6 a,c	6 a,c
New Brunswick Coast				X

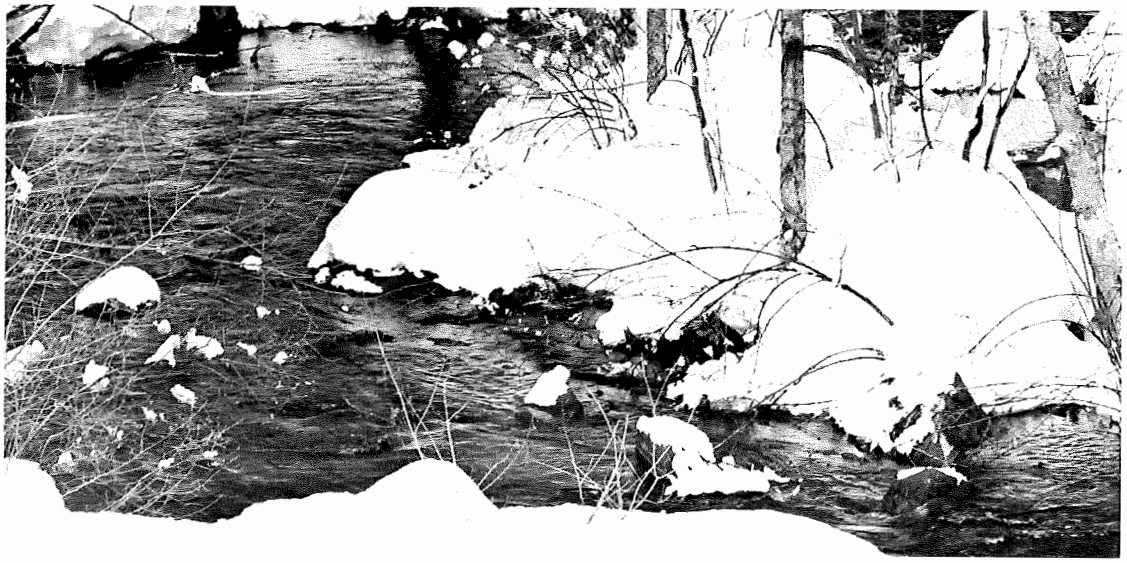


TABLE 3 *THE MAJOR DRAINAGE BASINS OF MAINE*

Major Drainage Basins in Maine	Total Acreage of Maine Portion (in thousands)	Percent of Maine Land Area Drained	Total 1970 Population of Maine Portion (in thousands)	Percentage of Total 1970 State Population
Androscoggin	1747	8%	157.0	16%
Kennebec	3757	18%	164.3	16%
Penobscot	5485	26%	146.8	15%
Piscataqua	157	1%	26.0	3%
Presumpscot	415	2%	55.1	6%
Saco	529	2%	49.2	5%
Saint Croix	646	3%	9.2	1%
Saint John	4710	22%	88.8	9%
Coastal				
Eastern	2244	11%	50.3	5%
Mid-Coastal	945	4%	66.4	6%
Southern	623	3%	180.6	18%
	21,258	100%	993.7	100%

Lucy Martin/Maine Times

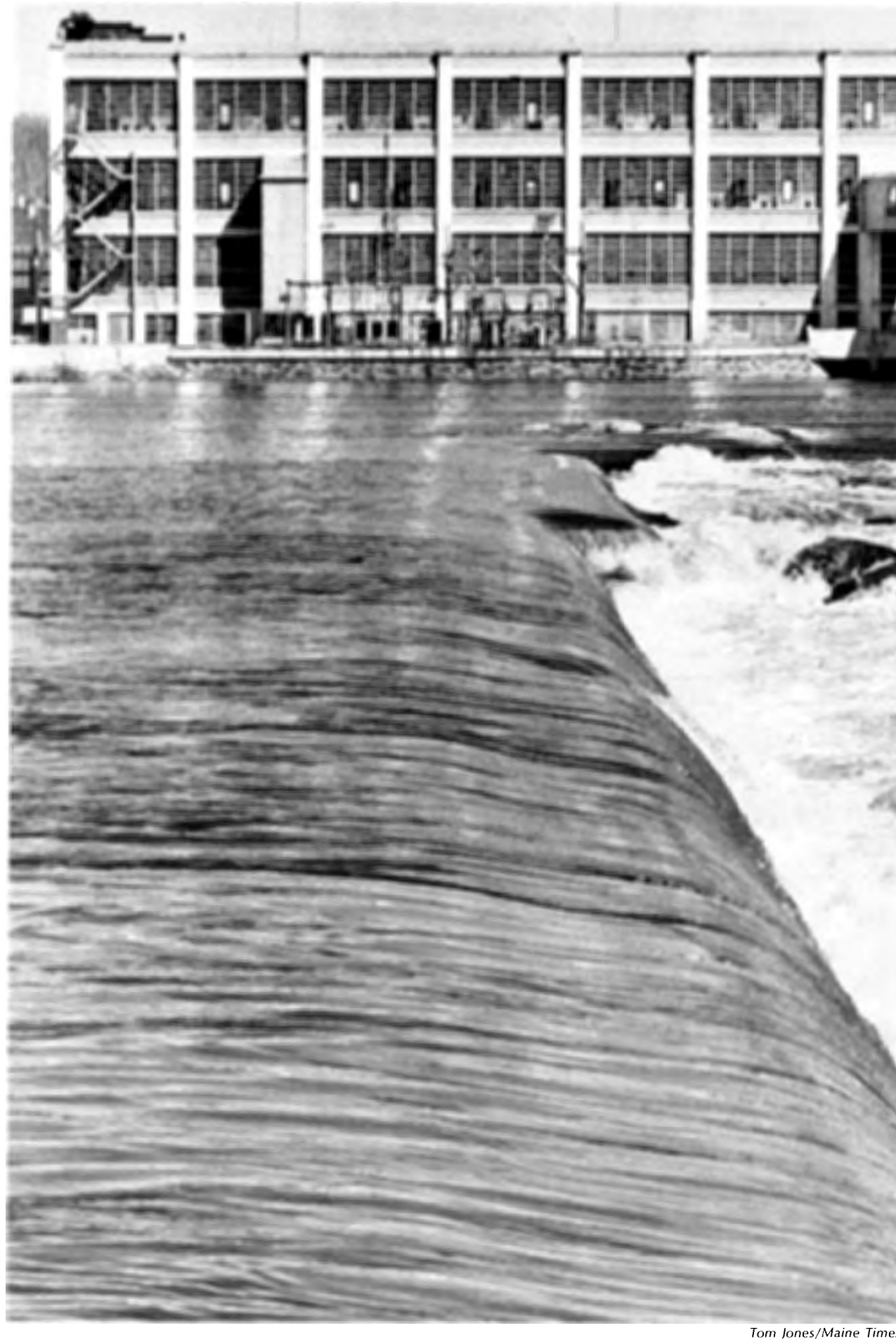
The State of Maine contains a total area of 33,215 square miles,[1] including its coastal islands. Lakes and ponds account for 2,200 square miles, or about 7% of the total surface area. (References for Tables 4-13 will be found at the end of this section).

THE MAJOR RIVER AND COASTAL BASINS IN MAINE

TABLE 4

Major River and Coastal Basins in Maine	Total Drainage[2] Area of the Basin (in square miles)	Total Drainage[2] Area in Maine (in square miles)	Maine Portion of the Total Area	Percent of Maine Land Area Drained
Androscoggin	3,450	2,730	79%	8%
Kennebec	5,870	5,870	100%	18%
Penobscot	8,570	8,570	100%	26%
Piscataqua	1,022	246	24%	1%
Presumpscot	648	648	100%	2%
Saco	1,697	827	49%	2%
Saint Croix	1,635	1,010	62%	3%
Saint John	21,360	7,360	34%	22%
Coastal				
Eastern	3,507	3,507	100%	11%
Mid-Coastal	1,476	1,476	100%	4%
Southern	971	971	100%	3%
	50,206	33,215		100%

Tables 5-13, at the end of this section, show comparative statistics for these river basins and their major tributary areas.



Tom Jones/Maine Times

MINOR DRAINAGE BASINS[4] WITHIN THE ANDROSCOGGIN RIVER SYSTEM

TABLE 5

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Androscoggin Errol Dam at Umbagog Lake in Errol, NH	At Merrymeeting Bay between Brunswick and Topsham, ME	161	1,254	36%
Little Androscoggin Bryant Pond in Woodstock, ME	Androscoggin River in Auburn, ME	46	353	10%
Nezinscot East & West Branches in Peru & Woodstock, ME	Androscoggin River in Turner, ME	31	181	5%
Dead Kimball Pond in Vienna & New Sharon, ME	Androscoggin River in Leeds, ME	23	89	3%
Webb Lake Webb in Weld, ME	Androscoggin River in Dixfield, ME	15	132	4%
Swift Swift River Pond in Houghton, ME	Androscoggin River in Mexico, ME	25	125	4%
Ellis Ellis Pond in Roxbury, ME	Androscoggin River in Hanover, ME	20	163	5%
Bear[3] Grafton, ME	Androscoggin River in Newry, ME	13	45	1%
Sunday[3] Riley, ME	Androscoggin River in North Bethel, ME	10	51	1%
Lakes Area[3] Long Pond in Sandy River Plt., ME	Errol Dam on the Androscoggin River in Errol, NH	42	407	12%
Megalloway Parmachenee Lake in Lynchtown, ME	Androscoggin River in Errol, NH	47	439	13%
Cupsuptic Cupsuptic Pond in T4R5, ME	Cupsuptic Lake in T4R3, ME	20	66	2%
Kennebago Rock Pond in Chain of Ponds, ME	Mooselookmeguntic Lake in Rangeley ME	29	145	4%
			3,450	100%

TABLE 6 *MINOR DRAINAGE BASINS[4] WITHIN THE KENNEBEC RIVER SYSTEM*

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Kennebec				
Moosehead Lake between Sapling & Big Squaw, ME	Merrymeeting Bay between Richmond & Dresden, ME	145	1,722	29%
Cobbosseecontee				
Cobbossee Lake in Manchester, ME	Kennebec River in Gardiner, ME	17	240	4%
Messalonskee				
Messalonskee Lake in Oakland, ME	Kennebec River in Waterville, ME	10	210	4%
Sebasticook				
Main Stream Pond in Harmony, ME	Kennebec River in Winslow, ME	48	950	16%
Wesserunsett[3]				
Confluence of East & West Branches at Athens, ME	Kennebec River in Skowhegan, ME	14	142	2%
Sandy				
Sandy River Ponds at Sandy River Plt., ME	Kennebec River in Starks, ME	69	593	10%
Carrabassett				
Carrabassett Valley Me at confluence of Houston Brook & the South Branch	Kennebec River in North Anson, ME	35	400	7%
Dead				
Long Falls Dam at Flagstaff Reservoir T3R4 BKP WKR, ME	Kennebec River in The Forks Plt., ME	23	878	15%
Moose				
Beattie, ME T2R8 WBKP	Moosehead Lake, in Rockland Strip, ME	76	735	13%
			5,870	100%

MINOR DRAINAGE BASINS[4] WITHIN THE PENOBSCOT RIVER SYSTEM

TABLE 7

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Penobscot Confluence of East & West Branches in Medway, ME	At Penobscot Bay between Stockton Springs & Castine, ME	105	1,168	14%
Orland Toddy Pond in Orland, ME	Penobscot River in Orland, ME	8	122	1%
Marsh Branch South Prospect, ME at confluence of Perkins Brook and Hawes Stream	Penobscot River at Marsh Bay between Frankfort and Prospect, ME	4		
Branch North Drake Pond in Jackson, ME		20	159	2%
Souadabscook Etna Pond Carmel, ME	Penobscot River in Hampden, ME	18	152	2%

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Kenduskeag Dexter, ME	Penobscot River in Bangor, ME	36	214	2%
Pushaw Little Pushaw Pond in Hudson, ME	Stillwater River in Old Town, ME	18	226	3%
Passadumkeag Confluence of East & West Branches at T3R1 NBPP	Penobscot River in Passadumkeag, ME	43	385	4%
Piscataquis Confluence of East & West Branches	Penobscot River in Howland, ME in Blanchard, ME	76	1,454	17%
Mattawamkeag Confluence of East & West Branches in Haynesville, ME	Penobscot River in Mattawamkeag, ME	48	1,490	17%
East Branch Grand Lake Dam at Grand Lake Matagamon in T6R8, ME	Penobscot River in Medway, ME	47	1,100	13%
West Branch Confluence of North & South Branches in Pittston Academy Grant, ME	Penobscot River in Medway, ME	97	2,100	25%
			8,570	100%

TABLE 8

MINOR DRAINAGE BASINS WITHIN THE PISCATAQUA RIVER SYSTEM

Main Stem Piscataqua At the confluence of the Cocheco & Salmon Falls Rivers between S. Berwick, ME and Dover, NH	Atlantic Ocean at Portsmouth Harbor	13	55	5%
Great Bay Area (NH) (Includes the Exeter, Lamprey, Oyster and Bellamy River basins and bay area)			455 (NH)	45%
Cocheco New Durham, NH	Piscataqua River in Dover, NH	34	182 (NH)	18%
Salmon Falls At Great East Lake between Wakefield, NH and Acton, ME	Piscataqua River between S. Berwick, ME and Dover, NH	37	330 216 (ME) 114 (NH)	32%
			1,022	100%

MINOR DRAINAGE BASINS[4] WITHIN THE PRESUMPSCOT RIVER SYSTEM

TABLE 9

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Presumpscot				
Sebago Lake between Windham & Standish, ME	Casco Bay between Falmouth & Portland, ME	24	371	57%
Songo - Crooked				
Songo Pond in Albany, ME	Sebago Lake between Naples & Casco, ME	44	277	43%
			648	100%

MINOR DRAINAGE BASINS[4] WITHIN THE SACO RIVER SYSTEM

TABLE 10

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Saco				
At Saco Lake in Crawford Notch, NH	Atlantic Ocean between Biddeford & Saco, ME	124	763	45%
Little Ossipee				
Balch Pond in Newfield & Acton, ME	Saco River in East Limington, ME	31	187	11%
Ossipee				
Ossipee Lake in Effingham Falls, NH	Saco River in Cornish, ME	18	455	27%
Old Course Saco				
Cold River in Batchelder's Grant, ME	Saco River in Fryeburg, ME	18	192	11%
Swift				
Mt. Kancamagus in Livermore, NH	Saco River in Conway, NH	21	100	6%
			1,697	100%

TABLE 11

MINOR DRAINAGE BASINS[4] WITHIN THE SAINT CROIX RIVER SYSTEM

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Saint Croix				
Grand and Spednik Lakes in Forest City, ME	Passamaquoddy Bay Atlantic Ocean	90	961	59%
West Grand Lakes				
Lombard Lake in Lakeville, ME	Grand Falls Flowage between Fowler and Baileyville, ME	48	674	41%
			1,635	100%

TABLE 12

MINOR DRAINAGE BASINS[4] WITHIN THE SAINT JOHN RIVER SYSTEM

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Main Stem Saint John				
Little Saint John Lake in T5R20 WELS, ME (including minor basins in Canada)	In Saint John, New Brunswick	415	16,034	75%
Meduxnekeag				
Meduxnekeag Lake in New Limerick, ME	Saint John River in Woodstock, New Brunswick	34	497	2%
Prestile				
Fort Fairfield, ME	Saint John River in Connell, New Brunswick	32	237	1%
Aroostook				
At confluence of the Munsungan and Millinocket Streams in T8R8 WELS, ME	Saint John River in Aroostook Junction, New Brunswick	105	2,440	12%
Fish				
At confluence of several streams in T13R8, WELS, ME	Saint John River in Fort Kent, ME	63	892	4%
Allagash				
Eagle & Churchill Lakes in northern Piscataquis County, ME	Saint John River in Allagash Plantation, ME	63	1,260	6%
			21,360	100%

MINOR DRAINAGE BASINS[4] WITHIN THE COASTAL DRAINAGE SYSTEM

TABLE 13

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Eastern				
Dennys Meddybemps Lake in Meddybemps, ME	Cobscook Bay between Dennysville and Edmunds, ME	21	131	2.2%
East Machias				
Crawford Lake in Princeton, ME	Machias River in East Machias, ME	35	314	5.3%
Machias Fifth Machias Lake in T36MD, ME	Machias Bay in Machiasport, ME	75	495	8.3%
Pleasant Pleasant River Lake in Beddington, ME	Pleasant Bay in Addison, ME	37	127	2.1%
Narraguagus Eagle Lake in T34MD	Narraguagus Bay in Millbridge, ME	50	247	4.2%
Union[3] A confluence of East & West Branches in Waltham & Mariaville, ME	Union River Bay in Surry, ME	48	561	9.4%
Tunk[3] Little Tunk Pond in Sullivan, ME	Joys Bay in Steuben, ME	16	50	1.0%
Remainder of Eastern Coast & Islands			1,582	26.4%
Mid-Coastal[3]				
Passagassawakeag Lake Passagassawakeag in Brooks, ME	Belfast Bay at Belfast, ME	12	66	1.1%
Saint George Quantabacook Pond in Searsmont, ME	Thomaston, ME	32	240	4.0%
Medomak Liberty, ME	Muscongus Bay in Waldoboro, ME	24	81	1.4%
Damariscotta Washington, ME	Salt Bay in Damariscotta Mills, ME	22	56	0.9%
Sheepscot Montville, ME	Between Edgecomb & Wiscasset, ME	44	253	4.3%

Source[5]	Mouth	Length[6] (in miles)	Minor[2] Drainage Basin Area (in square miles)	Percent of the Major Drainage Basin
Eastern				
Whitefield, ME	Merrymeeting Bay in Dresden, ME	20	52	0.9%
Remainder of Mid-Coastal Area & Islands			728	12.2%
Southern[3]				
Royal				
Sabbathday Lake in Gloucester, ME	Casco Bay in Yarmouth, ME	35	143	2.4%
Kennebunk				
Kennebunk Lake in Wyman, ME	Atlantic Ocean in Kennebunkport, ME	16	56	0.9%
Mousam				
Mousam Lake in Shapleigh, ME	Atlantic Ocean in Kennebunk, ME	25	119	2.0%
Remainder of Southern Coast & Islands			653	11.0%
			5,954	100.0%

References indicated on tables of major & minor basins

[1] The Maine Handbook - 1968, Department of Economic Development, State of Maine

[2] New England-New York Inter-Agency Committee, Comprehensive Survey of the Resources of Resources of the New England-New York Region, US Department of the Army, March, 1955.

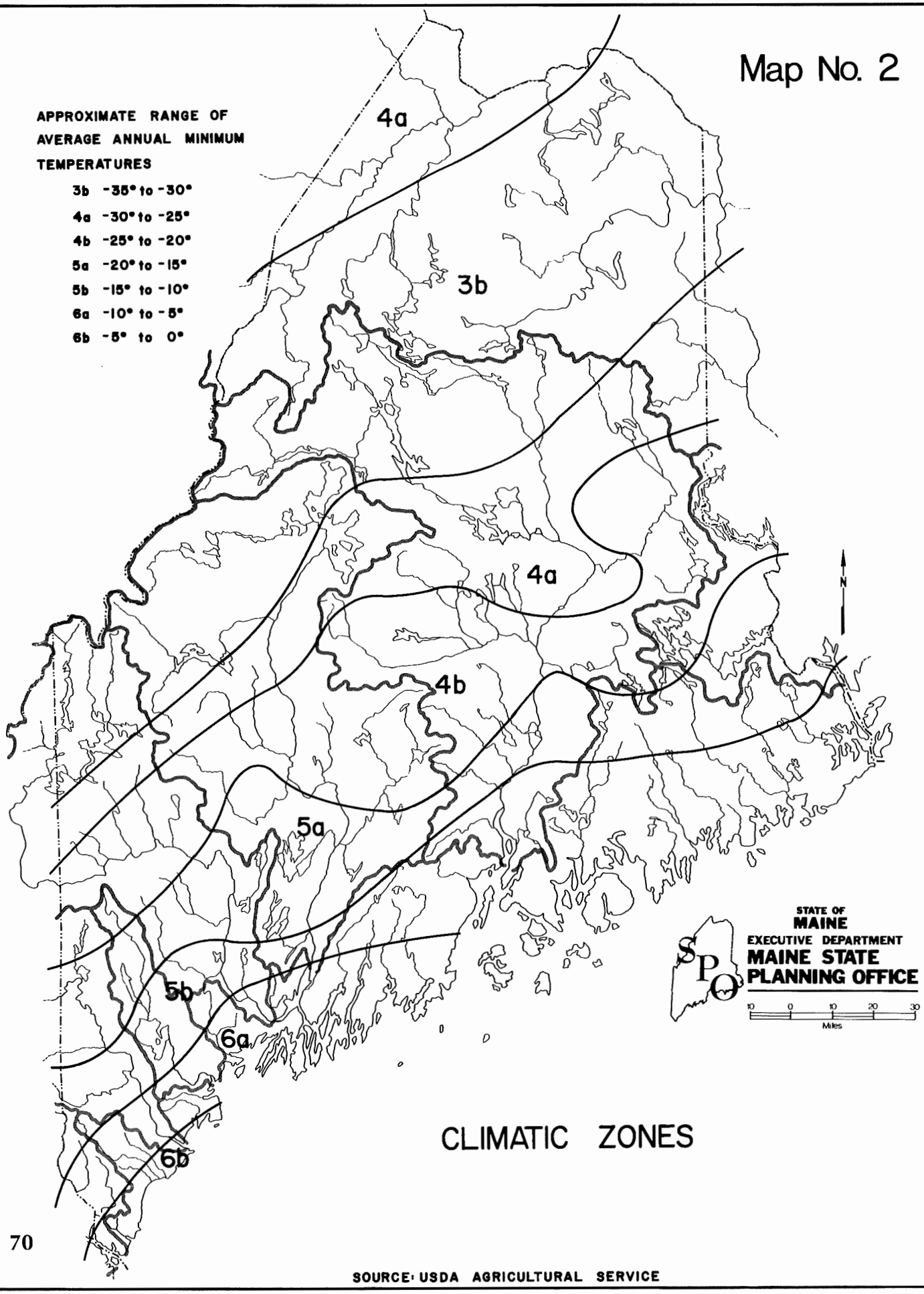
[3] From State Planning Office data and analysis of the basin area.

[4] Most minor basins are named for the major river draining them.

[5] The sources may be that of the named river if it extends well into the basin, or may be where major flow begins.

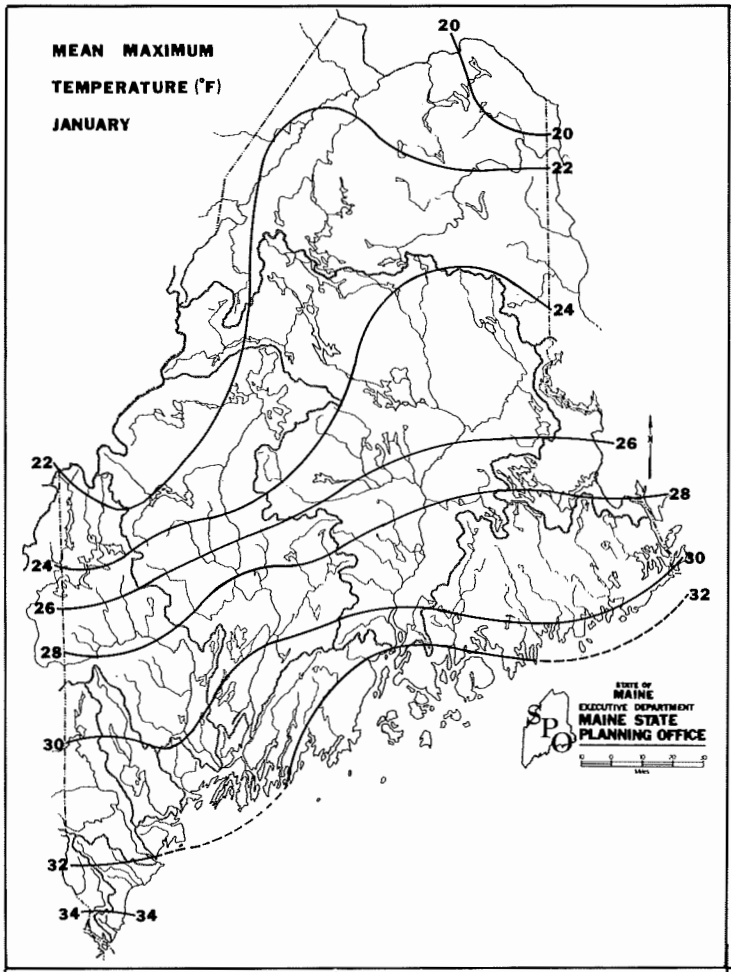
[6] Length is from source to mouth, not necessarily length only of named river.

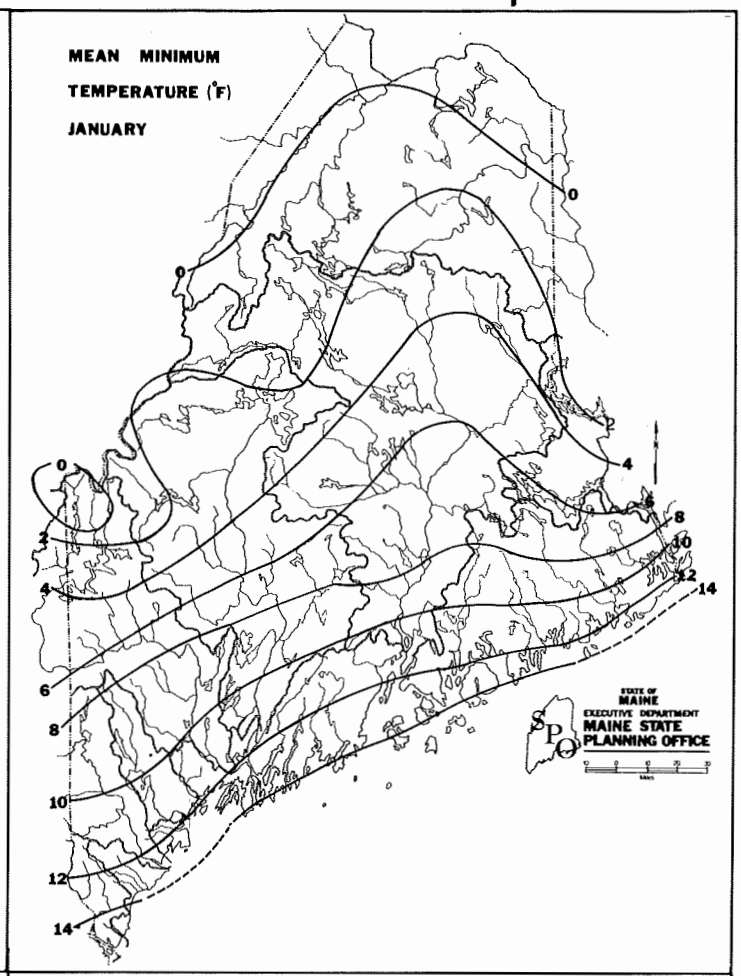
Map No. 2

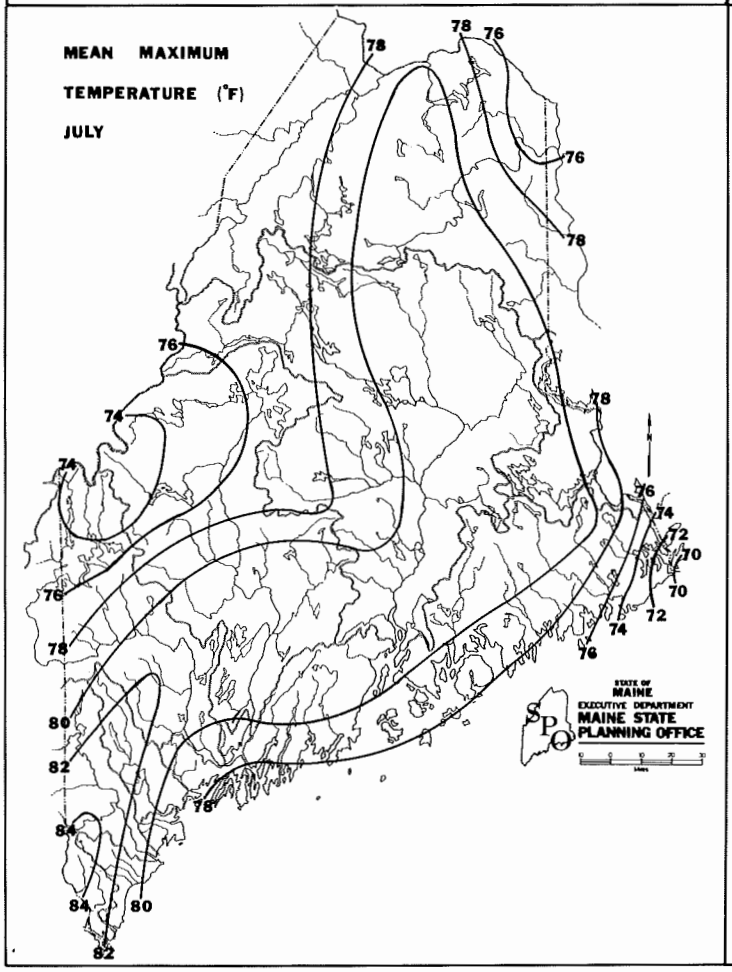


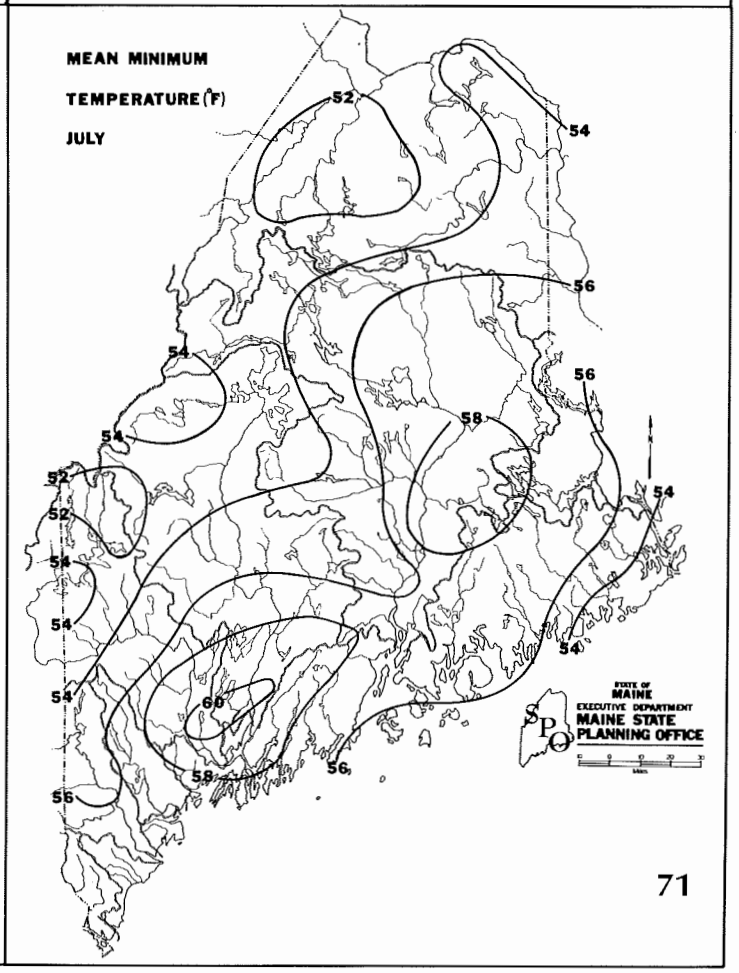
CLIMATIC ZONES

SOURCE: USDA AGRICULTURAL SERVICE









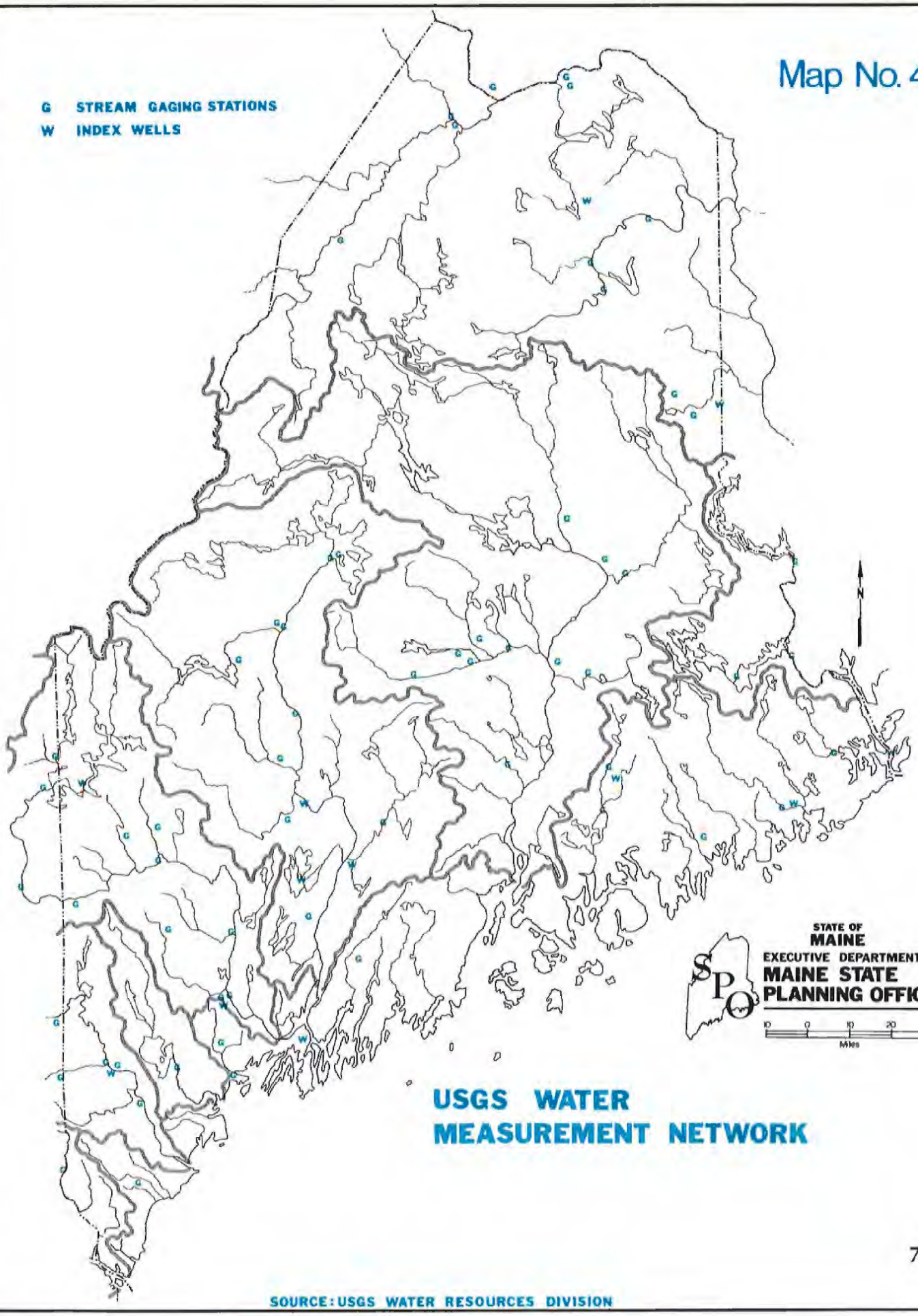
SUMMARY OF TEMPERATURE DATA

AFTER NOAA

Stephen Nichols/Maine Times

Map No. 4

G STREAM GAGING STATIONS
W INDEX WELLS



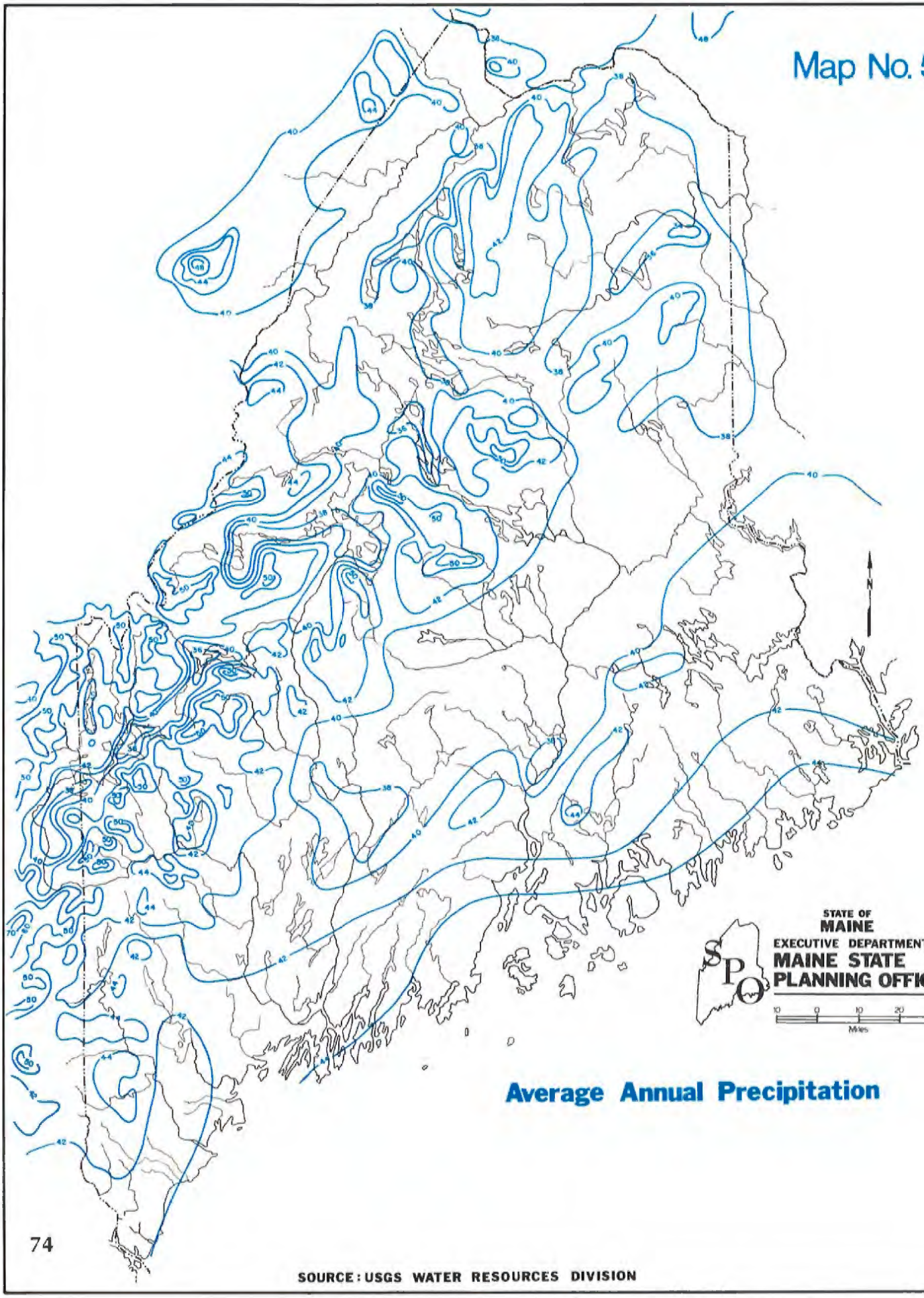
STATE OF MAINE
EXECUTIVE DEPARTMENT
MAINE STATE PLANNING OFFICE

10 0 10 20 30
Miles

USGS WATER MEASUREMENT NETWORK

SOURCE: USGS WATER RESOURCES DIVISION

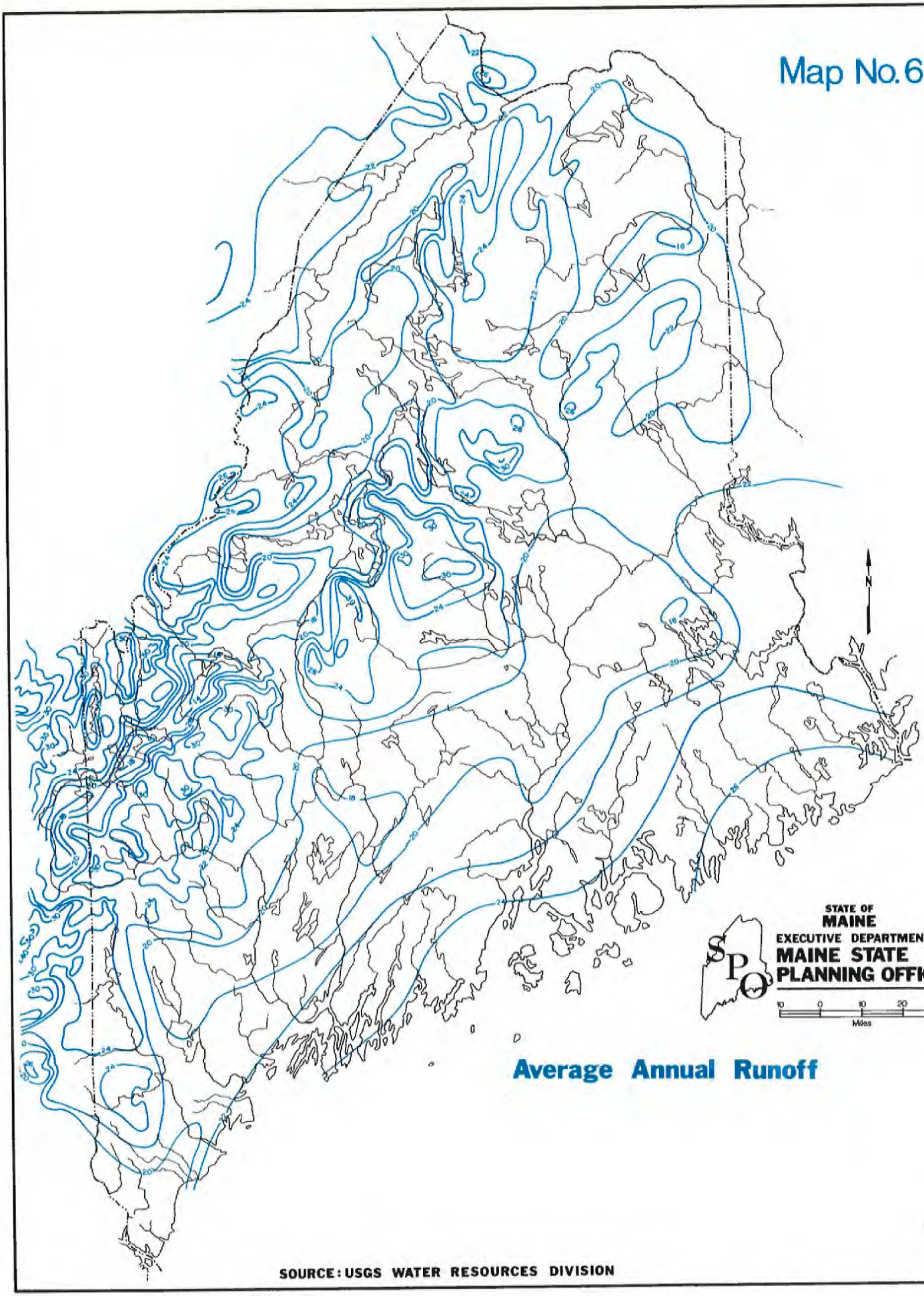
Map No. 5



Average Annual Precipitation

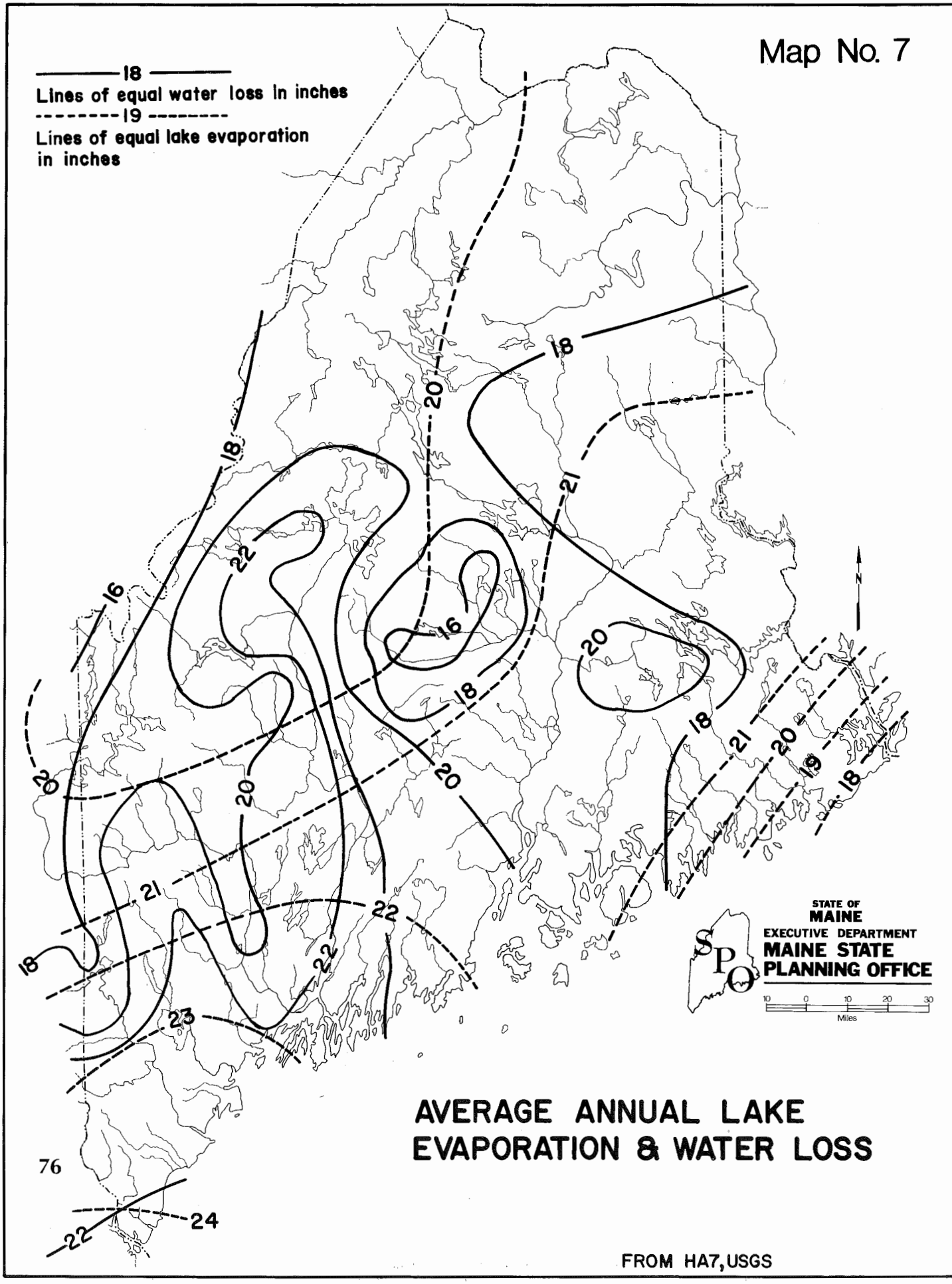
SOURCE: USGS WATER RESOURCES DIVISION

Map No. 6

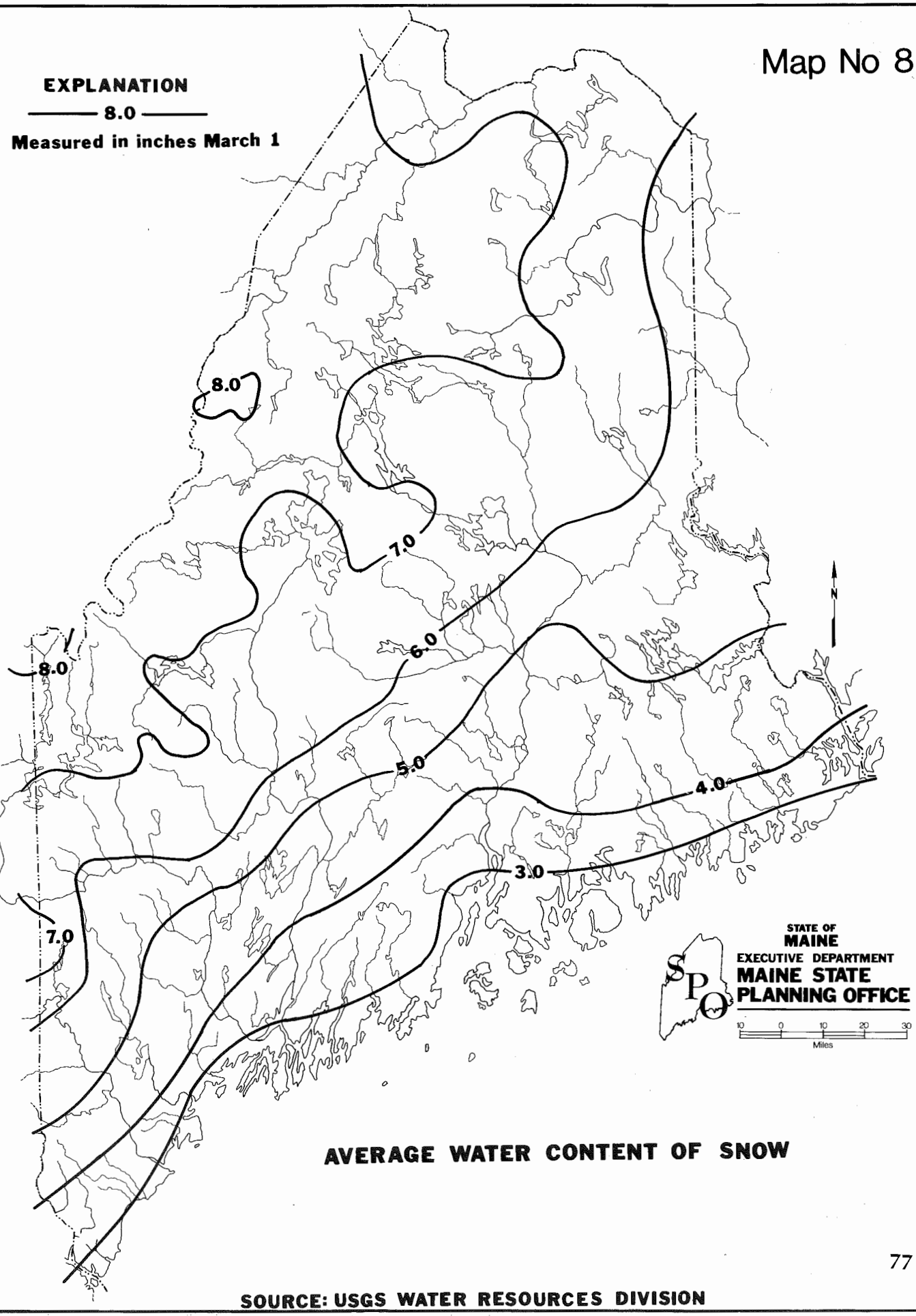


Average Annual Runoff

SOURCE: USGS WATER RESOURCES DIVISION


Map No. 7
18
Lines of equal water loss in inches
19
Lines of equal lake evaporation in inches
STATE OF MAINE
EXECUTIVE DEPARTMENT
MAINE STATE PLANNING OFFICE
SPO
10 0 10 20 30
Miles
AVERAGE ANNUAL LAKE EVAPORATION & WATER LOSS
76
FROM HA7, USGS

Map No 8

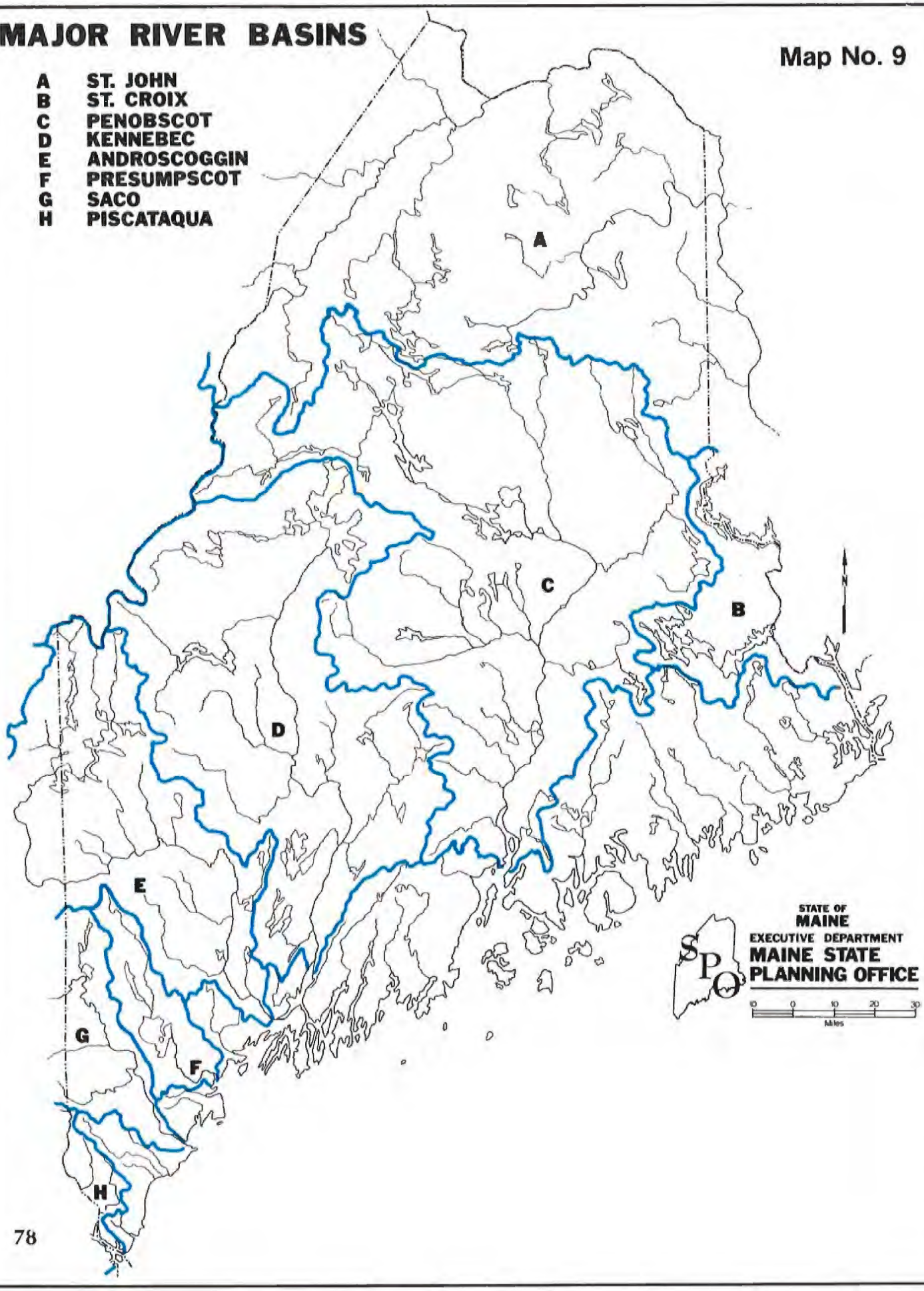


AVERAGE WATER CONTENT OF SNOW

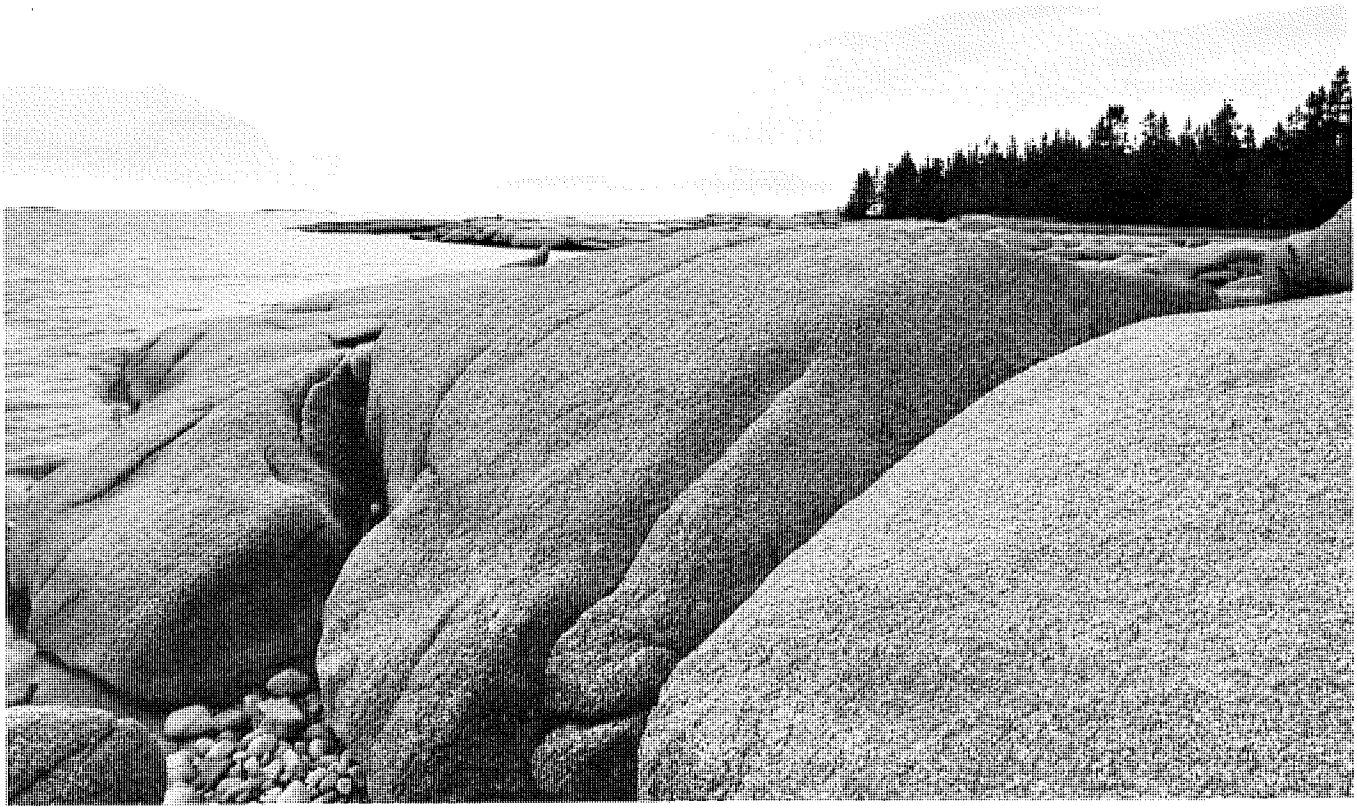
SOURCE: USGS WATER RESOURCES DIVISION

MAJOR RIVER BASINS

Map No. 9



Tom Cieslinski/Dept. of Parks & Recreation



Alda Stich

Map No. 10

NORTHEASTERN RIVER BASIN AREAS

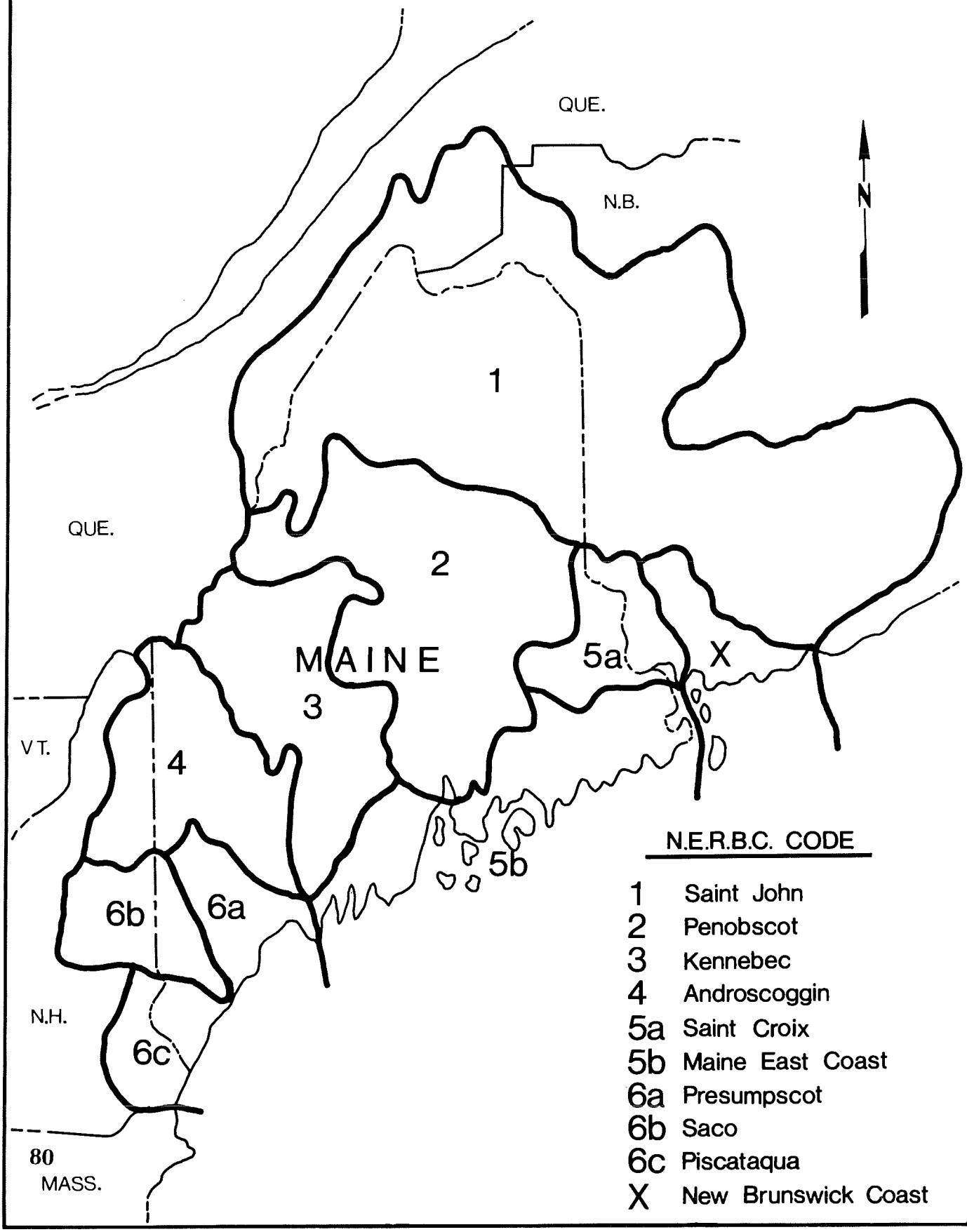
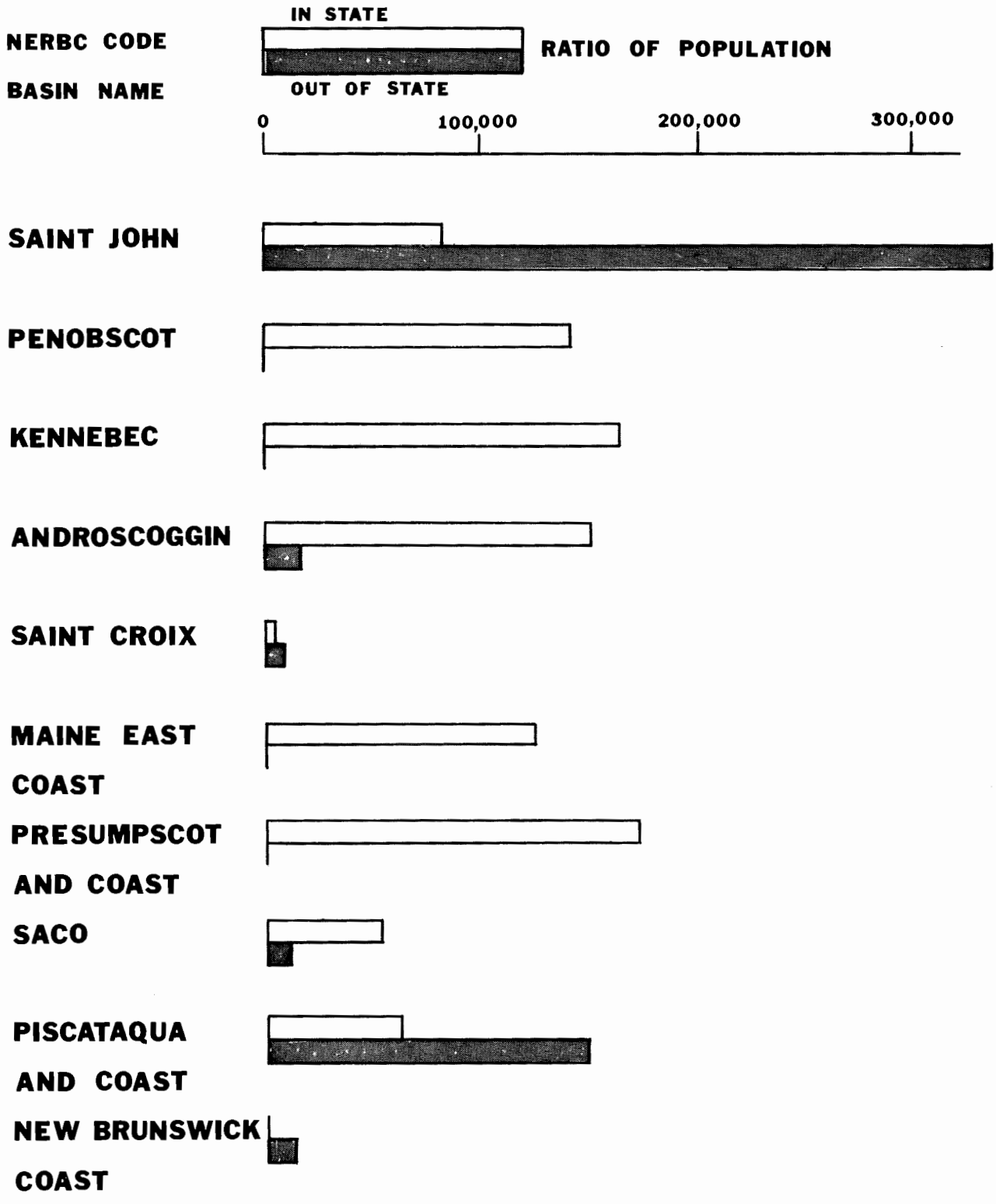
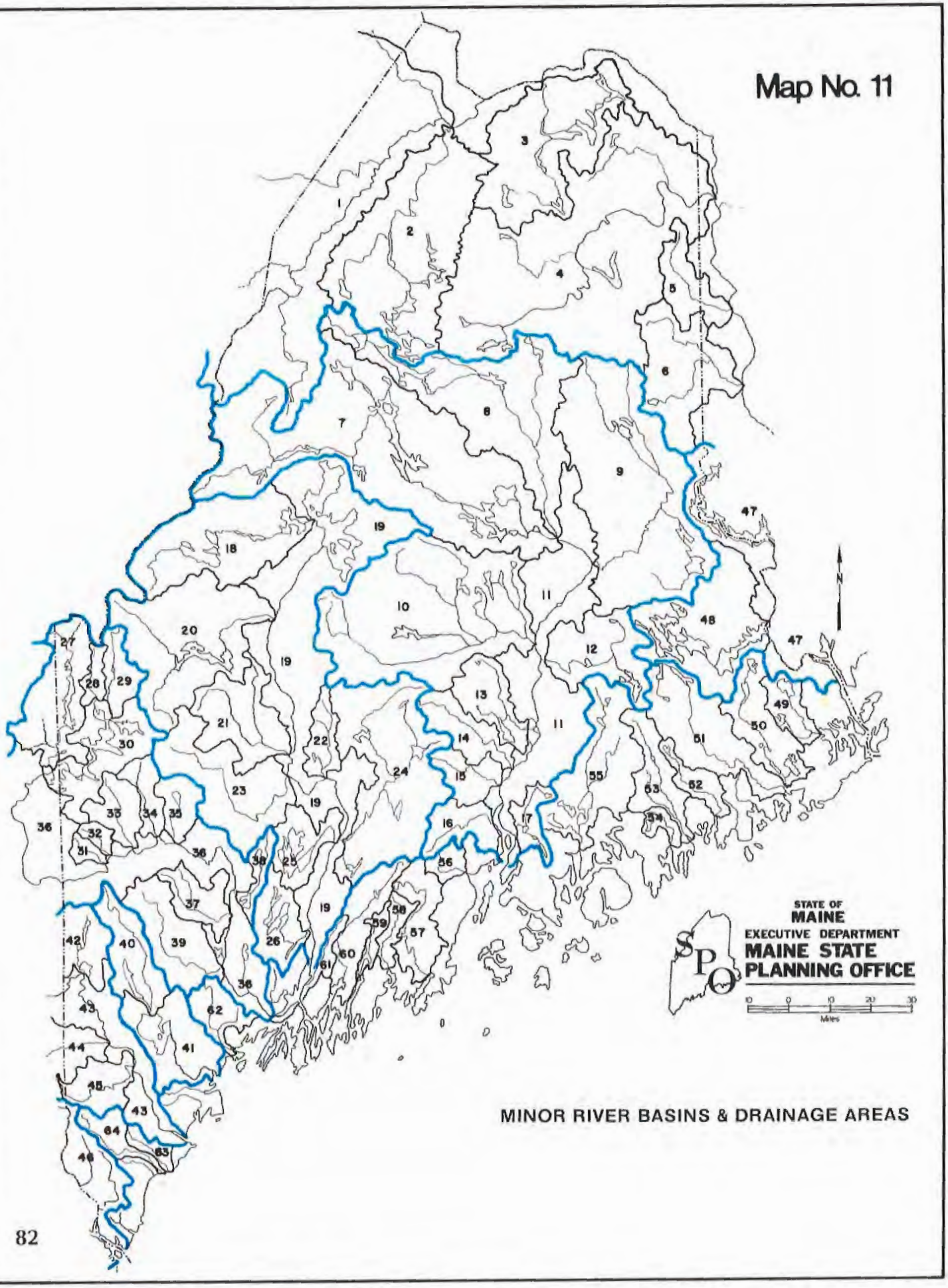


Chart 2

NORTHEASTERN RIVER BASIN AREAS




Map No. 11
STATE OF
MAINE
EXECUTIVE DEPARTMENT
MAINE STATE
PLANNING OFFICE
SPO
Miles
MINOR RIVER BASINS & DRAINAGE AREAS

Saint John River System
1. Main Stem
2. Allagash
3. Fish
4. Aroostook
5. Prestile
6. Meduxnekeag

Penobscot River System
7. West Branch
8. East Branch
9. Mattawamkeag
10. Piscataquis
11. Main Stem
12. Passadumkeag
13. Pushaw
14. Kenduskeag
15. Sourdnahunk
16. Marsh
17. Orland

Kennebec River System
18. Moose
19. Main Stem
20. Dead
21. Carrabassett
22. Wesserunsett
23. Sandy
24. Sebasticook
25. Messalonskee
26. Cobbosseecontee

Androscoggin River System
27. Megalloway
28. Cupsuptic
29. Kennebago
30. Lakes Area
31. Sunday
32. Bear
33. Ellis
34. Swift
35. Webb
36. Main Stem
37. Nezinscot
38. Dead
39. Little Androscoggin

Presumpscot River System
40. Songo-Crooked
41. Main Stem

Saco River System
42. Old Course Saco
43. Main Stem
44. Ossipee
45. Little Ossipee

Piscataqua River System
46. Main Stem

Saint Croix River System
47. Main Stem
48. West Grand Lakes

Coastal Drainage System
Eastern
49. Dennys
50. East Machias
51. Machias
52. Pleasant
53. Narraguagus
54. Union
55. Tunk

Mid Coastal
56. Passagassawakeag
57. Saint George
58. Medomak
59. Damariscotta
60. Sheepscot
61. Eastern

Southern
62. Royal
63. Kennebunk
64. Mousam

LAND

A fundamental basis for the subject of water and related land resources is a technical study of land and its relation to water in order to describe the land-water setting, focus upon important problems and point the way toward resolution of these problems. While some aspects of such a study are rather abstract, they have potential for direct bearing upon the very practical problems of living on earth. Surveys to locate and describe bedrock formations and surficial deposits and studies of the movement of water through air and over and through the land area are research projects strictly informational in nature as background for application to solve practical problems.

MAJOR PHYSIOGRAPHY

The Physiography Committee of the U.S. Geological Survey recognizes five sections as physiographic units of the New England Province, named and described in the Table below.[1] The Maine land forms comprise three of these sections as shown on Map 12.

9. New England Province

   A. Seaboard Lowland Section. Peneplains below 500 ft. post-maturely eroded and glaciated; few monadnocks.

   B. New England Upland Section. Dissected and glaciated peneplains on complex structual features; monadnocks.

   C. White Mountain Section. Subdued glaciated mountain masses of crystalline rocks.

   D. Green Mountain Section. Linear ranges of subdued and glaciated mountains and residual plateaus.

   E. Taconic Section. Maturely dissected and glaciated mountains and peneplain on resistant folded strata.

The Seaboard Lowland Section is made up of rolling coastal lands usually with sharply dissected coastline dropping off steeply into deep water. This section is distinct and not related to the great Atlantic Coastal Plain with its flat lands, long barren beaches and extensive saltmarsh. Deep water close to land in coves is present frequently and forms an area of many actual and potential harbors for large ships with deep draft in contrast with the Atlantic Coastal Plan section with harbors only in association with major rivers. Long beaches have formed mainly from Portland southward, while the remainder comprises rocky peninsulas interspersed with many islands meeting the ocean in abrupt fashion. The length of mainland coastline touching tidewater is

[1] Physical Division of U.S. In cooperation with the Physiographic Comm. of the U.S.G.S. Nevin M. Fennaman and Douglas W. Johnson.

approximately 3,500 miles, 14 times the 250-mile straightline distance from Kittery to Eastport. There are about 1,200 coastal islands as well as thousands of small rock outcrops making a truly beautiful landscape; a viewer at the coast rarely looks upon unbroken ocean, for there are almost always variable peninsulas and islands in view.

The New England Upland Section is defined as dissected and glaciated peneplains on complex structural features and monadnocks. Most of the State is upland which is rolling throughout, interspersed by occasional mountains made of hard rock that has resisted erosion. Through glacial action of scouring out valleys and blocking at outlets, this section is dotted with many lakes and ponds. Because the slope of most of this section is gentle to moderate, it is suitable for habitation especially in river valleys and most people live in this region. The top of this section occurs in the Rangeley-Jackman area from which the major rivers originate and course their way northward, eastward and southward to the ocean.

The White Mountain Section is the northernmost extension of the Appalachian Chain and is located in the west-central part of the State from New Hampshire and runs northeasterly, terminating with the mountains of Baxter State Park. Topography is irregular, and the mountains range from 2,000-4,000 feet in elevation. This region is dissected by river systems and contains a number of large lakes. Soils are thin but by accepted standards visual beauty of this region is rated as high.

The U.S. Department of Agriculture breaks down these physiographic sections into a number of major land resources areas. These areas are specific topographically and have been delineated on the basis of similarities for agriculture with emphasis on intensity of potential soil and water conservation problems. They are characterized by particular combinations or patterns of soils including slope and erosion, climate, water resources and land use. These land resources areas have been divided into a number of subareas as shown on Map 13.

GEOLOGY

The events leading to the formation of the land mass of Maine occurred both very long ago and rather recently with respect to the earth's history. The bedrock formations at or near the surface were either laid down as sediments on ocean bottoms or from upthrust of molten materials from the earth's interior mainly during the lower Paleozoic Era, the time-scale ranging from more than 300,000,000 to 450,000,000 years ago. Specifically, most of the sedimentary and plutonic rocks were formed during the Ordovician, Silurian, and Devonian periods. During these periods there were numerous times when formations were warped, uplifted, folded and faulted as well as undergoing erosion constantly, making a veritable jumble of varied rock types such that one can hardly find an outcrop in which the bedding plane is horizontal such as those in the western United States. The presence of plutonic rocks that now cover one-fifth of the State's area indicates considerable volcanic

activity in the past. As a matter of interest some rocks on Northhaven and and in the Chain of Ponds area are believed to be of substantially older formations, the latter tentatively dated at 1,300,000,000 years. With increasing acceptance of the theory of continental drift and a forced reexamination of very basic geological principles, Maine is now viewed with increased interest as a possible site where major deep-earth formations intersect and interact. That these volcanic events occurred long ago means that such an intersection is now relatively inactive in contrast with the San Andreas fault in California, which is rather active.

The loose materials covering the bedrock formations, called surficial deposits, were laid down only 10,000 to 20,000 years ago when a major glacier covered the State. Movement of ice from a center in eastern Canada brought along these materials scraped from land farther north. Movements of the glacier, melting of ice, depression of land under the weight of a layer of ice believed to be up to two miles thick were factors that completed formation of the Maine landscape and left an unusually jumbled assemblage of various surficial deposits. No doubt considerable erosion of bedrock was caused by the glacier, although the hard bedrocks here have been highly resistent to erosion, leaving the varied topography now present. Of special significance was the scouring out of many valleys by the glacier, leaving the large number of lakes and ponds in the State. On the coast ice depressed the bedrock land up to several hundred feet through sheer weight. When the ice melted the ocean invaded our present coastal land area and large amounts of clay materials were deposited. Eventually the land rebounded to present levels allowing erosion to wash away much of these materials into the ocean. These events are so recent that barrier beaches have not yet formed to considerable extent through erosion of uplands, as in the mid-Atlantic states, leaving such a rocky, extremely dissected coastline.

Bedrock geology of Maine has undergone research for a long time and hundreds of papers on the subject have been published by research geologists. In 1967 the Maine Geological Survey of the Department of Conservation, published a map at a scale of 1:500,000 summarizing what was known of bedrock and locating specific formations. This map is still available and a valuable reference. It is summarized on Map 14, Generalized Geologic Map of Maine, 1972. Since 1967, the Bureau has continued research, refined and revised considerably the knowledge of bedrock and is drafting a new summary map at a scale of 1:250,000. In addition to the summary maps the Bureau has published detailed bedrock survey work on 15' and $7\frac{1}{2}$' quadrangle map bases of the U.S. Geologic Survey.

Survey of surficial deposits has received less attention than that for bedrock information. Although there are many publications on this subject, there is no published summary map for the State. Reconnaissance survey is underway by the U.S. Geological Survey, which has published several maps of summary information to support its research for groundwater in surficial deposits.

Map 15 summarizes this work and supporting publications are listed below.[1] The Maine Bureau of Geology has begun compilation of a summary map of surficial deposits at a scale of 1:250,000 for use as a working master, and there are plans to issue this map as a general publication in the future. The Bureau has also undertaken the survey of surficial deposits on the base of 15' and 7½' U.S. Geological Survey guadrangle maps. The surficial geological maps of quadrangles are available as open-file reports (black line mylars or paper overlays). Knox and Washington Counties maps are scheduled for completion in January, 1975, while maps for Lincoln, Sagadahoc and York Counties should be completed by spring 1975.

SOILS

Soils are developed in surficial deposits. Soil is generally considered that part of the surficial deposit in which plants grow. More specifically, soil is the unconsolidated mineral or organic matter on the surface of the earth that is biologically weathered and serves as the natural medium for the growth of land plants. The United States Department of Agriculture early in this century began a systematic survey of soils in the United States. In Maine this survey did not get underway significantly until after World War II when modern principles were better known and Soil Scientists of the Soil Conservation Service of the United States Department of Agriculture were attached to Soil Conservation Districts to begin or refine soil survey work.

[1] HA-76. Geologic map of the surficial deposits of part of southwestern Maine and their water-bearing characteristics. 1963. G. C. Prescott.

HA-225. Surficial geology and availability of ground water in part of the lower Penobscot River Basin, Maine. 1966. G. C. Prescott, Jr.

HA-285 Ground-water favorability areas and surficial geology of the lower Androscoggin River basin, Maine. 1968. G. C. Prescott, Jr.

HA-337. Ground-water favorability areas and surficial geology of the lower Kennebec River basin, Maine. 1969. G. C. Prescott, Jr.

HA-443. Ground-water favorability and surficial geology of the lower Aroostook River basin, Maine. 1972. G. C. Prescott, Jr.

HA-485. Ground-water favorability and surficial geology of the lower St. John River valley, Maine. 1972. G. C. Prescott, Jr.

HA-486. Ground-water favorability and surficial geology of parts of the Meduxnekeag River and Prestile Stream basins, Maine. 1972. G. C. Prescott, Jr.

HA-529. Ground-water favorability and surficial geology of the Cherryfield-Jonesboro Area, Maine. 1974. G. C. Prescott, Jr.

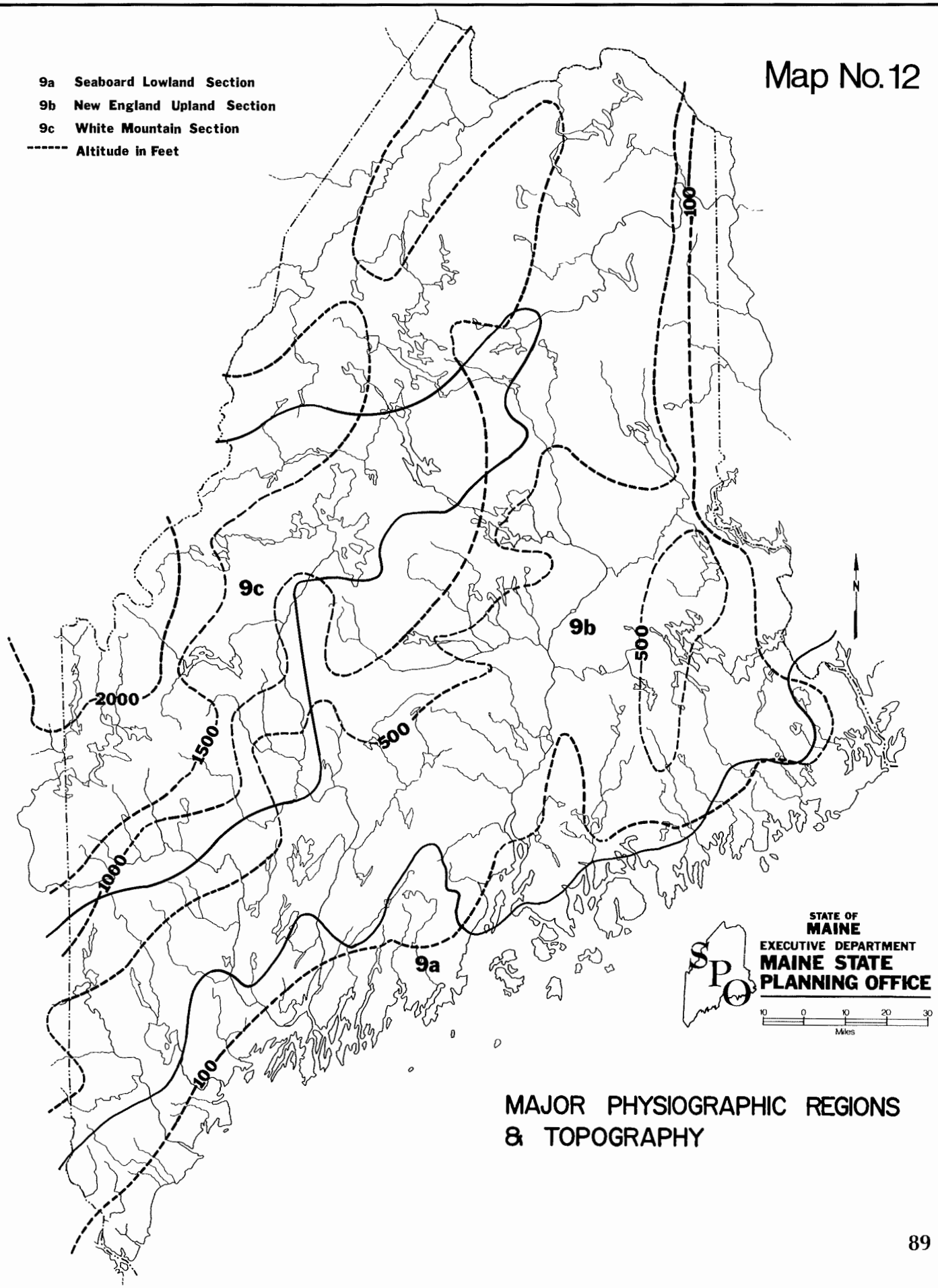
Today soil survey work in Maine is carried on cooperatively by the Soil Conservation Service, the Maine Agricultural Experiment Station and the Maine Soil and Water Conservation Commission and is part of the National Cooperative Soil Survey in the United States. The soil survey classified soils taxonomically (similar to the botanical classification of plants) with soil series analogous to plant species in the lowest category. Soil series are named after the place they were first discovered or known. All soils within a soil series have similar chemical and physical properties. For mapping purposes soil series are divided into phases based on factors such as stoniness or slope that affect use and management. In the area soil surveyed, thus far in Maine 85 soil series have been recognized and there are about 650 unique mapping units or kinds of soils. The Soil Survey in Maine is therefore a soil identification and mapping project conducted cooperatively by State and Federal agencies.

Map 16 shows the status of the National Cooperative Soil Survey in Maine to date. Within three years surveys for Knox-Lincoln, Waldo and York counties should be completed. As these surveys are completed soil scientists will be transferred to other counties needing soil surveys. For plantations and unorganized townships, a reconnaissance survey will be started in the spring of 1975. This survey will be made at 1:62,500 scale and will provide soils information for this vast area in a short time. Standards for this type of survey are the same as that for a detailed soil survey, but the mapping units are composed of associations of soil series rather than phases of soil series. During the 1974 field season soil scientists gathered basic soil information in the wilderness area to enable them to classify the soils and design mapping units compatible with the objective of the survey.

The origins of soil survey took root in the suitability of soils to grow crops. Since the early 1900's, however, a soil classification system based on soil properties has been developed. Because the classification system is based on soil properties, the soil can be interpreted for many uses. In the past there has been a dismal record of failure of projects of all kinds because soil factors were not taken into account, and these projects simply did not fit the land where they were located. In Maine during the 1960's the Soil Conservation Service began to prepare soil suitability maps based on soil survey for communities for such classes of land use as agriculture, recreation, woodlands, wildlife, urban development and industrial development. In 1967 a general soil suitability guide was published[1] followed by a set of soil descriptions and interpretations[2] to be used with the guide. With the existence of these guides, there is increased interest in completion of the soil survey as a fundamental cornerstone in the development of good land use practices within the State.

[1] Soil Suitability Guide For Land Use Planning in Maine. 1967. Misc. Publ. 667 Rev. Maine Agricultural Experiment Station.

[2] Statewide Set of Maine Soil Descriptions and Interpretations. 1970. Soil Conservation Service, U.S. Department of Agriculture, Orono, Maine.


9a Seaboard Lowland Section
9b New England Upland Section
9c White Mountain Section
Altitude in Feet
Map No. 12
9c
9b
9a
2000
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1000
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500
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100
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STATE OF
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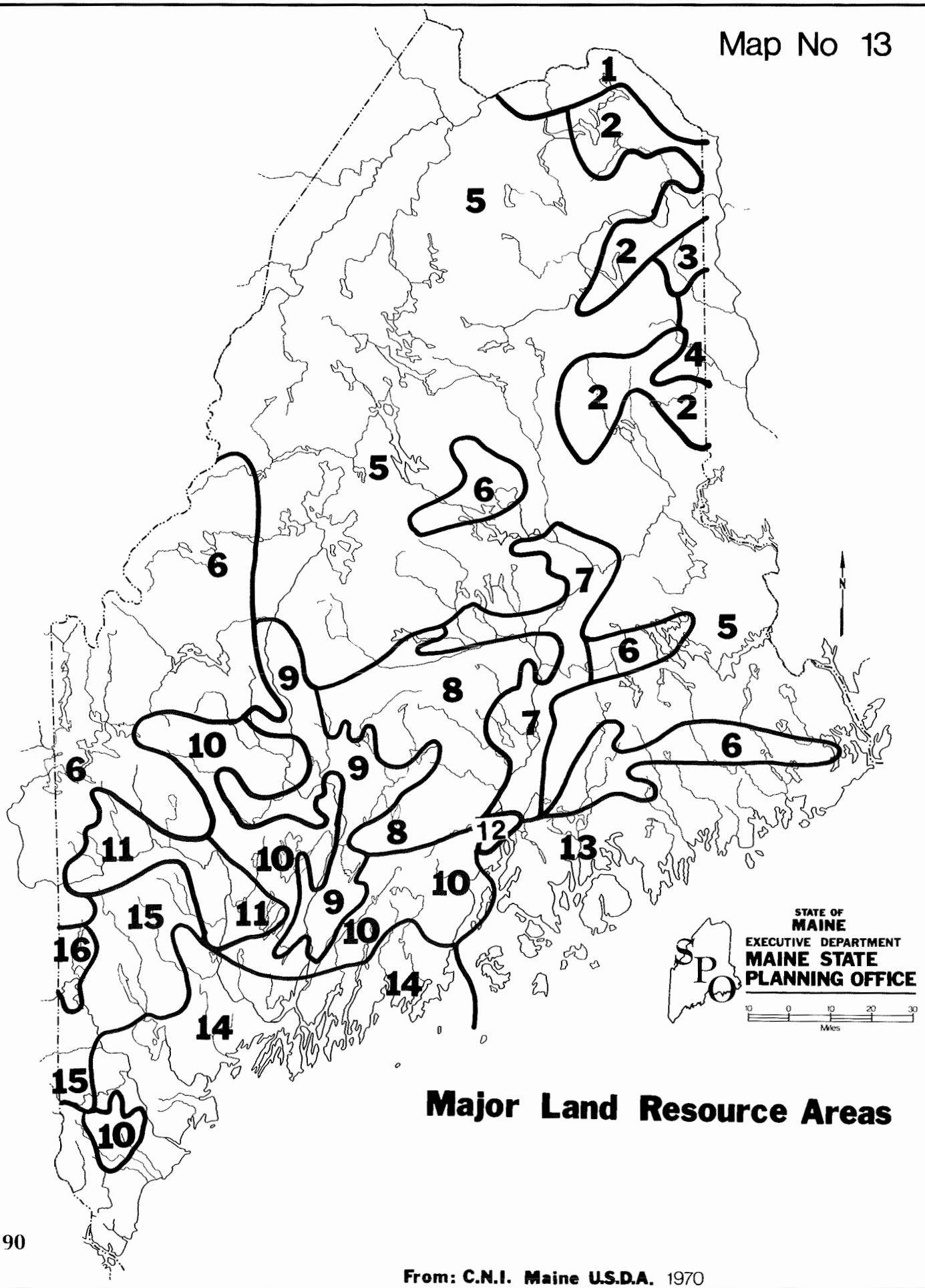
MAJOR PHYSIOGRAPHIC REGIONS
& TOPOGRAPHY

Map No 13



Major Land Resource Areas

From: C.N.I. Maine U.S.D.A. 1970

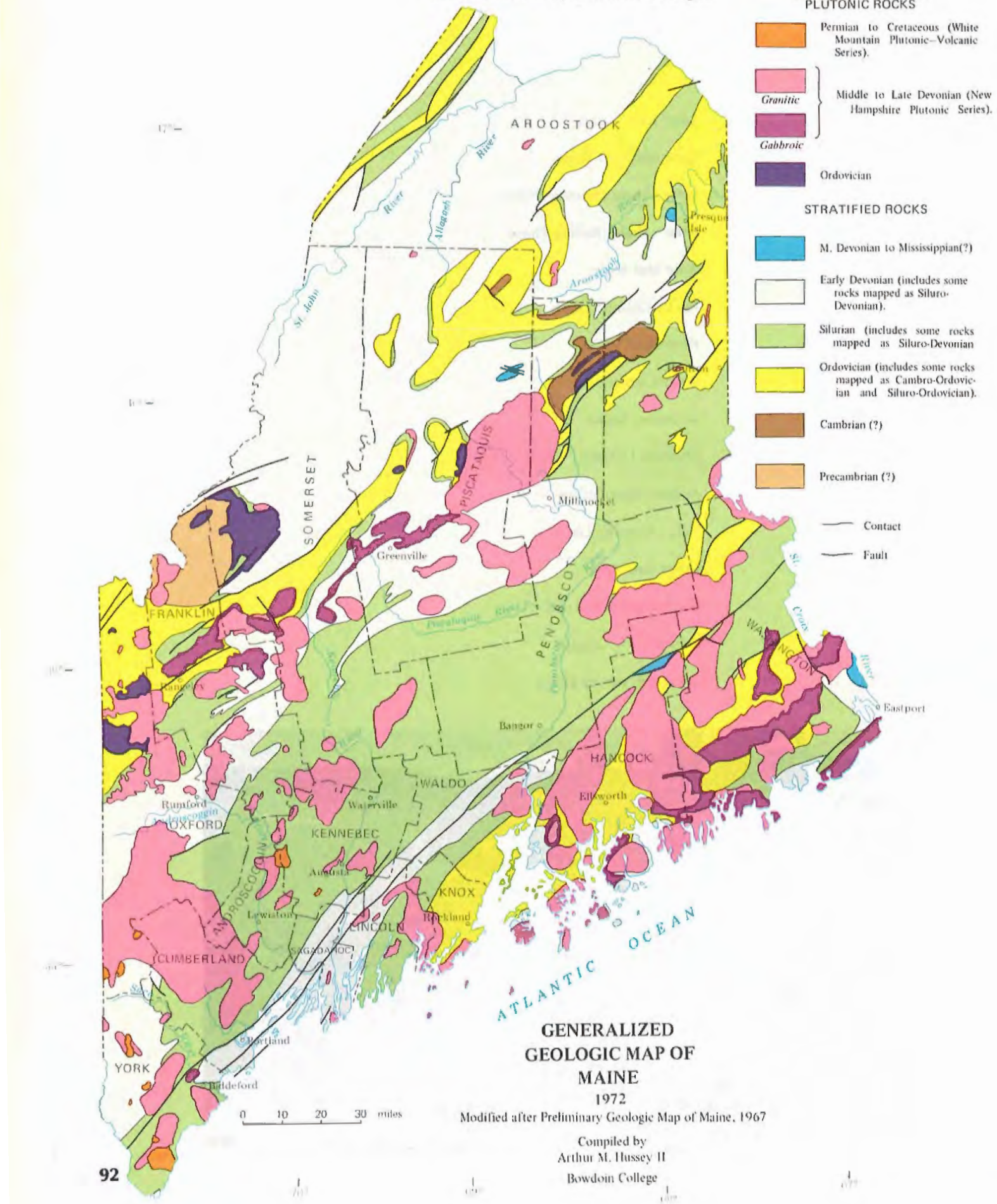
MAJOR LAND RESOURCES AREAS

Area No.	Area
1	Saint John Valley
2	Slate and acid Shale
3	Lime - Shale (Sloping Phase)
4	Lime - Shale (Rolling Phase)
5	Slate and Shale
6	Rocky Granitic Lands
7	Penobscot Valley
8	Bangor Upland
9	Kennebec Valley
10	Charlton Uplands
11	Androscoggin Valley
12	Hilly - Granitic Lands
13	Down East Area
14	Coastal sands and clay
15	Central Hilly Granitic
16	Conway-Fryeburg Plains

Alda Stich

Department of Forestry
MAINE GEOLOGICAL SURVEY
Augusta
Robert G. Doyle, State Geologist
Walter A. Anderson, Asst. State Geologist

Map No. 14

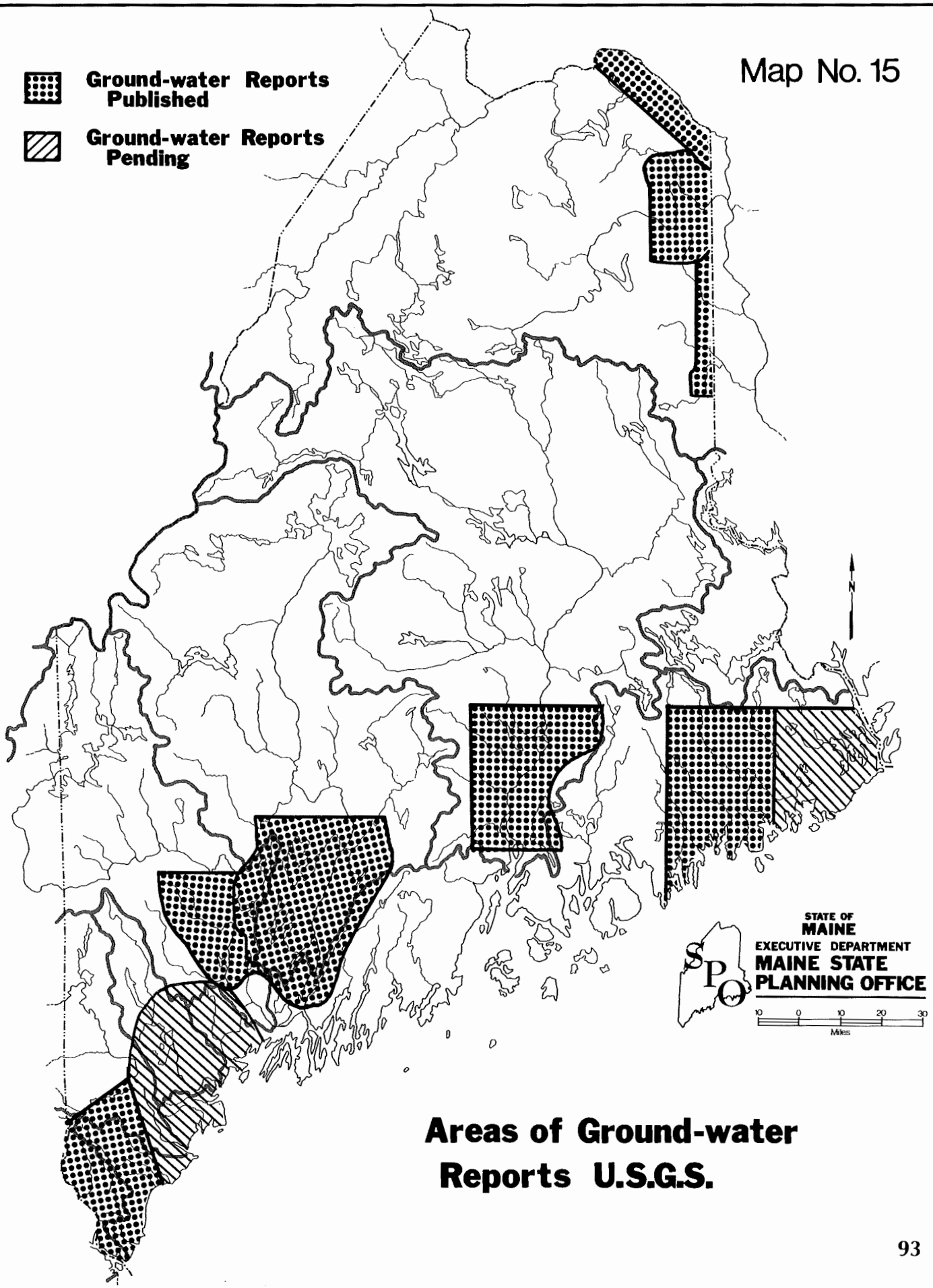


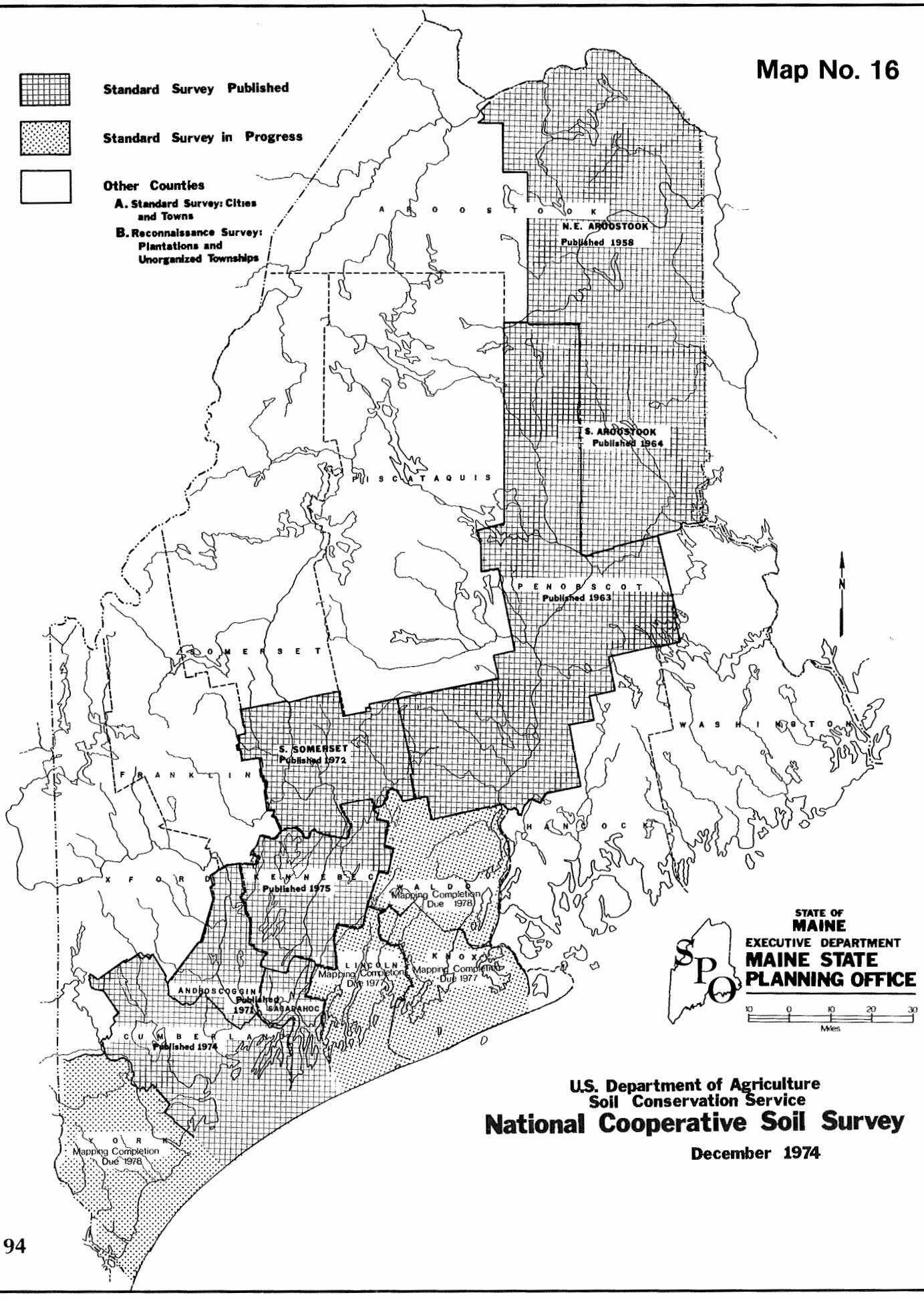
GENERALIZED GEOLOGIC MAP OF MAINE

1972

Modified after Preliminary Geologic Map of Maine, 1967

Compiled by
Arthur M. Hussey II
Bowdoin College


Ground-water Reports Published
Ground-water Reports Pending
Map No. 15
N
STATE OF MAINE
EXECUTIVE DEPARTMENT
MAINE STATE PLANNING OFFICE
SPO
10 0 10 20 30
Miles
Areas of Ground-water Reports U.S.G.S.


Map No. 16
Standard Survey Published
Standard Survey in Progress
Other Counties
A. Standard Survey: Cities and Towns
B. Reconnaissance Survey: Plantations and Unorganized Townships
A R O O S T O O K
N.E. AROOSTOOK
Published 1958
S. AROOSTOOK
Published 1964
P I S C A T A Q U I S
P E N O B S C O T
Published 1963
S O M E R S E T
S. SOMERSET
Published 1972
F R A N K L I N
W A S H I N G T O N
H A N C O C K
O X F O R D
K E N N E B E C
Published 1975
W A L D O
Mapping Completion Due 1978
K N O X
L I N C O L N
Mapping Completion Due 1977
Mapping Completion Due 1977
ANDROSCOGGIN
Published 1974
SAGADAHOC
C U M B E L A N D
Published 1974
Y O R K
Mapping Completion Due 1978
N
STATE OF MAINE
EXECUTIVE DEPARTMENT
MAINE STATE PLANNING OFFICE
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Miles
U.S. Department of Agriculture
Soil Conservation Service
National Cooperative Soil Survey
December 1974

Mapping of Land and Water Resources

Mapping of land is a major program of fundamental importance to water resources planning and management. There is a proliferation of projects based upon photography from the ERTS[1] satellite, U-2 flights and various low-level flights for specific purposes. Photographs are often used directly rather than serve solely as a source for map making. It is difficult to keep track of all these public and private projects involving Maine, since each agency requires a specific area coverage and degree of detail suitable for its purposes. This problem was a significant reason in 1974 for the enlargement of the role of the Maine Mapping Advisory Committee, a group of specialists from those State agencies with interests in mapping, to include inventory of such projects with the additional goal of reducing their unnecessary duplication. It is expected that within the near future, this Committee will fulfill this function with periodic publication of the aerial photography and mapping programs in progress, and begin to suggest improvements for their greater effectiveness.

The major program for mapping the natural features of Maine is conducted by the Topographic Division of the U.S. Geological Survey. This program has been underway for about one hundred years to provide general base maps of the United States. Principles, standards and technique are well developed but under constant revision and improvement. The resulting maps are of the best quality obtainable. There are several series pertaining to the State as summarized in Table 14. Map 17 depicts the status of the mapping program in the State of Maine to date.

[1] Earth Resources Technology Satellite.

Tom Jones/Maine Times

The features shown on these maps are waterways, topography, culture and vegetation. The degree of detail shown depends primarily upon the scale, and the wide range of scales available allows considerable latitude in choice of maps for display purposes.

TABLE 14 *SUMMARY OF USGS MAPPING IN MAINE*

SCALE	COVERAGE	SIZE	STATUS as of DEC. 1974
1/500,000	Statewide	30"x44"	Completed
1/250,000	1°x2° Earth's surface	22"x32"	Complete, ongoing for revision
1/62,500	15'x15' Earth's surface	12"x17"	Nearly complete; terminated, 23 maps unavailable
1/24,000	7½'x7½' Earth's surface	17"x23"	20% complete, ongoing

Of interest is the termination of the 15' series for the United States, announced in 1965. For Maine this series of 190 maps was completed, including revisions of most maps, except for nine quadrangles in extreme northwestern Maine. Provisional two-color maps with standards of the 1:250,000 series have been issued for this region. Budgetary limitations forced a decision to abandon this series in favor of the 1:24,000 series. One consequence has been a discontinuance of 15' maps once they have been covered by four $7\frac{1}{2}$' maps. As of December, 1974, twenty-three 15' maps are no longer available as regular edition and more will drop out in the future.

One basic reason for the decline of the 15' map series is the demand and need for maps with the better standards of the $7\frac{1}{2}$' series. This modern age of planning requires higher standards throughout to come to grips with the complex problems facing society, and for some time there has been a decided preference for the superior accuracy, content and detail of the maps of the 1:24,000 scale.

Throughout the United States there is at least two-thirds coverage on average of this series, but in Maine there is only about 20% coverage. Of 710 maps needed for the State, 135 have been published with 30 in process and 545 remaining. The mapping program is proceeding rather slowly for Maine. Since December, 1967, there have been 49 new maps published, approximately 7 per year. At this rate it will require 78 years to complete this series of base maps of such importance to all sorts of planning efforts for determination of the best future for the State.

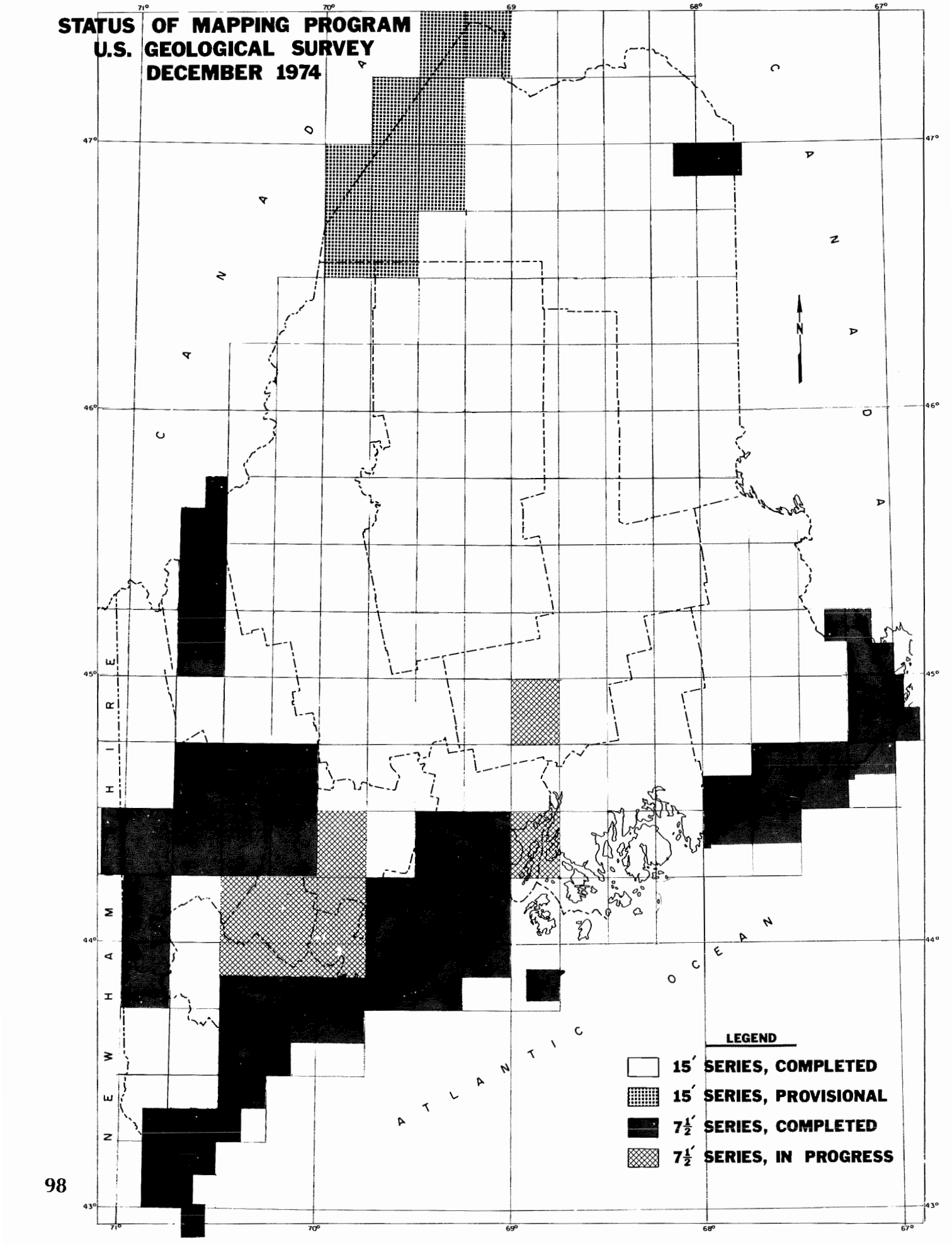
The reason that other states have completed or come closer to full coverage of $7\frac{1}{2}$' mapping is that they have maintained a steady, large appropriation to the U.S. Geological Survey cooperative mapping program, in which matching Federal grants are made for mapping. In Maine cooperative mapping appropriations was begun in 1938, and has been carried forward at the annual

rate of $20,000. While the strictly Federal portion of the annual mapping has averaged $150,000-200,000, the cooperative program has been $40,000 to be used according to priorities set by the Maine Mapping Advisory Committee. The present cost to prepare one $7\frac{1}{2}$' map is now approximately $25,000, which renders the cooperative mapping program highly inadequate. It is generally understood that Federal appropriations to the Geological Survey for mapping are likely to diminish rather than increase. Regarding interdepartmental transfers, the Department of Defense has phased out its contribution to mapping, and the Department of Housing & Urban Development will reduce its contributions once certain urban areas are mapped. (The projects started in 1974 for Bangor, Augusta and Lewiston were financed by HUD.) Therefore, the State will have to increase its appropriation drastically in order to improve the rate of mapping and provide a proper graphic base for many planning programs in addition to water and related land resources. Completion of the $7\frac{1}{2}$' series would cost over $13,000,000 at present cost levels.

Municipal Series. Using the U.S.G.S. 15' series maps the State Planning Office has prepared a file of maps of the organized minor civil divisions of Maine at a scale of 1" = 1000' for general reference and usage. Similar base maps at a scale of 1" = 1320' for the unorganized townships and plantations have been prepared by the Land Use Regulation Commission.

Regional Series. Beginning in 1972 the Water Resources Division of the State Planning Office and the Bureau of Geology, Department of Conservation, jointly undertook to prepare a mapping overlay system based upon the U.S.G.S. series of 1:250,000 with the intent to provide a source to construct regional maps for various purposes at this scale or 1:125,000. Such regions as the entire State, counties, and major river basins (including interstate basins) have been designated. In addition to the components of the U.S.G.S. maps - water, culture and contours - overlays have been prepared for reduced water and culture, minor civil division outlines, minor civil division names and river basin outlines. A base file of negatives is gradually building up from which to select and build desired composites of these various regions. This system is available for general use, and the Water Resources Division and Bureau of Geology offer assistance to any person or agency interested in securing maps from this basic source.

STATUS OF MAPPING PROGRAM
U.S. GEOLOGICAL SURVEY
DECEMBER 1974



An Analysis of Water and Related Land Resources Subjects

SECTION 4

This section discusses the major subject areas defining water and related land resources. An important point to note is that these subject areas are mainly concerned with institutional management programs designed to utilize water and land resources for specific purposes, generally operating separately without much interaction with each other. The highlights of these institutional programs and major problems relating to them are sketched to serve as a basis for their better coordination into a synthetic water and related land resources program for Maine. The consideration of population and the economic setting and futures are also major subject areas serving as significant background for discussion of water and related land resources planning and management. They are omitted from this report because they are being covered in other concurrent publications.

A. Water Law

One of the more important matters governing water resources planning and management is the underlying common law framework often called water law. Like other aspects of law, it is complex and properly the domain of legal specialists and the judicial branch of government. In this regard the following summary touches upon a few basic principles to illustrate their significance to water resources activities.

Before any water resources project plan is prepared or legislation passed influencing water resources management, proponents should consult with legal specialists or face the possible risk of offering proposals that could be turned back through failure to take into account basic common law relating to water. Maine has entered the age of major environmental protection based upon Federal and State legislation, mostly of recent origin, designed to create agencies with regulatory power to ameliorate or stop environmental abuse occurring within the State. Maine is also about to enter the age of comprehensive water and related land resources planning and management programs that intend actively to allocate and balance competing and conflicting uses of the resource. Whatever the merits of environmental protection and comprehensive planning for wise management of our natural resources, they face the test of common law, and at least some have said that such a test would be severe and the outcome not at all certain. The basic reason is that the Maine body of water-related common law, up until recently, has itself not faced much interaction with public activity in behalf of environmental protection and comprehensive planning, and, in keeping with legal procedures based upon precedent, is highly conservative. There are several studies* relating

*1 Public Rights in Maine Waters. 1965. G. Graham Waite. Maine Law Review 17. 161-204.

*2 Maine Law Affecting Marine Resources. 1969-70. Harriet P. Henry & David J. Halperin. Vols. I, II, III, & IV. School of Law, University of Maine.

to water-related common law that serve as excellent reference material on this subject in addition to the specific matters of these studies. Also from time to time, articles significant to water law appear in the "Maine Law Review", a journal published by the School of Law, University of Maine.

Since Maine was settled in colonial times by English-speaking people who founded the Massachusetts Bay Colony and since climatic conditions were similar to that of the British Isles, especially with regard to the hydrologic cycle, the water-related common law prevailing in Britain was adopted for Maine as well as for the remainder of the eastern United States and Canada. This form of water law is called the doctrine or system of riparian rights.

In keeping with international tradition, the open ocean was universal territory circumscribed by bands of territorial water for a long time set at three miles out from land. Territorial or tidal water and inland surface water were considered public water to the territorial inhabitants, and intertidal lands were considered public as well. Rights to use of water belonged to landholders abutting such waterways as tidal water, rivers and lakes. Groundwater was considered property of landholders above. Since there would likely be many landholders in an inland watershed, water could not be diverted to areas outside a watershed, and after use it had to be returned to the watercourse essentially undiminished in quantity and quality. Reasonable rather than unlimited use was the guideline.

Since lakes and ponds were so abundant in the Massachusetts-Maine colony, those over 10 acres were considered part of the public realm and access was granted to "freemen" as long as they "trespasseth not upon another man's corn". Since this mode of access was usually on foot or by horseback through unimproved land, use of water was necessarily restricted, essentially being limited to fishing, hunting, drinking, bathing, watering livestock, and harvest of ice. While the riparian system derives essentially from abundance of water, it is possible to speculate that superabundance here led to this Great Ponds Doctrine of public rights where normally private rights would prevail. Only Massachusetts, Maine and New Hampshire have formally adopted and perpetuated this apparent contradiction to the riparian system.

Generally speaking, river basin management to insure the optimum use of water resources for all classes of users will result from comprehensive studies and plans and be carried out by a legally constituted governing body, be it the Executive Branch of State government, county or local government or new regional governing bodies whose jurisdictional territories would align with river basins. Such management will include coordination of all water uses into an optimal framework and will certainly require alterations in present management practices by specific users. The practice of allowing rivers to assimilate or carry away domestic and industrial waters shall be greatly reduced and corrective measures be installed with costs borne by the parties discharging such water. Regulation of river flow is certain to be influenced to benefit all users rather than be managed by industrial and hydroelectric power companies solely for their benefit. Prevention of flooding, and

*3 Coastal Zone Management in Maine. A Legal Perspective. 1973. Harriet P. Henry, Maine State Planning Office.

improvement of fisheries and water quality through low flow augmentation are needs to be satisfied through a broader control of river flow rates. Maintenance of levels in lakes now subject to drawdown for supply of water downstream is another matter that will become important as multiple use of these lakes increases. But basically, in a river basin with increasing development and population, the matter of supply itself will become paramount and demand for withdrawal will increase and require regulation. All of these matters will involve property rights, especially rights to water by riparian owners. Like construction of highways, river basin management with manipulation of water flow rates and control of withdrawal will involve in part a "taking of property" or intrusion upon these riparian rights. The riparian doctrine was designed to operate within a framework of water abundance in that uses by riparians, while extensive, do not interfere unduly with other owners. Therefore, as the pressure builds for competing water use this system may become inadequate since it would be court-administered over clashing property rights and general social and environmental needs. A number of eastern states with traditional riparian doctrines have introduced modifications to allow management by an executive branch through institution of a permit system governing water use. This is a new concept in Maine but bears study in anticipation of a water supply crisis which would be difficult to resolve through common law applications and the highly classical riparian doctrine in effect today. [1]

B. Water Supply

While hydrology is the study of all phases of water movement above, on and below the earth's surface, it is a study in itself and makes no specific application to human problems. Water supply is that most important phase of water resources concerned with the quantity and quality of water available and its possible or actual use for human purposes. Usage can be either consumptive, such as drinking water or a component of a processed or manufactured product (canned foods) or nonconsumptive, such as domestic and industrial washing or processing and carrying away of wastes, cooling in fuel-fired electric generation plants or for direct production of energy as it flows from uplands to the ocean.

DOMESTIC AND MUNICIPAL WATER SUPPLY

This aspect of water supply concerns provision of water usually for consumptive purposes in homes and certain industries, the intent being to provide a supply of water safe for human consumption at any time or of such quality suitable for specific manufacturing or industrial purposes. The supply may be made on an individual basis or collectively and piped to a large number of homes or industries through the use of water companies. The sources of water are rivers, lakes, and groundwater. In contrast with the large metropolitan areas in the remainder of the North Atlantic Region, Maine does not face a pending shortage of water for domestic and municipal supply within the foreseeable future.

[1] Water Policies for the Future. 1973. National Water Commission, Section F, Chapter 8, p 280-294. Washington, D.C.

Rivers form the most reliable supplies of large quantities of water but are often of poor quality because of natural causes or pollution from upstream point sources. A number of water companies use rivers, but this source has diminished somewhat, the chief example being Bangor because of poor quality in the Penobscot River in recent times. In northern Maine a number of water companies use rivers because water quality is still good. The major company in southern Maine still using a major river is the Biddeford and Saco Water Company which uses the Saco River just upstream from the city. While the Saco River is relatively unpolluted, there are problems arising through coliform count and sediments in water used for this water system out of the river. It is not known whether corrective measures to protect the water quality upstream through zoning or pollution abatement or other means would result in continued sufficient quality of water for the use of this system.

Many companies use lakes and ponds as a source of high quality water. For some ponds the entire watershed is often acquired or protected by the water company in order to assure water quality. The results are usually clean supplies but often limited, and in the case of some lakes water quality is diminishing and may render these sources unsuitable for this purpose.

Groundwater is the favored source of water by many water companies and individual users located in the rural areas, which are far from connections with existing water lines. About 30% of Maine's people obtain groundwater from private wells sunk into surficial deposits or bedrock. Supplies are usually sufficient for these individual users. Some water companies obtain their supplies from groups of wells in gravelly surficial aquifers.

Water Companies. A water company is defined as an institution that provides water service to more than one family. There are 162 companies presently operating in the State, as shown in Table 15, serving about 70% of Maine's people. They range in size from those servicing few customers to the large Portland Water District with thousands of customers. Most of these are of the nonprofit kind of enterprise while some are investor-owned utilities. They are subject to regulation by the Public Utilities Commission in matters of financing, pricing and marketing, and also by the Division of Health Engineering in the State Department of Health and Welfare with respect to health aspects of the water supply itself.

In 1962 the Public Health Service of the United States Department of Health, Education and Welfare, published standards for drinking water supplies. Of more interest is the adoption of standards by the State of Maine on November 27, 1973, by the State Department of Health and Welfare. Table 16 summarizes the Federal and State standards and includes "ideal" quality standards adopted by the American Water Works Association. It should be noted that the new standards include limits and design goals, the latter generally matching or exceeding the ideal standards of the AWWA.

Not stated in these regulations is a policy specifically against direct reuse of wastewater for potable supplies. Because of a discernable lack of need to reuse wastewater in Maine through the great abundance of normal supplies, the matter may never come up for attention. There should be such a policy against direct reuse in view of present uncertainty that viruses usually present in wastewater can be adequately deactivated.

When these new State standards were adopted all water companies were informed of them, and a four-year time period was given in order to bring drinking water into compliance with the maximum limits or design goals as shown in the standards. There are three general devices needed by companies with which to comply with these standards. One is to cover open standpipe reservoirs; another is to cover non-metal open reservoirs or rechlorinate water emanating from them. The third device is generally filtration or some kind of advance treatment besides disinfection for all surface waters.

Compliance with these new standards within the timetable by water companies through installation of these devices seems hardly assured in view of the large capital outlay needed for their construction. The bulk of the financing will have to be done by the companies through bond issue offerings and rate increases to cover part of these new costs, because there is no traditional, large, public funding program to assist water companies. The Department of Housing and Urban Development grants program has been phased out, and the Farmer's Home Administration program of grants and loans for construction of water supply facilities is relatively small in face of needs and is always fully subscribed. Generally in consideration of the large Federal and State water resources grants programs for construction of such facilities as dams for power and flood control, wastewater treatment or navigation improvements, and that a majority of Maine's water companies are of the nonprofit type, it seems anomalous that there is no similar program for assistance in the development and maintenance of domestic water supply, by far the most important aspect of water resources. Its lack will be most apparent during the attempt by Maine's water companies to meet the new State water quality standards designed to protect the health of the people. It is recommended that an investigation be initiated promptly to determine the most feasible means including an enlarged Federal grants program, to provide capital funding for construction of needed devices.

An alternate means to meet standards might be to shift to acquisition of relatively remote lakes and ponds with little or no development on their watersheds for supply which might meet standards directly or could through relatively inexpensive treatment measures. This approach often gains favor in water resources reports as one assuring water quality for domestic supply and providing general protection to lakes and ponds and of maintaining open space. Whatever the merits of these ancillary benefits, in the long run such a policy is likely to fail in its main purpose because supplies from this type of source are usually limited and often outgrown by future demand and because of a tendency for development to occur in these watersheds and reduce water quality to the point where the full treatment measures will be required even though appropriate land use controls might be in effect. It is possible that

the imposition of high water quality standards by the State might promote the tendency of companies to seek and develop reliably large supplies and build in adequate treatment measures such as filtration to meet potable water quality standards. Acquisition of pristine surface supplies from ponds near the tops of watersheds would diminish. The development of regional water supply systems, as has been predicted and recommended for coastal Cumberland and York Counties, would be another factor toward use of large reliable sources that would be treated to meet quality standards.

NONCONSUMPTIVE WATER SUPPLY

The natural flow of rivers from uplands to lowlands through the State certainly represents a major source of supply of large quantities of water for various purposes. In addition to a supply for domestic water, such uses as industrial process water and washing, elimination of wastes, power generation, power generation cooling, low flow augmentation, and irrigation are major purposes for the large amounts of water available in rivers.

The Colonial settlers in Maine clearly understood that best use of river water could be made through the alteration of flow characteristics which normally see too much water going through in the spring runoff and at other times too little water going through during the midwinter and dry summer periods. There were dams constructed at the outlets of lakes, sometimes raising the lake levels, with capability of opening the dam to release stored water at a later time, thus providing a regulation of the stream flow downstream. Many dams were made across lakes for the purpose of assisting log drives to downstream mills. Since log driving diminished long ago and has nearly become an obsolete procedure, many of these dams have long since been abandoned and no longer used for storage or for any discernable purpose. Larger dams were put together to form storage reservoir networks for basins mostly in the latter part of the last century and up until the middle of this century, the last being for the creation of Flagstaff Lake in 1953. Therefore, while much of the old storage system is gone, major dams remain and form the considerable storage system used today (Table 17).

There are possibilities for increased storage capacity by the construction of new dams and resulting reservoirs on most of our major Maine rivers. Some of these possibilities were listed in the report of the New England-New York Interagency Committee in 1955 and are summarized on Map 18 and Table 17. While at present there is no need for construction of these projects solely for the purpose of increasing water storage, greater development of Maine's river basins will require a greater safe yield in the rivers. A higher average flow would increase the output of power generation from the present hydroelectric plants on rivers. Should it be determined that our major river banks should be sites for large thermal power plants a larger yield of water in rivers would certainly be helpful for providing cooling water for the condensers of these plants. Regional water systems that might become quite large would require a considerable flow of water from the rivers which is actually withdrawn and consumed from the river. The Steep Falls project on the Saco River would about

quadruple the safe yield of this river and contribute greatly to the value of this source of supply for domestic use. Currently there is often a wish expressed for greater low flow in the summertime for the purposes of achieving better water quality in our rivers and to provide a better habitat to attract and maintain anadromous fisheries in those rivers where they are already present or could be introduced. Large-scale irrigation is a practice relatively unknown or unused in Maine or New England at the present time mainly through the presence of adequate rainfall during summer. Irrigation is most important in the cultivation of market garden crops where timely watering is essential for successful growing even though summers may be generally moist. And in Aroostook County where potatoes are grown on a large scale, it has been forecast that irrigation of potatoes is likely to increase substantially.

Recording these projects from the New England-New York Interagency report calls attention to the fact that they were determined to be the best sites available and their completion would complete the storage capacity of Maine's major river basins in a practical way. It is clear that the conversion of some of these sites to storage reservoirs would run counter to present planned usage. A proposal to place a dam across Allagash Lake would certainly raise a hue and cry, and construction of the Steep Falls project in Hiram would inundate a tremendous area of land and wetland in the Brownfield-Fryeburg area. But it could turn out in the future under high population that full development of the river basins' water resources would be needed and that consideration of these sites would be taken more seriously.

WATER EXPORT

Being situated on the edge of the Boston-Washington megalopolis, Maine might find itself in the position to develop a policy toward exportation of its water to Boston for domestic supplies. It would be unwise to believe "it couldn't happen here" because, despite a large legal backdrop against interbasin transfer of water, such transfers can and do occur simply because large cities must have more water. California was able to secure water from the Colorado River, New York City from the Delaware and Boston from the Connecticut through litigation that was handled directly by the U.S. Supreme Court.

The NEWS Study has revealed that the major cities in the northeastern states will require large interbasin transfers of water beginning near the year 2000. Despite excellent long range plans and projects, Providence, Rhode Island, will have to import water about 1990 from western Rhode Island and add new reservoirs to its already large surface supply system. New York City is to resolve its water supply "ultimately" by taking from Lake Ontario. There are several plans to increase the water supply for Boston sequentially through new withdrawals from points in the Connecticut River Basin into Quabbin Reservoir and then to Boston and through skimming flood peaks of the Merrimack River at Lowell. Successful implementation of these plans would create a good supply of water by the year 2020 and lessen the potential demand for supplies in New Hampshire and Maine. However, it is possible that future

flood control projects installed in the Connecticut and Merrimack River basins might reduce the flood peaks on these rivers below the point where practicable or legal flood skimming could occur. Another countering consideration is the desire by the Metropolitan District Commission of Massachusetts to maintain the very high quality of its present sources of supply. This attitude could possibly mitigate plans to acquire water directly from the Connecticut and Merrimack Rivers, both of which have mediocre to poor water presently and would be expected to remain below that presently used in the Boston system even after appropriate cleanup projects by that time. Treatment of Merrimack flood waters to drinking water standards in the amount of 500 million gallons per day is not feasible today and would likely require technological advance and a better water quality base.

The quest for high quality water points directly to Lake Winnipesaukee New Hampshire and the Saco River and Sebago Lake in Maine. It is likely that the Maine water bodies will become the fundamental sources of supply for York and Cumberland counties, respectively, so that a potential conflict is apparent. Under a sharing of the Saco River, construction of the Great Falls storage and hydroelectric power project would be needed to raise the daily safe yield from 255 cubic feet per second to 1,050 cfs. Further withdrawals from Sebago Lake for this purpose would likely reduce the Presumpscot River flow beneath the point of practicality for power generation and industrial process use. Further demand would entail pipelines all the way up to Richardson Lakes or even Wyman and Chesuncook Lakes for "ultimate" satisfaction.

The State has no policy regarding export of water and should develop one in advance of overtures from Boston that water is needed there. Reliance upon past court decisions that there shall be no interbasin transfers is likely to fail in light of certain major decisions otherwise allocating such transfers to fulfill domestic water demand. The matter should be given study and information developed about the nature of possible projects, their environmental impact and their economic impact. The last mentioned is exceedingly important because Maine, as a State with deep traditions of riparian doctrine, has established that water has no intrinsic price, and consequently, there is no yardstick to measure the impacts of export.

Alda Stich

TABLE 15 *SOURCES OF SUPPLY OF MAINE WATER UTILITIES*

NAME OF UTILITY	ADDRESS	SOURCE OF SUPPLY	FORM OF TREATMENT
Addison Pt. W. Dist.	Addison	Springs	A
Alfred W. Co.	Alfred	Dug Well	None
Allen W. Co.	Columbia Falls	Springs	None
Andover W. Co.	Andover	Stony Brook	A
Anson W. District	North Anson	Hancock Pond	A
Ashland W. Dist.	Ashland	Machias River	A,B,C,D,E,F
Auburn W. Dist.	Auburn	Lake Auburn*	A,F
Augusta W. Dist.	Augusta	Carlton Pond*	A,B
		G. P. Wells	None
		Cobbossee Lake (Aux.)	A,B
Avon Valley Water Assn.	Avon	Buys from Phillips	A
Bangor W. Dist.	Bangor	Floods* & Burnt Ponds	A,B,F
Bar Harbor W. Co.	Bar Harbor	Eagle Lake	A,B,F
Bath W. Dist.	Bath	Nequasset Lake	A,B,F
		Thompson Brook (Aux.)	A,B,F
Belfast Water Dist.	Belfast	G. P. Wells	F
		Little River	A,B,C,F
Berwick Water Dept.	Berwick	Dug Well (Salmon Falls River)	A,B,C
Bethel Water Dist.	Bethel	Chapman Brook	A
Biddeford & Saco W. Co.	Biddeford	Saco River	A,B,C,D,E
Bingham Water Dist.	Bingham	G. P. Well	None
Blethen Spring W. Co.	Dover-Foxcroft	Springs	None
Boothbay Harbor W. System	Boothbay Harbor	Adams Pond	A,B
Bowdoinham W. Dist.	Bowdoinham	G. P. Well	A
Brewer W. Dist.	Brewer	Hatcase Pond	A,F
Bridgton W. Dist.	Bridgton	Highland Lake	A,F
Brownville Jct. W. Dist.	Brownville Junction	G. P. Well, Dug Well (River Aux.)	A
Brownville W. Dist.	Brownville	Driven & Drilled Wells	None
Brunswick & Topsham W. Dist.	Brunswick	Driven Wells & G. P. Wells	A,B,F,G
Buckfield Water Dept.	Buckfield	North Pond	None
Bucksport W. Co.	Bucksport	Silver Lake	A,B,C,F
		Alamoosook Lake (Aux.)	A,B,C,F

SOURCES OF SUPPLY OF MAINE WATER UTILITIES (continued)

NAME OF UTILITY	ADDRESS	SOURCES OF SUPPLY	FORM OF TREATMENT
Calais W. & Power Co.	Calais	Dug Well (St. Stephens-Canada)	A
		St. Croix River (Aux.)	A,B,C
Camden & Rockland W. Co.	Rockland	Mirror Lake*	A,B,F
		Grassy Pond (Aux.)	A,B,F
		Chickawaukee Lake (Aux.)	A,B,F
		Wells (Union & Warren)	—
Canton W. Dist.	Canton	Anasagunticook Lake	A
Caribou W. Works Corp.	Caribou	Aroostook River	A,B,C,D,E,F
Castine W. Dist.	Castine	Springs, Dug Well & Drilled Wells	A,C
Clinton W. Dist.	Clinton	Gravel Packed Well	A,B,F,G
Cornish W. Co.	Cornish	Springs	A
Damariscotta Mills Water Assn.	Nobleboro	Damariscotta Lake	A
Damariscotta & Newcastle W. Co.	Damariscotta	Little Pond*	A,B,F
Danforth W. Dist.	Danforth	Drilled Wells, Dug Well (River) Aux.	A
Dexter W. Works	Dexter	Lake Wassookeag	A
Dixfield L. & W. Co.	Dixfield	Aunt Hannah Brook, Podunk Pond (Aux.)	A
Dover & Foxcroft W. Dist.	Dover-Foxcroft	Salmon Pond*	A
Eagle Lake Water Dist.	Eagle Lake	Well, Fish River	A
East Boothbay W. Dist.	Boothbay	G. P. Well & Driven Wells	A
Eastport W. Co.	Eastport	Little River	A,F
East Vassalboro W. System	East Vassalboro	Outlet China Lake	A
Ellsworth Water Co.	Ellsworth	Branch Lake Stream	A,F
Farmington Falls W. Co.	Farmington Falls	Drilled Wells	None
Farmington Village Corp.	Farmington	Varnum Pond G. P. Well	A,G
Fort Fairfield Util. Dist.	Fort Fairfield	Gravel Packed Well	A,B,F
		Pattee Brook	A,B,C,D,E,F
Fort Kent W. Co.	Fort Kent	G. P. Well	A
		Fish River (Aux.)	A
Franklin W. Dept.	Franklin	Springs & Well	A
Freeport Water Co.	Freeport	Burr's Pond, Impounded Stream	A,C
Friendship W. Co.	Friendship	Wells	A
Fryeburg W. Co.	Fryeburg	Driven Wells, Collecting Well, Springs	A
Gardiner W. Dist.	Gardiner	Cobbossee Stream	A,B,C,D
		Gravel Packed Wells	A,B,C,D

SOURCES OF SUPPLY OF MAINE WATER UTILITIES (continued)

NAME OF UTILITY	ADDRESS	SOURCES OF SUPPLY	FORM OF TREATMENT
Gray W. Dist.	Gray	Springs	A
Greenville W. Co.	Greenville	Big Squaw Pond*	A
Guilford W. Co.	Guilford	Bennett Pond*	A
		Gravel Packed Well	
Hallowell W. Dist.	Hallowell	Jamies Pond	A,B
Hampden W. Dist.	Hampden	Gravel Packed Well	A,F
		Purchase from Bangor W. Dist.	
Harrison W. Co.	Harrison	G. P. Well	A
Hartland W. Co.	Hartland	Starbird Pond	A
Hebron W. Co.	Hebron	Halls Pond	A
Highland W. Co.	Greenville	Springs	None
Houlton W. Co.	Houlton	"B" Stream & G. P. Wells	A,F
Howland W. Dept.	Howland	Piscataquis River	A
Island Falls W. Co.	Island Falls	Dyer Brook	A,F
Jackman W. Lt. & P. Co.	Jackman	Wood P.	A,F
Jay Village W. Dist.	Jay	Purchase from Livermore Falls W. Dist.	A
Kennebec Water Dist.	Waterville	China Lake	A,F
K.K. & Wells Water Dist.	Kennebunk	Branch Stream	A,B,C,D,E
Kezar Falls W. Co.	Kezar Falls	Drilled Wells	A,B
Kingfield W. Co.	Kingfield	Tufts Pond Stream	A
Kittery W. Dist.	Kittery	Folly & Boulter Ponds*	A,B,C,D,E
Lamoine Beach W. Co.	Lamoine	Blunt's Pond	None
Lewiston W. Dept.	Lewiston	Lake Auburn*	A,F
Limerick W. Dist.	Limerick	Springs & Well	A
Limestone W. & Sewer Dist.	Limestone	Silver Spring Brook, Limestone Stream (Aux.)	A,B,C,D,E
Lincoln W. Dist.	Lincoln	G. P. Wells	A
Lisbon W. Dept.	Lisbon Falls	G. P. Wells & Driven Wells	None
Livermore Falls W. Dist.	Livermore Falls	Moose Hill Pond	A
		Parker Pond (Aux.)	
		G. P. Well (Aux.)	None
Long Pond W. Co.	Sorrento	Long Pond	A
Lubec W. & E. Dist.	Lubec	Dug Wells, Driven Wells and Gravel Packed Wells	A
Lucerne W. Co.	Lucerne	Clear Lake	A

SOURCES OF SUPPLY OF MAINE WATER UTILITIES (continued)

NAME OF UTILITY	ADDRESS	SOURCE OF SUPPLY	FORM OF TREATMENT
Machias W. Co.	Machias	Gravel Packed Well	A,F
		Machias River (Aux.)	A,F
Madawaska W. Dist.	Madawaska	St. Johns River	A,B,C,D,E,F
		Martin Brook	A
Madison W. Dist.	Madison	Hancock Pond	A
Mars Hill & Blaine W. Co.	Mars Hill	Young Lake & Brook	A
Mechanic Falls W. Co.	Mechanic Falls	Range Brook	A,C
Mexico Water Dist.	Mexico	Wells & Brook	A,F
		Swift River	A,B,C,D,E,F
Milbridge W. Co.	Milbridge	Springs	None
Millinocket W. Co.	Millinocket	West Branch Penobscot River	A,B,C,D,E,F
Milo Water Dist.	Milo	Sebec River	A,C
Monhegan W. Co.	Monhegan	Driven Wells	A
Monson Water Dept.	Monson	Wells	None
Morrill W. Co.	Morrill	Driven Well	None
Moscow W. Dist.	Moscow	Purchase from Bingham W. Dist.	A
New Harbor Water Co.	New Harbor	Drilled Wells	None
Newport W. Co.	Newport	Lake Nokomis	A
New Sharon W. Co.	New Sharon	Drilled Wells	None
Norridgewock W. Dist.	Norridgewock	Gravel Pack Well	None
North Berwick W. Co.	North Berwick	Perkins Brook	A,C
North Haven W. System	North Haven	Fresh Pond	A,F
North Jay W. District	North Jay	Purchase from Wilton W. Co.	A
North Village W. Co.	North New Portland	Springs	None
North Yarmouth W. Dist.	North Yarmouth	Purchase from Portland W. Dist.	A,B
Northeast Harbor W. Co.	Northeast Harbor	Upper & Lower Hadlock Ponds	A,F
Northern Water Co.	East Millinocket	Gravel Packed Wells	A,F
Northport Mt. Spring W. Co.	Northport	Springs	None
Norway Water Dist.	Norway	G. P. Well	A,F
		Pennesseewassee Lake (Aux.)	A,B,F
Oakland W. Co.	Oakland	Messalonskee Lake	A
Old Town Water Dist.	Old Town	G. P. Wells	A,F,G

SOURCES OF SUPPLY OF MAINE WATER UTILITIES (continued)

NAME OF UTILITY	ADDRESS	SOURCE OF SUPPLY	FORM OF TREATMENT
Oxford W. Dist.	Oxford	G. P. Well	A
Paris Utility Dist.	South Paris	G. P. Well	None
Patten W. Dist.	Patten	Drilled Well	None
Penobscot W. Co.	Orono	G. P. Wells	A,F,G
		Chemo Lake (Aux.)	A,F
Phillips W. Co.	Phillips	Mt. Blue Pond	A
Pittsfield W. Works	Pittsfield	G. P. Well & Dug Wells (River)	A,F
Port Clyde Water Dist.	Port Clyde	Drilled Wells	A
Portland Water Dist.	Portland	Sebago Lake & Wells	A,B
Presque Isle W. Dist.	Presque Isle	Presque Isle Stream	A,B,C,D,E,F
Quantabacook W. Co.	Harrington	Spring	None
Rangeley W. Co.	Rangeley	Cascade S.	A
		Rangeley Lake (Aux.)	A
Richmond W. Works	Richmond	Gravel Packed Well	None
Rumford W. District	Rumford	Zircon Brook & G. P. Well	A,F
Sabbathday Lake W. Works	New Gloucester	Driven Well	None
Sandy Point W. Co.	Sandy Point	Well	None
Sanford W. District	Sanford	Driven Wells and G. P. Well	A,B,C
		Littlefield Pond (Aux.)	A
Sangerville W. Supply Co.	Sangerville	Purchase from Guilford W. Co.	A
Seal Cove W. Dist.	Seal Cove	Seal Cove Pond	A
Seal Harbor W. Co.	Seal Harbor	Jordan Pond	A,F
Searsmont W. Co.	Searsmont	Spring	None
Searsport W. District	Searsport	Half Moon Pond	A
Skowhegan W. Co.	Skowhegan	Pond & Brook	A,C,D
Small Point W. Co.	Small Point	Spinney Pond	A,C,E
Solon Water Dist.	Solon	G. P. Well	A
South Berwick W. Dist.	South Berwick	G. P. Wells	A
South Freeport W. Dist.	South Freeport	Spring	None
Southport W. System	Southport	Sawyer Pond	A
Southwest Harbor W. Co.	Southwest Harbor	Long Pond	A,F
Starks W. Dist.	Starks	Well & Spring	None

SOURCES OF SUPPLY OF MAINE WATER UTILITIES (continued)

NAME OF UTILITY	ADDRESS	SOURCE OF SUPPLY	FORM OF TREATMENT
Stonington W. Co.	Stonington	Burnt Land Pond	A
Stratton Water Co.	Stratton	Gravel Packed Wells & Brook (Aux.)	A
Strong W. Dist.	Strong	Day Mountain Pond	A
Sugarloaf Mtn. Corp.	Crockertown	Brackett Brook	A
Sullivan Harbor W. Co.	East Sullivan	Long Pond	None
Van Buren W. Dist.	Van Buren	Violette Brook	A,F
Vinalhaven W. Co.	Vinalhaven	Round Pond	A
Waldoboro Water Co.	Waldoboro	Quarry	A
		Drilled Wells & G. P. Well & Brook (Aux.)	A,B
Washburn W. Co.	Washburn	G. P. Well	A,F
Webster W. Dist.	Sabatus	Gravel Packed Well	A
Weeks Mills W. System	Weeks Mills	Springs	A
West Paris W. Dept.	West Paris	Gravel Packed Wells	A
West Side Aqueduct Co.	Cherryfield	Spring	None
West Skowhegan Aqueduct Co.	Skowhegan	Spring	None
Wilton Water Co.	Wilton	Varnum Pond	A
Winter Harbor W. Co.	Winter Harbor	Birch Harbor Pond	A
Winterport W. Dist.	Winterport	Lowes Brook & Wells	A,C
Winthrop Water Dist.	Winthrop	Upper Narrows Pond	A
Wiscasset Water Co.	Wiscasset	Wards Brook & Wells	A,C
Woodland W. & E. Co.	Woodland	G. P. Well	F
Yarmouth W. Dist.	Yarmouth	Gravel Packed Wells	None
York Water Dist.	York	Chases Pond*	A,B

* Indicates that supply is partly or fully closed to fishing.

A — Chlorination
B — Other Chemical
C — Filtration
D — Coagulation
E — Sedimentation
F — Fluoridation
G — Removal Plant

TABLE 16 *SUMMARY OF AGENCY STANDARDS FOR WATER QUALITY FOR HUMAN CONSUMPTION*

CHEMICAL & PHYSICAL CHARACTERISTICS OF POTABLE WATER

	U.S. ENVIRONMENTAL PROTECTION AGENCY STANDARDS				MAINE DEPT. OF HEALTH & WELFARE		AMERICAN WATER WORKS ASSOCIATION
	1962		1973 Proposed Standards		1973		
Substance or Factor	Recommended Limits mg/l	Tolerance Limits mg/l	Esthetic Limits mg/l	Health Limits mg/l	Design Goals mg/l	Maximum Limits mg/l	Ideal Water Quality mg/l
CHEMICAL							
Alkyl Benzene Sulfonate	0.5						0.2
Aluminum							0.05
Arsenic	0.01	0.05		0.1	0-0.01	0.01	0.01
Barium (as salts)		1.0		1.0	0-0.05	1.0	0.5
Cadmium		0.01		0.01	0-0.005	0.01	0.01
Chloride	250.0		250.0		50.0	100.0	
Chromium		0.05		0.05	0-0.025	0.05	0.01
Copper	1.0		1.0		0-0.5	1.0	0.2
Cyanide	0.01	0.2		0.2	0-0.01	0.01	0.01
Fluoride	0.6-1.7		0.6-1.7	1.4-2.4	1.2	2.0	Inversely variable to temperature
Iron	0.3		0.3		0.10	0.3	0.05
Lead		0.05		0.05	0.025	0.05	0.03
Manganese	0.05		0.05		0.025	0.05	0.01
Methylene Blue Active Substances					0.25	0.5	
Mercury				0.002	0-0.0025	0.005	
Nitrate (as NO_3)	45.0			45.0	2.5	5.0	5.0 (N)
Nitrite					0.0	1.0	
Organic-Carbon Adsorbable							
CCE	0.2			0.7	0-0.15	0.3	0.04
CAE				3.0	0-0.75	1.5	0.10
Phenols	0.001				0-0.0005	0.001	0.0005
Selenium		0.01		0.01	0-0.005	0.01	0.01
Silver		0.05		0.05	0-0.025	0.05	0.02
Sodium					50.0	100.0	
Sulfate	250.0		250.0		50.0	100.0	
Zinc	5.0		5.0		2.0	5.0	1.0

SUMMARY OF AGENCY STANDARDS FOR WATER QUALITY FOR HUMAN CONSUMPTION (continued)

CHEMICAL & PHYSICAL CHARACTERISTICS OF POTABLE WATER

	U.S. ENVIRONMENTAL PROTECTION AGENCY STANDARDS				MAINE DEPT. OF HEALTH & WELFARE		AMERICAN WATER WORKS ASSOCIATION
	1962	1973 Proposed Standards			1973		
Substance or Factor *	Recommended Limits mg/l	Tolerance Limits mg/l	Esthetic Limits mg/l	Health Limits mg/l	Design Goals mg/l	Maximum Limits mg/l	Ideal Water Quality mg/l
PHYSICAL							
Turbidity	5.0*			1.0*	0-1*	5*	less than 0.1
Non-Filterable Residue							0.1
Nuisance Organisms							none
Color	15.0*		15.0		0-10*	15*	3.0*
Odor (T.O. No.)	3.0*		3.0*		0-2*	3*	no change on carbon contact
Taste					none	none	none
Hardness as $CaCO_3$							80.0
Coliform							1.0 per litre
Filterable Residue							200.0
Foaming Agents			0.5				
Dissolved Solids	500.0				75.0-150.0	150	
pH					minimum corrosion	10.0*	
RADIOACTIVE							
Radon 222 and daughters						15,000 UUC/l)	
Gross beta						1,000 UUC/l) Pico curies	
Radium 226						3 UUC/l) per litre	
Strontium 90						10 UUC/l)	

Note: All figures are maximum concentrations in ideal water.

* Units

SUMMARY OF AGENCY STANDARDS FOR WATER QUALITY FOR HUMAN CONSUMPTION (continued)

CHEMICALS & PHYSICAL CHARACTERISTICS OF POTABLE WATER

	U.S. ENVIRONMENTAL PROTECTION AGENCY STANDARDS				MAINE DEPT. OF HEALTH & WELFARE		AMERICAN WATER WORKS ASSOCIATION
	1962	1973 Proposed Standards			1973		
Substance or Factor	Recommended Limits mg/l	Tolerance Limits mg/l	Esthetic Limits mg/l	Health Limits mg/l	Design Goals mg/l	Maximum Limits mg/l	Ideal Water Quality mg/l
PESTICIDES							
Aldrin		0.017		0.001			
Chlordane		0.003		0.003*			
DDT		0.042		0.05			
Dieldrin		0.017		0.001			
Endrin		0.001		0.0005			
Heptachlor		0.018		0.0001			
Heptachlor Epoxide		0.018		0.0001			
Lindane		0.056		0.005			
Methoxychlor		0.035		1.0			
Toxaphene		0.005		0.005*			

*Limits selected on the basis of odor, toxic limits are similar

TABLE 17 *WATER STORAGE SUMMARY, MAINE*

* Water Resources Data for Maine 1973, US Geological Survey. pp. 33-35
**Power project as well as storage

Basin River	Existing Reservoir	Storage in Acre Feet NENYIAC 1950	Storage in Acre Feet USGS 1973*	Proposed Projects NENYIAC NAME	Proposed Projects NENYIAC Storage in A/FT	Present Monthly Minimum Flow or Safe Yield (cfs)	New Flow With Storage Projects (cfs)
ST. JOHN							
Aroostook	Millinocket Lake	23,100	25,500	Masardis	535,000		1,500
	Squapan Lake	58,600	66,400				
St. John		81,700	91,900	Dickey	7,700,000		4,100
Fish				Fish River Lake	124,000		
				St. Froid	115,000		
				Fish River (P)**	65,000		787
					8,539,000		
Madawaska	Temiscouata	105,000					
Green	First Lake	17.000					
Tobique	Sisson Branch	97,000					
	Trousers Lake	36,600					
	Long Lake	28,300					
	Serpentine Lake	25,600					
		309,500					
Basin Totals		391,200	91,900		8,539,000		
ST. CROIX							
St. Croix			303,000				
	Spednic Lake	202,000				573 Baileyville	
	East Grand	100,000				605 Calais	
Grand Falls							
	Grand Falls	86,000	82,000				
	West Grand	157,000	190,000				
	Sysladobsis Lake	31,800					
	Other	15,650					
Basin Totals		592,450	575,000				

WATER STORAGE SUMMARY, MAINE

Basin River	Existing Reservoir	Storage in Acre Feet NENYIAC 1950	Storage in Acre Feet USGS 1973*	Proposed Projects NENYIAC NAME	Proposed Projects NENYIAC Storage in A/FT	Present Monthly Minimum Flow or Safe Yield (cfs)	New Flow With Storage Projects (cfs)
PENOBSCOT							
West Branch	Upstream Lakes	229,600	27,600				7,00 West Enfield
	Chesuncook Lake	688,700	689,000				
	Millinocket Lake	45,900					
	Pemadumcook Lake	344,300	345,000				
		1,308,500					
East Branch	Chamberlain Telos	105,600	116,000				
	Grand Lakes	41,300	41,000	Grand Lakes	48,200		
		146,900		Sawtelle (P)	92,400		
				Allagash	32,500		
				Whetstone (P)	255,000		
					428,100		
Piscataquis	Sebec Lake	45,900	57,700				
	All Other Lakes	68,700		Bonnie Brook (P)	57,400		
		114,600					
Mattawamkeag				Stratton Rips (P)	863,000		
Basin Totals		1,570,000	1,276,300		1,348,500		
KENNEBEC						1,500	3,070
Upper	Brassua Lake	196,510	196,000				
Kennebec	Second Roach Lake	4,960					
Basin	First Roach Lake	21,530	22,000				
	Moosehead Lake	544,770	547,000				
	Moxie Pond	14,690	10,000				
	Flagstaff Lake	275,480	277,000				
	Dead River Pond	5,160					
	Spencer Lake	14,670					
	Wyman Pond	60,380	60,500				
	Indian Pond		22,000				
				Grand Falls	207,070		
				Pierce Pond	10,000		
		1,138,150	1,134,500		217,070		

Basin River	Existing Reservoir	Storage in Acre Feet NENYIAC 1950	USGS 1973*	Proposed Projects NENYIAC NAME	Storage in A/FT	Present Monthly Minimum Flow or Safe Yield (cfs)	New Flow With Storage Projects (cfs)
Sebasticook	Plymouth Pond	9,040					
	Great Moose	23,990					
	Sebasticook Lake	20,800					
		53,830	54,000				
Messalonskee	Upper Lakes	11,710					
	Great Pond	22,270					
	Long Pond	5,370					
	Messalonskee Lake	32,500					
		71,850					
Sandy River				Greenleaf	100,000		
Basin Totals		1,263,830	1,188,500		317,070		
ANDROSCOGGIN						1,315 Gorham	1,973 Gorham
Upper Lakes	Kennebago Lake	16,660					
	Rangeley Lake	30,800	30,800				
	Mooselookmeguntic	191,900	192,000				
	Richardson Lakes	130,600	131,000				
	Aziscohos Lake	218,300	220,000				
	Umbagog Lake	72,300	71,000	Umbagog Lake	+182,700		
		660,560	644,800				
Androscoggin	Gulf Island Pond	25,300	25,300				
Little Androscoggin	Pennesseewassee L.	4,400					
	Thompson Lake	21,800	21,800				
	Lake Auburn	13,300	13,300				
		39,500	35,100				
Basin Totals		725,360	705,200		182,700		
						255 Great Falls	1,050 Great Falls

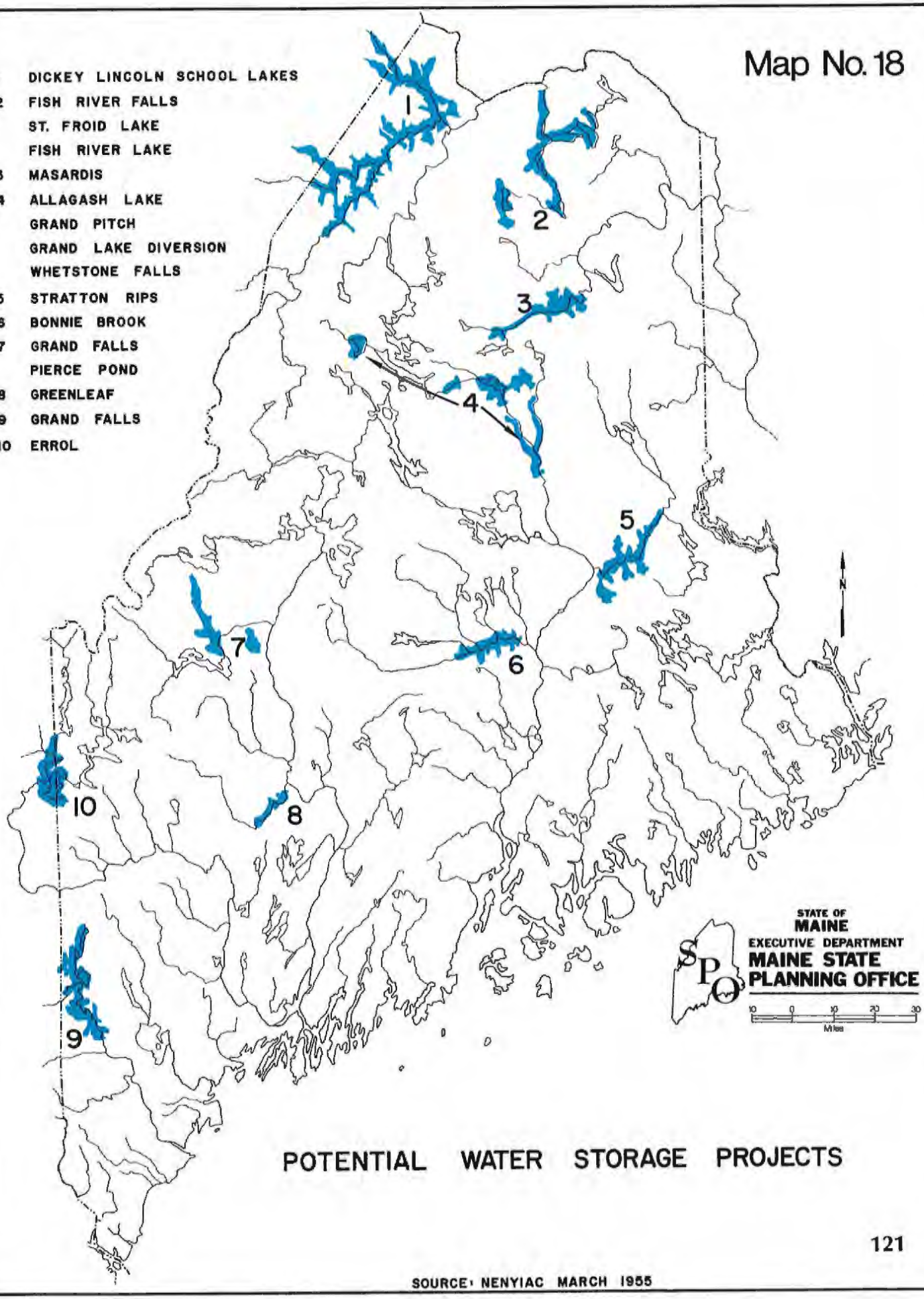
Basin River	Existing Reservoir	Storage in Acre Feet NENYIAC 1950	USGS 1973*	Proposed Projects NENYIAC NAME	Storage in A/FT	Present Monthly Minimum Flow or Safe Yield (cfs)	New Flow With Storage Projects (cfs)
SACO							
Upper Basin	Conway Lake	11,480				450 Saco	
	Kezar Lake	8,800					
	Moose Pond	16,300					
	Hancock Pond	3,900		Great Falls (P)	275,000		
		40,480	41,400				
Ossipee R.	Silver Lake	3,350					
	Pine River Pond	6,500					
	Ossipee Lake	23,050					
	Bickford Pond	1,630					
	Colcord Pond	2,180					
		36,710	36,700				
Little Ossipee	Balch Pond	5,490					
	Little Ossipee Pond	2,590					
	Ledgemere	5,280					
		13,360	13,460				
Other	Watchic Pond	2,140					
Basin Totals		92,690	91,560		275,000		
PRESUMPSCOT							
	Sebago Lake	222,670					
	Crystal Lake	3,740					
	Highland Lake	10,580					
	Long Lake	29,940					
	Pleasant & Parker Lakes	6,140					
	Thomas Pond	3,090					
	Crescent & Panther Pond	9,300					
		285,460	253,000 (Sebago & Long Lakes only)				
Basin Totals		285,460	253,000				

WATER STORAGE SUMMARY, MAINE

Basin River	Existing Reservoir	Storage in Acre Feet NENYIAC 1950	Storage in Acre Feet USGS 1973*	Proposed Projects NENYIAC NAME	Proposed Projects NENYIAC Storage in A/FT	Present Monthly Minimum Flow or Safe Yield (cfs)	New Flow With Storage Projects (cfs)
PISCATAQUA							
Salmon Falls	Great East Lake	11,800				50	
	Horne Pond	1,100					
	Wilson Pond	500					
	Milton Pond	13,300					
	Lovell Pond	2,600					
		29,300	29,400				
Lamprey R.	Mendums	3,500					
	Pawtuckaway Pond	9,400					
		12,900					
Basin Totals		42,200	29,400				
COASTAL							
Union River	Graham Lake	149,220					
	Green Lake	18,370					
	Branch Lake	16,070					
		183,660					
Machias R.	Third Machias Lake	22,900		Upper Holmes Falls (P)	154,300	52	452
East Machias R.	Crawford L.	15,300					
	Gardner Lake	27 550					
		42,850					
Megunticook	Megunticook Lake	7,650					
Damariscotta	Damariscotta Lake	21,700					
Mousam	Mousam Lake	9,450					
	Estes Lake	5,350	16,000				
		44,150					
Coastal Totals		293,560	16,000		154,300		

Map No. 18

1 DICKEY LINCOLN SCHOOL LAKES
2 FISH RIVER FALLS
ST. FROID LAKE
FISH RIVER LAKE
3 MASARDIS
4 ALLAGASH LAKE
GRAND PITCH
GRAND LAKE DIVERSION
WHETSTONE FALLS
5 STRATTON RIPS
6 BONNIE BROOK
7 GRAND FALLS
PIERCE POND
8 GREENLEAF
9 GRAND FALLS
10 ERROL



STATE OF
MAINE
EXECUTIVE DEPARTMENT
MAINE STATE
PLANNING OFFICE

10 0 10 20 30
Miles

POTENTIAL WATER STORAGE PROJECTS

SOURCE: NENYIAC MARCH 1955

Tom Jones/Maine Times

C. Water Quality

While the subject area of water quality is not as important as water supply, within the definition of water resources, the state of the art in depicting and resolving water quality problems is the more highly developed in Maine and the nation as a whole. The obvious degradation of the major rivers through municipal and industrial point source waste loads is amenable to engineering solutions and hardly requires forerunner comprehensive water resources plans to help bring about drastic improvement in river water quality. Yet as the Maine programs continue they would benefit from the completion of comprehensive water resources plans. And, indeed, the future beyond the cleanup period may introduce an element of unforeseen demand for use of cleaned-up riverways, further showing a need for comprehensive planning. Map 19 depicts the status of planning and facility construction statewide for municipal wastewater pollution abatement facilities. Map 20 indicates the locations of the water quality measurement stations.

In some circles it is apparently believed that attention to water quality and environmental protection in general began in 1970, possibly with the observance of Earth Day in April of that year. This is not the case, of course, and undoubtedly competent observers could cite mandates for environmental protection even from ancient times. The efforts toward conservation of natural resources and the establishment of the National Park System early in this century should be familiar to everyone. The smoke abatement measures in Saint Louis during the 1930's and in Pittsburgh during the 1940's are also noteworthy examples. Like many other subjects of concern, environmental protection receives attention constantly by those authorized in the matter, while general public attention rises and falls in cyclical fashion, although given the appearance on each rise by certain spokesmen as an entirely new happening. The work on environmental protection proceeded steadily from the early part of this century giving rise to a general belief that the situation was generally under control. But there were three general factors that contributed significantly to a recent basic reappraisal of efforts to achieve and maintain environmental quality.

1. The introduction of organic pesticides shortly after World War II promised a great age as research specialists responsible for these introductions gave public assurance that they were harmless to mammals in the dilute quantities used and also that their success in the field depended in part upon their stability. There was at the time not the slightest hint about side effects and permanent damage to other life in treated areas or that these materials could build up in concentration through food chains in the higher forms of life and cause detrimental effects or that certain decomposition products of these pesticides were highly toxic to living things. Later while there were many scientists developing information about the harmful effects of pesticide usage previously determined to be safe and who published warnings voluminously, it remained for Rachael Carson to bring the matter to general public attention with her book "Silent Spring".

2. Atmospheric testing of nuclear weapons in the 1940's to 1963 scattered radioactive materials over the planet. Since information was being compiled during that time that uncontrolled radiation was harmful to life, public attitude was voiced worldwide that such testing should stop. That an international treaty has been put into effect banning atmospheric nuclear explosions attests to this widespread belief.

3. The rapid increases in population and development and rising technology in themselves brought about environmental degradation through sheer magnitude and disabused the public of belief that what pollution there was could be safely assimilated. As a result there is established without dispute a principle of absolute pollution which states that continued release of certain materials into the air, land and water will result in permanent environmental degradation and eventually render the planet uninhabitable.

These three factors essentially ushered in the modern age of environmental protection, and it is clear that measures to achieve it have general widespread public support. The holding of the Environmental Congress in Stockholm in 1972 has revealed the world-wide scope of this pressing matter. Of national significance to environmental awareness and the need for protection was passage of the National Environmental Policy Act in 1969 (Public Law 91-190) which authorizes and directs Federal agencies in the decision-making process to give appropriate consideration to environmental amenities and values, along with technical considerations. The results of this analysis are to be included in proposals for Federal action. This is the law which called for the writing of Environmental Impact Statements. Another far-reaching response to the need for environmental protection was enactment of the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500. This Act establishes goals that

(1) the discharge of pollutants into navigable waters be eliminated by 1985.

(2) an interim goal of water quality be provided for the protection of fish, shellfish and wildlife, and for recreation by July 1, 1983.

(3) the discharge of toxic pollutants in toxic amounts be prohibited.

(4) Federal financial assistance be provided to construct publicly owned waste treatment plants.

(5) water quality and areawide waste treatment management planning include multiobjective water resources and land use planning.

(6) regional or river basin (Level B) plans be completed by the Water Resources Council for all river basins in the United States by 1980 (Section 209).

(7) a major research and demonstration effort be made to develop technology to eliminate the discharge of pollutants.

In Maine public attention to soil erosion dates well back into the early 1900's and was increased markedly in 1941 with the passage of Maine Soil Conservation District enabling legislation. The Maine Soil and Water Conservation Commission and Maine's sixteen Soil and Water Conservation Districts have developed comprehensive programs to control erosion and limit sediment in Maine's waters. These programs are directed at individuals, groups, and units of government with agriculture, forestry, recreation, wildlife, urban and industrial land use interests. Program activities have been limited by funds, but the thousands of acres under soil and water conservation management are testimonial to the success of these Soil and Water Conservation District programs.

Attention to water quality began formally in 1941 with creation of the State Sanitary Water Board to bring about abatement of industrial pollution of the Androscoggin River. Concentration remained focused upon rivers, whose water quality contrasted sharply with the remainder of Maine's environment. The State Legislature enacted a general program during the 1960's designed to abate water pollution from industrial and municipal sources through installation of appropriate treatment plants for wastewater. The agency responsible has undergone many changes, but during recent years changes have accelerated as Federal funding, improved legislative appropriations and governmental reorganization have combined to create a cabinet level Department of Environmental Protection which has expanded its scope from attention to river pollution to that of lakes, estuaries, territorial ocean, air and land.

POINT SOURCE POLLUTION

Abatement programs for point source pollution of all types are well underway for completion by October, 1976, according to recent information from the Department. Most of the industrial plants are on schedule for meeting this deadline, and the Department is presently processing hundreds of applications for waste discharge by private homeowners who had never installed appropriate underground disposal systems. The primary source of delay will be inadequate funding to municipalities for construction of sewage treatment plants from Federal sources, which have been stretched through delayed appropriation and impoundment of appropriations made. Nevertheless, the program shows every sign of succeeding in its primary mission to reduce drastically this type of pollution into Maine's waterways and adjacent ocean. However, there is evidence that it will not be as cost-effective as it might be, a direct result of launching into an engineering program before accomplishment of comprehensive water resources planning for river basins.

By way of general background, listed below are several alternative policy frameworks available that can be brought to bear in achieving water pollution abatement. Sometimes they operate singly or in combination, and sometimes a shift from one to another is deemed desirable or mandated by law.

1. Water Quality Standards. Under this approach the natural waters of a region or state are classified differentially according to their present conditions or level of quality desired or proposed. It is known that upstream lakes or streams would be normally of good quality and that lower reaches of main stem rivers would be of poor quality. Classification would take this into account and seek to place activities to match water quality goals. Industries would continue to operate along main rivers through installation of wastewater treatment facilities suitable to maintain the legal classification. Maine began this approach in its program to undertake water pollution abatement during the 1960's, and passage of the Federal Water Quality Act of 1965 stimulated final resolution of this approach, calling for standards to be adopted by states and approved by the Federal government. In 1967, based upon much field work by the Water Improvement Commission, the Legislature enacted a detailed classification system of the State's waters, the now familiar A, B, C, D levels for inland waters and SA, SB, SC and SD for tidal waters. According to the program, the Commission (now the Department of Environmental Protection) was assigned to identify all point sources of pollution, determine the level of abatement at each source needed to bring receiving waters up to classification levels, inform polluters and receive, review, and accept their plans and oversee construction of abatement facilities, all generally to be in operation on or before October 1, 1976.

2. Effluent Standards. This approach calls for water quality standards in wastewaters to be discharged. By setting uniformly high standards, receiving waters are not polluted and no allowance is made for assimilation of wastes in such waters downstream from point sources. This is the thrust of the Federal Water Pollution Control Act Amendments enacted in October, 1972 and it augments the present State program of water quality standards. The Act sets an ambitious goal of zero pollution or the use of effluent standards to match receiving waters by 1985. As an interim goal all waters are to be of sufficient quality for contact recreation by 1983.

3. Effluent Charges. This system exacts a payment by polluters to discharge wastewater into natural waterways in proportion to the volume of wastewater and the amount of polluting materials discharged. It is intended to provide an incentive to polluters to construct treatment facilities to qualify for a reduction in charges greater than costs of treatment. Income received by a state or regional governing body is to be used to carry out further pollution abatement in the receiving waterways. Under conditions of heavy industrial concentrations the point sources, although under treatment, will in aggregate pollute receiving waters to a significant degree. In this case charges levied can be used to construct and operate treatment facilities for the entire receiving waters and send good water downstream. In Maine conditions are such that treatment of individual point sources is likely to achieve water quality goals, rendering the concept of charges impractical in our present state of relatively light development. The Federal Water Pollution Control Act Amendments of 1972 in effect knocks out application of this concept as well since effluents must not pollute receiving waters.

4. Basin Water Quality Management. This approach applies essentially the concept of water quality standards to specific river basins in order to find the best pathways toward water quality goals. In determining the amount of pollution in the wastewater of any point source, the regulating authority must estimate the effects a range of loads will have upon receiving waters and select a load value that will not degrade the downstream reach of receiving water below the legal classification. This assimilative capacity of flowing water to reduce the pollution load by natural means is considered in estimating a permissible load from a point source. Armchair generalizations are insufficient for making this range of estimation, and field work to characterize each receiving water is necessary for best results. Field work was indeed carried out by the staff of the Water Improvement Commission during the 1950-1965 period to determine the differential classification of Maine's waterways subsequently adopted. Such work was limited by partial lack of knowledge about reduction of loads that would be put into effect. The higher standards imposed by the Federal Water Pollution Control Act Amendments of 1972 have mitigated the value of this field work, and a more adaptible approach is needed to cope with, among other things, a seemingly constant series of changes in requirements by regulatory authorities. For a partial remedy to the problem the State Planning Office financed a University of Maine research team to develop a model program for water quality management for the lower Penobscot River, which could be expanded and applied to other basins. Their report[1] was published recently, and the Department of Environmental Protection is considering further financing to this research group with the goal of establishing an improved method to measure water pollution and devise appropriate management programs to achieve water quality goals at least cost. Data from this study are reproduced in a summary report[2] prepared by the Penobscot River Study Team. This report forms the basis for a critical evaluation of the present program to abate water pollution using the effluent standards method. The data indicate that greatly diminishing returns would be encountered in the installation of secondary treatment for point sources of pollution. There would be only a slight improvement in river water quality gained by doubling the capital expended for construction of the secondary treatment plants. The Study Team believes that these data speak well for use of the basin water quality management approach and suggests strongly its adoption for the lower Penobscot River.

NON-POINT SOURCE POLLUTION

The other aspect of water quality is pollution from non-point sources. This means of lowering water quality is usually insidious since pollutants, either man-made or natural, can enter waterways in such a diffuse manner as to be virtually incapable of detection and measurement. Non-point source pollution has not been recognized as a problem for resolution until recent times, and clearly mandated Legislative jurisdiction to the Department of Environmental Protection to devise remedial programs did not come about until the 1972-1974 period.

[1] Development of a Water Quality Management Program for the Lower Penobscot River and Estuary. 1974. Franklin E. Woodard, Herman C. Sylvester and John A. Foster. University of Maine.

[2] Penobscot Policy Choices. 1974. The Penobscot River Study Team, Richard Harvey et al. Environmental Studies Center, University of Maine.

Most non-point pollution is an acceleration of natural processes through land use activities. Land disturbance for agriculture, recreation, urban, industry, commerce, wildlife, and forestry and management of these areas has in many instances increased sediment load, dissolved minerals and organic matter into adjacent waterways. The Soil and Water Conservation District program has helped to reduce water pollution. In Maine thousands of landowners, groups and units of government have received technical assistance from districts to protect and improve land. Yet, a great deal more could be done as is readily apparent from field observation of sheet erosion on wide, open fields plowed up and down slopes, eroding banks on streams, construction cuts and fills and the washing away of churned up soil resulting from forest harvest operations. Many land disturbances, such as the construction of large buildings, results in hundreds of tons of soil loss per acre. The problem of soil erosion has not gained much attention by Maine residents. Soil erosion can be controlled with proper planning that includes directing development onto suitable soils, limiting the exposure of bare soil to a minimum amount of time, control runoff water on the disturbed area, and trap sediment before it leaves the area.

It was not until several major lakes in Maine began to show symtoms of accelerating eutrophication several years ago that public attention turned to non-point source pollution. While it turned out that the worst instances were due to point source pollution from industrial operations or discharge of collected sewage in municipalities or due to an aggregation of many small wastewater discharges from homes and cottages along shorefronts, on other lakes settlement and land use practices on watershed land were causing eutrophication through increased sediment loading. In midwestern states extensive crop agriculture on lake watersheds induced rapid eutrophication and even filled lakes in entirely converting them to new farmland within a fifty year span. But these events apparently went unnoticed here; only when eutrophication occurred here did public awareness of the matter of non-point source pollution develop.

The 106th Legislature authorized and appropriated funds to the Department of Environmental Protection to head up a program of water quality management of lakes and ponds undertaken by the Department and other agencies. While point sources of pollution are to be noted, study is to be broadened to include non-point pollution in order to prevent, arrest or reverse eutrophication of Maine lakes and ponds.

That some lakes in Maine and many others across the nation have undergone rapid eutrophication because of settlement on watershed land indicates that these relatively still water bodies have a lower capacity to assimilate inflow of sediment, mineral elements and organic matter. To make appropriate quantitative determination of such capacity requires intensive study of each lake and many variable factors to gain an understanding of lake-land relationships. There are reports on some of the problem lakes in Maine that

illustrate the complexity of the problem and the data required to initiate proper management programs. The Lakes Project of the Department of Environmental Protection will complete an inventory of known information, study preliminary findings and proceed with further research and begin or continue water quality management activities as conditions warrant.

In July of 1974, a three-year cooperative lake studies project was initiated with the Water Resources Division of the U.S. Geological Survey. A total of 43 lakes will be studied with the following objectives:

1. To gather baseline data on a large number of Maine lakes.

2. To evaluate water quality sampling methods, frequencies, and parameters for use on Maine lakes.

3. To assist in the development of guidelines for long range planning to assess Maine's water resources with respect to lakes.

4. To determine the accuracy of any lake classification scheme that may be assigned to Maine lakes.

5. To assist in the determination of the impact of shoreline development on Maine lakes.

Project data collection to fulfill these objectives will be of two types, water quality surveys and hydrologic characterization of lake environments. Results of the water quality analysis will be published in the annual data report series of the U.S. Geological Survey. Final project results and evaluations will be published in the Water Resources Investigation Series of the U.S. Geological Survey.

It seems clear that there will be increased attention to control land use practices on lake watershed lands in the future as an important device to meet water quality goals. For the obvious wastewater problem brought about by community settlement along lake shores special attention will be required to minimize this wastewater load, for it would appear that many lakes cannot assimilate the load from a surrounding ring of homes and cottages and community centers even if proper methods of underground disposal are used. And the collection, treatment and discharge of wastewater from such centers might introduce a source of pollution where none existed despite advanced degrees of treatment. The Lakes Project group is fortunate to have Haley Pond in Rangeley for demonstration to determine if tertiary treatment of sewage collected from Rangeley center will in fact arrest or reverse eutrophication now going on in this pond. It will be possible to compare pond characteristics before and after installation of this facility. While the Rangeley situation will be watched carefully, there is the possibility that other towns such as Harrison and Bridgton may have to adopt other means of sewage disposal such as

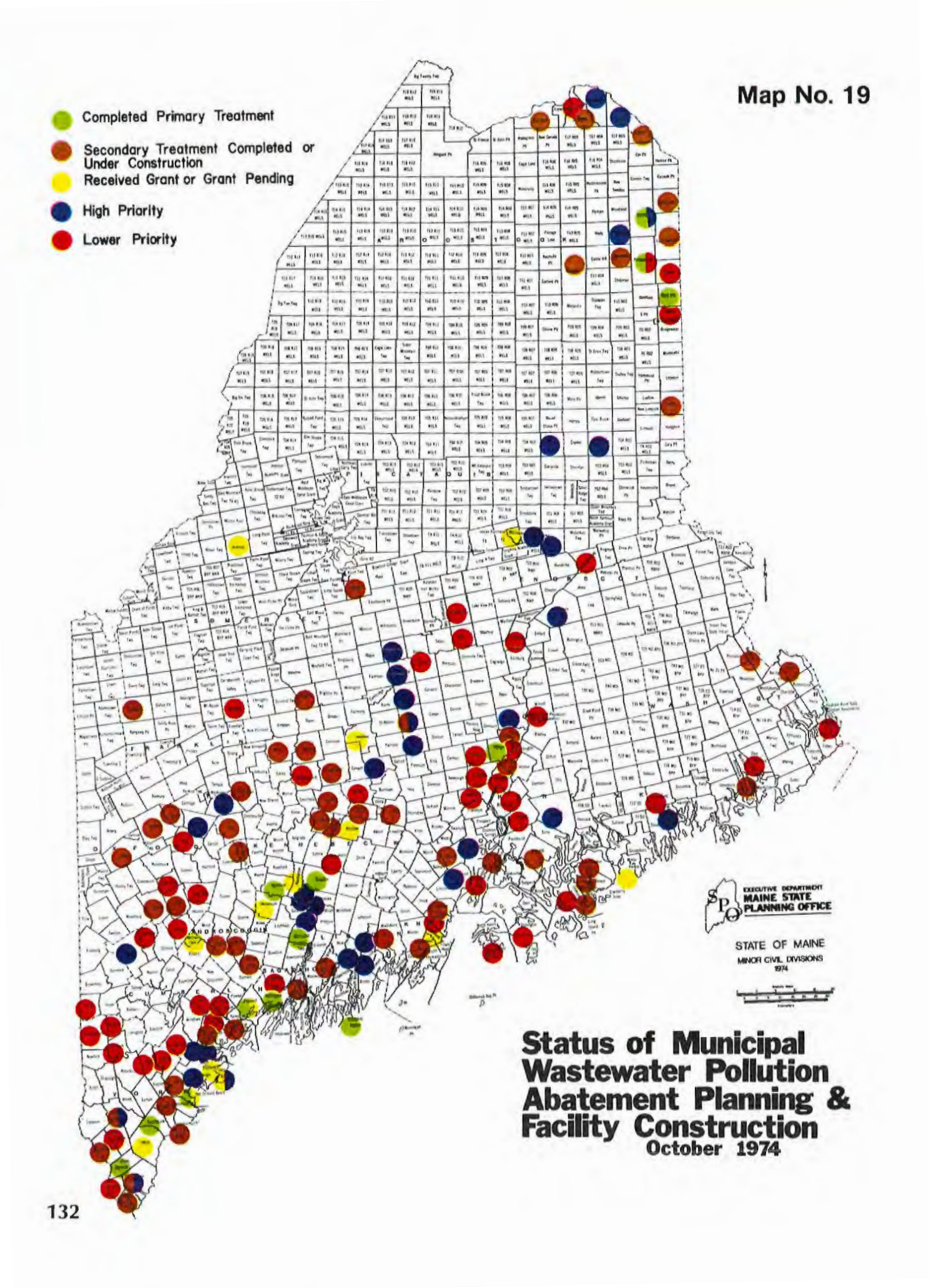
piping it away as Winthrop did, or make land disposal at a site well away from the lake shore.

Appropriate studies to frame good management programs for Maine lakes and ponds will ultimately be rather costly, but preventive meaures resulting from these studies and management programs will be far less costly than restorative programs to reverse eutrophication, some of which would likely be unsuccessful regardless of cost and effort.

Lucy Martin/Maine Times

Lucy Martin/Maine Times

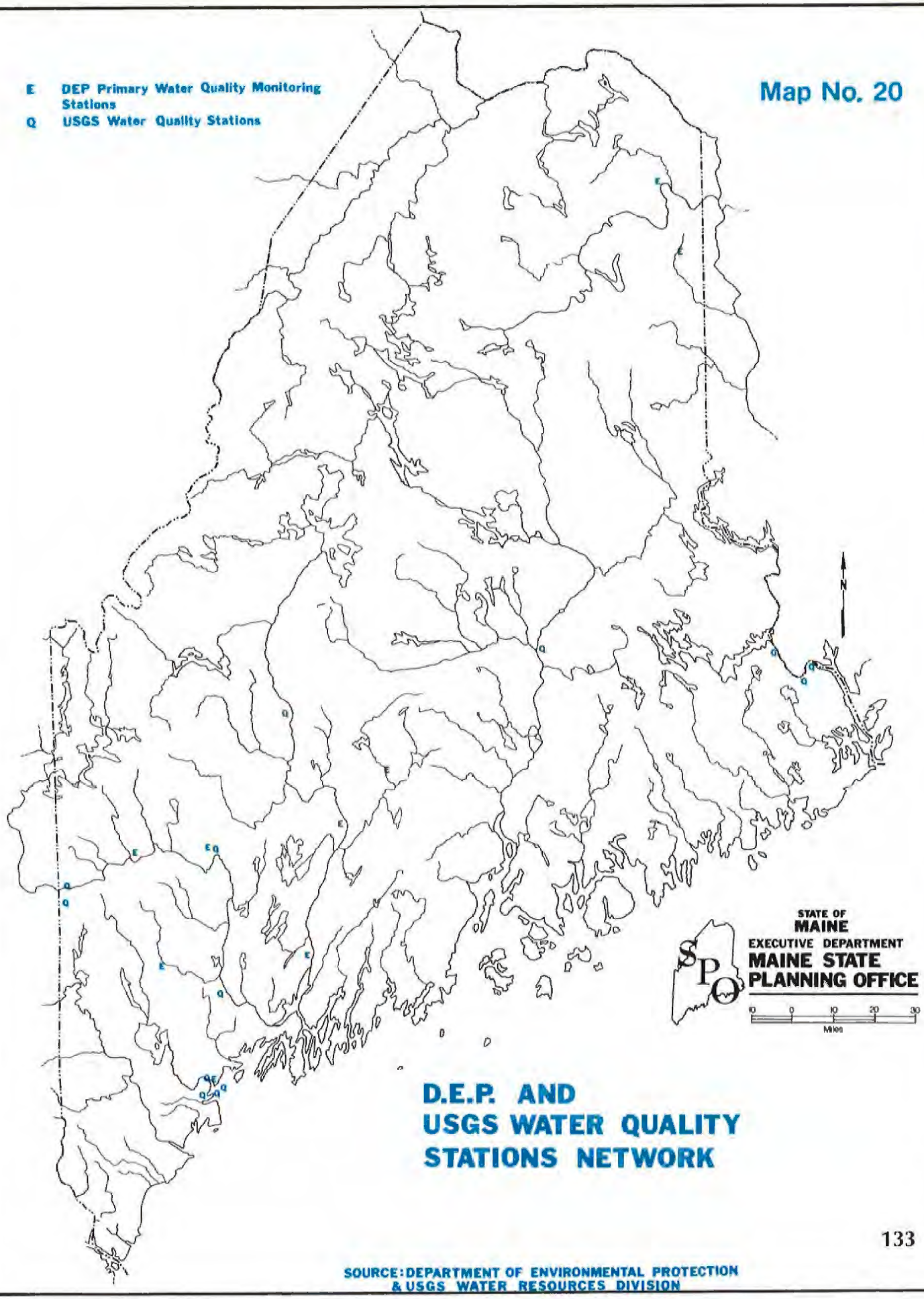
Tom Jones/Maine Times


Map No. 19
Completed Primary Treatment
Secondary Treatment Completed or Under Construction
Received Grant or Grant Pending
High Priority
Lower Priority
EXECUTIVE DEPARTMENT
MAINE STATE PLANNING OFFICE
STATE OF MAINE
MINOR CIVIL DIVISIONS
1974
Status of Municipal Wastewater Pollution Abatement Planning & Facility Construction
October 1974

E DEP Primary Water Quality Monitoring Stations

Q USGS Water Quality Stations

Map No. 20



D.E.P. AND USGS WATER QUALITY STATIONS NETWORK

SOURCE: DEPARTMENT OF ENVIRONMENTAL PROTECTION & USGS WATER RESOURCES DIVISION

Tom Jones/Maine Times

D. Floods

FLOOD OCCURRENCE IN MAINE

Hydrologists usually refer to "streamflow rates of low percentage frequency" what most people call "floods", the latter making a judgment on high flow rates by use of a word that carries negative connotations. Floods are associated with loss of life, personal injury, and the damage they can cause to the land being flooded and to property located there. A flood is defined as a temporary inundation of land by water through natural means or failure of man-made devices that release water upon these lands. The most frequent type of flooding is caused by natural high rates of flow in rivers and streams that raise stream levels with water spilling on to streambank land. Such high flow rates are accompanied by strong currents which may cause damage through flow action or carry large floating objects such as ice, logs, buildings or fuel tanks which can batter structures along the streambanks. In Maine the ocean floods certain coastal lands infrequently and causes damage to shore property. The areas flooded comprise only a small fraction of the State's land, but it is that land interfacing with water - the most significantly developed and potentially useful land - which makes the matter of flooding one of concern.

There have been a number of historic floods that have caused extensive damage to property and loss of life in Maine. From records of floods that occurred in colonial times it is difficult to ascertain real damages and compare magnitudes with more recent floods. The flood in the spring of 1936 still stands in the memory of many as the greatest flood for much of Maine and the New England area generally. Warm, heavy rains rapidly melted a fairly heavy snowpack and caused very high flow rates. Although the 1936 flood is not the "flood of record" (the highest flow ever measured) for most stations, it did cause the most damage in Maine, especially in central and southern basins. Loss of property was estimated at $8 million throughout the State. In 1923 and 1953 there were similar spring floods causing damage along river fronts. In 1972 Hurricane Agnes caused record floods and great damage in New York and Pennsylvania while Maine escaped damage through light rainfall. In December, 1969 and 1973, prolonged rains caused considerable flood damage in southern Maine, while in the spring seasons of 1973 and 1974 the Fort Kent area sustained considerable damage through flooding from high flow rates and ice jamming of the Saint John River. Average annual damages from flooding have been estimated to be approximately $2 million in Maine using 1966 as a base year.

While flood damages and suffering in Maine are acute to the people subjected to them, their magnitude is slight in comparison with flood damages in the Mississippi River Basin or in the great river valleys in Asia. The great floods in the middle west can persist for weeks and cover land miles from the central river. In India and China loss of life has often numbered in the hundreds of thousands through flooding with most physical property being swept away. The river basins of Maine are relatively small compared with

the world's largest rivers. The drop in elevation as the main stream winds to the ocean is rather abrupt. Therefore, the high water peaks are not as great as in larger rivers and they pass quickly. Most of the land is in forest cover which maximizes natural flood retardation, and most of the coast is of ledge rather than barrier beaches and thus more resistant to erosion from ocean flooding. Nonetheless, the matter of flooding is not taken lightly, for floods are the greatest type of natural disaster likely to occur in Maine. Appropriate agencies have been increasingly concerned with this problem and the means to predict and warn of flooding and to prevent or eliminate flood damages.

FLOOD WARNING

In Maine the Water Resources Division of the U.S. Geological Survey maintains a continuous study of the factors influencing flooding. From streamflow records of many years statistical analysis will reveal the probability that peak discharges of a specific rate will occur at the gaging stations. The probabilities are expressed as recurrence intervals in years, and those selected are 2 year (50%), 25 year (4%), 50 year (2%) and 100 year (1%) intervals. It should be pointed out that many stations have been in operation for a limited number of years, too few to serve as a base for proper statistical certitude. Consequently, flood probability tables prepared from this analysis are provisional and unpublished at present.

A special element contributing to flooding in Maine is the winter snowpack that, upon melting in the spring, forms part of the usual spring runoff. For many years the U.S.G.S. Water Resources Division has gathered information about the occurrence of snow and factors influencing its melting and contribution to spring runoff in order to develop general information to help predict the flood potential in the snowpack for any given year. The most useful fact is a geographic display of snow cover expressed in inches of equivalent water throughout the winter. This information is gathered and reported monthly and assists significantly in the development of a general prediction of flooding probability. For example, in 1969 there was record water content in the snowpack in the mountain regions of Maine and New Hampshire, over 20 inches in some areas nearly equalling one year's average runoff. General flood warnings were issued that major or record floods could be expected if warm, heavy rainstorms occurred. Fortunately that spring was cool and dry and snow melted evenly producing steady runoff without unusual peaks. The Division has published generalized snowpack information[1] based on March 1, the average peak for the year. Map 8 shows some of this information. It should be noted that average water content in the mountains approaches eight inches, which is certainly of flood potential if melted or released in a short time through certain weather occurrences.

Peak discharge and snowpack information is very useful to the companies managing the water storage systems in the State, not only to assist operations

[1] Average Water Content of Snowpack in Maine. 1972. G. S. Hayes. Atlas HA 452. U.S. Geological Survey.

for best use, but to help prevent floods through judicious management when flood conditions occur. The storage systems constructed in the past that provide a regulated flow of water for hydroelectric power generation and industrial processing serve well to reduce peak discharges on our major rivers that would otherwise occur if there were no storage reservoirs present. The managers are conscious of flood conditions and often modify operations to ameliorate further the threat of flooding when possible, for the property most subject to damage from flooding belongs to the partners of the managing companies and protection here is indicated primarily in additon to serving the general public interest. It should be pointed out, however, that these reservoirs were constructed primarily for water supply purposes, and operations are geared to capture and store as much water as possible to provide a greater average flow through the summer and winter slumps. The goal is full storage after the spring peak runoff for later withdrawal as summer begins, and in most years the reservoirs are full at this time and often at other times after extraordinary rainstorms. While alterations in operations are made to ameliorate flooding when conditions warrant, there is a limit to effectiveness compared with other river systems with reservoirs constructed primarily for flood control and operated to store water only during flood periods. In June, 1972, Maine's storage reservoirs were full when Hurricane Agnes struck the northeastern states. Had rainfall from this storm been comparable to that experienced in New York and Pennsylvania, there would have been record flooding incapable of amelioration because of the lack of water storage capabilities.

The National Weather Service has prepared simulated flood levels in Maine for such conditions as shown in the table below.

AGNES PROTOTYPE CRESTS FOR MAINE

RIVER	STATION	CREST	PREVIOUS RECORD
Penobscot	West Enfield	30'	25.15'
Penobscot	Bangor	19'	15.5'
Kennebec	Wyman Dam	60,000 CFS	58,000 CFS
Kennebec	Skowhegan	205,000 CFS	133,500 CFS
Kennebec	Augusta	49'	30'
Androscoggin	Rumford	120,000 CFS	74,000 CFS
Androscoggin	Gulf Island	170,000 CFS	118,000 CFS
Androscoggin	Lewiston (Auburn)	33'	27.57'
Saco	West Buxton	72,000 CFS	60,000 CFS
Saco	Bradbury	59'	57.8'

In addition to its meteorological forecast and warning program, the National Weather Service also has a river forecast and flood warning service presently in operation for the State of Maine. The Service issues flood forecast and warnings when enough rain has fallen to cause rivers to overflow their banks or when melting snow, combined with rain, will have the same effect. At the present time there are nine locations where river and flood forecasts are officially issued in Maine.

River forecasts originate from the River Forecast Center at Hartford, Connecticut. Real time hydrologic data is provided by about 30 cooperative river and rainfall stations. In addition, this reporting network continuously provides updated river, rainfall, snow and temperature data for the Center's operations. There are 17 recording rain gages that are part of the hydroclimatic network that are used by State and Federal agencies for planning studies and procedural development work. This network submits its data on a monthly basis for printing and archiving.

After the hydrologic data are collected, they are processed by a computer where crest stage or discharge forecasts are computed. Forecast lead times vary from 12 hours at Skowhegan on the Kennebec to about 72 hours at West Buxton on the Saco River. These forecasts and warnings are distributed by the Hartford Center and the Weather Service Forecast Office at Portland, to the State Bureau of Civil Emergency Preparedness, State and local police and radio and television stations for rapid dissemination to the public. Other need-to-know agencies such as the Corps of Engineers and the U.S. Geological Survey receive these forecasts and warnings for their operational use and needs. These forecasts are reviewed and updated every six or twelve hours while the rivers are above flood stage. They are disseminated by the Weather Service by direct telephone call and Civil Defense phones to those need-to-know agencies and persons. In addition to the nine existing authorized river forecast points, twelve other locations have been identified as potential danger or damage centers that require a formal river forecast and warning program. Preliminary data indicates that the Lewiston-Auburn area and Bath probably have the largest single potential flood problems in Maine.

Another type of flood problem in Maine is flash floods. On small streams, especially in the hilly areas and the headwaters of river basins, water levels rise quickly in heavy intense rainstorms and flash floods occur before the rain stops falling. Flash floods can also be caused by ice jam breaks which results in rapid rises in river stages in a short period of time even on larger river basins. Most of Maine, except for the coastal areas has a high or moderate flash flood potential. There is no time for the collection and processing of data and the issuance and dissemination of flood crest forecasts as previously described. To cope with this dangerous situation, the National Weather Service has developed three basic methods, any one or combination of, which may be used.

1. Community Self-help System. A network of rainfall and river observing stations is established in the area, and a qualified local flood warning representative collects reports from the network. The representative is authorized to issue public flash flood warnings, based on procedures prepared by the National Weather Service which show the local flooding that will occur under different conditions of temperature, soil moisture, and rainfall. On the basis of reported rainfall and these forecast procedures, the representative can prepare a flood forecast and issue a warning within minutes. Successful operation of a flash flood warning system requires active community participation and planning, but very little financial outlay.

2. Flash Flood Alarm System. This system consists of a sensor located at some optimum point upstream from the community to provide both an accurate indication of flood danger and to give as much warning time as possible. The rising flood waters activate this sensor and the signal is carried downstream by appropriate electronic circuitry to a police or fire station or other continuously staffed location from which a general alarm can be sounded. The alarm indicates that some critical flood level has been reached upstream from the community. No specific crest forecast is possible as in the self-help system. Neither the community Self-Help or the Flash Flood Alarm programs have been established in Maine. It is estimated that there are approximately a dozen or so locations that should be investigated for these systems. A Flash Flood Specialist is assigned to the River Forecast Center, Hartford, Connecticut to aid communities in determining which of the above methods is best for their area. The specialist will prepare procedures, help develop a reporting network and select a location for the flash flood alarm sensor.

3. Flash Flood Watch and Warning Program. When neither of the first two approaches is feasible, more generalized warnings are required. If meteorological conditions conducive to heavy, intense precipitation are observed or forecast for an area, a watch is issued. This alerts residents of the area to the potential occurrence of rainfall which could result in flooding. If excessive rainfall or actual flooding is expected or is reported, a warning is issued. This requires residents of the area to take necessary precautions against flooding. This program is in operation in the State of Maine at the present time. The Weather Service Forecast Office at Portland and the Weather Service Office at Caribou have the responsibility of issuing these watches and warnings.

The agencies concerned with flood warning have indicated a need for improving the data base in order to provide better flood warning. The installation of telemetering devices into a number of precipitation gages and stream gages of the U.S. Geological Survey network has been proposed recently. In addition a two-year schedule for installing new telemetered stream gages has been proposed costing $310,000 with annual maintenance cost of $67,000. There is to be equal Federal-State cost sharing. New gages are needed for lower reaches of the Androscoggin, Kennebec, Penobscot and Saco Rivers. Gages to measure the water level of several major lakes with considerable shoreline development would provide instant warning of rapidly rising levels. Funding of this proposal deserves priority in order to give improved means to public agencies to provide suitable flood warning.

LONG RANGE PROTECTION FROM FLOODS

Protection from flooding has been traditionally assigned to government for accomplishment. The concept of flood protection has two aspects. One is the installation of protective structures such as dams which can be closed for a limited time to prevent streamflow from building up to flood proportions, or dikes which keep river or ocean water within channels and away from land subject to flooding. The other is restriction or control of construction of damageable property within the areas known to be subject to flooding, these areas defined as floodplains. This latter device is known as a "non-structural" control.

Over a long period of time development of flood control structures has become dominant in large river systems subject to great damaging floods. On smaller rivers the nonstructural approach, or attention to keeping or removing damageable property out of the floodplains, has turned out to be the better approach. While in a cursory way the latter approach seems too obvious to be overlooked, the fact remains that development has occurred extensively along major rivers and the ocean because of compelling necessity. Design of such development to withstand prospective flood damage has often not been incorporated because of ignorance of flooding possibilities or a gamble that a damaging flood will not occur. One would rarely question the value of the flood control network under construction in the Mississippi River Valley in face of the alternative of removing development from a significant portion of that basin. In a larger sense projects to control flooding on the great rivers of Asia seem an obvious choice to affected nations that are developing enough to undertake such projects in view of the staggering damages incurred there through flooding.

In Maine presently the nonstructural aspect of flood control has received less attention than structural control. The U.S. Army Corps of Engineers, authorized to construct flood control structures pertaining to navigable rivers and the coast has been authorized to complete only one structure in Maine, a dam across the Narraguagus River to prevent ice jams from piling up along the shore in Cherryfield. In addition a multiple-purpose project has been authorized for the Saint John River, as described in the chapter on power. It is a matter of a lack of needs and requests of the Corps and unfavorable benefit/cost ratios of proposed projects strictly for flood control that has led to this situation. The Soil Conservation Service of the U.S. Department of Agriculture is authorized through Public Law 566 to carry out flood control programs on upstream watersheds measuring less than 250,000 acres. The scope of this program embraces such other factors than flood control as water supply, erosion control, recreation, fish and wildlife enhancement and low flow augmentation. After reconnaissance of more than forty watersheds where damaging floods are known to occur were made by the Soil Conservation Service, applications were made by sponsoring county soil conservation districts and/or county commissions for projects in 28 of these basins. At the present time there is one watershed project completed and work is underway on five others. The Soil Conservation Service has completed 15 floodwater retarding

and multi-purpose dams. There is one multi-purpose dam under construction. The small watershed program is locally sponsored by such agencies as Soil and Water Conservation Districts, towns, county commissions and water districts.

The Soil Conservation Service has planned and installed flood prevention measures through the Resource, Conservation and Development Program. There are three operational Resource, Conservation and Development projects in Maine. The flood prevention measures installed to date have benefited both rural and urban people. These measures are locally sponsored by Soil and Water Conservation Districts and towns. See Map 21 for status of the Watershed Protection and Flood Prevention and Map 22 for the Resource Conservation and Development Program in Maine.

In recent years attention has been focused upon the floodplain itself to see if there is an alternate way to reducing flood damage by controlling activities there. Casual observation of uncontrolled floodplain operations reveals that in some Maine communities structures tend to be removed from floodplains while in others structures are added, presumably according to how great damages were when and how long ago the last flood occurred. Sweeping generalities that "everything must be removed from the floodplain" form the basis of an unrealistic solution since much major property within the State and considerable habitation now occurs in the floodplains either through convenience or economic necessity. Residents are apparently willing and able to sustain flood losses that might occur. The problem is a large one and is now under attack from several directions.

The first part of the problem is appropriate delineation of floodplains. Since floods are randomly periodic and each of different magnitude, there is no absolute delineation possible. Chart 3 shows a typical riverine floodplain situation. Technical information is needed to lay out the floodplain borders based upon a low probability of flooding. The Corps of Engineers is authorized to perform flood information studies upon request by communities desiring authoritative delineation upon which to base controls. These are full-dress studies costing several thousand dollars per mile of major river and stream. Ground surveys are made to establish elevations for preparation of a floodplain map. Analysis is undertaken to determine a floodplain for an intermediate regional flood (100-year event), as well as a statistically much rarer and larger flood, known as the standard project flood. Published reports exist for the Androscoggin River in Lewiston and Auburn, the lower reaches of the Little Androscoggin River in Minot and Auburn, and the Saco River in Fryeburg. A fourth report is in progress for the Lower Androscoggin towns of Leeds and Lisbon and for the Swift River in Roxbury. A fifth study covering the towns on the Aroostook River between Masardis and Fort Fairfield is scheduled to be started in mid-1975. In addition, the Soil Conservation Service now performs floodplain information studies on smaller rivers and about a dozen studies are underway. The Soil Conservation Service signed an agreement with the Maine Soil and Water Conservation Commission in August, 1971, to conduct flood hazard analysis studies. Twenty-one applications have been referred to the Soil Conservation Service since this agreement was signed. One study has been completed, several others are in draft form. This program will

identify the 10 year, 100 year and 500 year frequency flood events for the local people. The reports will be used as a basis for floodplain management. See Map 23 Flood Hazard Analysis Program in Maine. The Water Resources Division of the U.S. Geological Survey is publishing reconnaissance-level delineations of areas subject to flooding through analysis of streamflow data and drafting them as overlays on the $7\frac{1}{2}$' and 15' guadrangle maps published by the Survey. A considerable number of these special maps has been published with priority given to those maps covering settled areas.

The remaining task is to provide proper guidance for enactment of appropriate regulations to reduce or prevent flood damage in flood prone areas. The U.S. Water Resources Council has published a comprehensive guide[1] for the formulation of regulations to come to grips with this problem. In Maine, the Shoreland Zoning and Subdivision Control Act is addressed in part to floodplain management, and the State Planning Office, in cooperation with the Department of Environmental Protection and the Land Use Regulation Commission published guidelines[2] for regulation of shorelands including floodplains.

In 1968 the Federal Department of Housing and Urban Development was authorized by Congress to undertake a national program of insurance assistance to owners of property subject to flood damage. Recognizing that there was much property within floodplains subject to damage by floods, Congress sought to provide relief and at the same time begin the task of securing floodplain delineation and induce municipalities to undertake management programs to reduce flood damage. To qualify for assistance in this program, called the National Flood Insurance Program, municipalities must apply and agree to abide by floodplain regulations. HUD has prepared 100-year floodplain maps based upon existing information to set off these areas in those communities where such conditions exist. In December, 1973, the Act was amended to set July 1, 1975, as a time limit for communities to enroll in the program. After that time property holders in the floodplains of those communities not enrolled are ineligible to purchase flood insurance, which is a prerequisite for Federal or federally-related financial assistance for buildings such as all forms of loans and grants including mortgage loans and disaster assistance loans from either a Federal agency or banks and savings and loans institutions.

To date there has been a minimal response by municipalities to enroll in this program to insure protection of property holders in floodplains. A partial reason is the paucity of suitable floodplain information for most communities. There are only a few communities covered by standard flood information studies. Substandard information maps, intended to be provisional for purposes of initiating the program, have often been received poorly by community officials because of inaccuracies and have helped bring about negative re-

[1] Regulation of Flood Hazard Areas to Reduce Flood Losses. 1971. Volumes I and II. Water Resources Council, Washington, D.C.

[2] Guidelines for Municipal Shoreland Zoning Ordinance. 1973. State of Maine.

actions about the program. There are provisions to update maps based upon local determination of error in order to provide better accuracy in the absence of standard flood information studies.

In October, 1974, the State Bureau of Emergency Preparedness was designated as the State coordinator to work with HUD and communities and stimulate greater participation and enrollment.

The programs listed above provide good tools for the establishment of floodplain management, one of the major weak points in Maine's recent programs to improve land use practices. The National Flood Insurance Program provides a forced incentive to undertake floodplain management through its provisions of withholding insurance and Federal aid for floodplain property unless such management is undertaken. Some major features of floodplain management comprise the following:

1. Designation of floodways and encroachment lines where no construction or landfill should be permitted.

2. Zoning for optimal land-use, both inside and outside the floodplain.

3. Subdivision regulations for controlling construction in presently undeveloped areas.

4. Building codes to reduce flood damages to buildings in the floodplain.

5. Floodproofing for reduction and elimination of flood damages by structural changes and adjustments. Applicable to both new and existing buildings.

6. Open space for recreational use in the floodplain.

7. Permanent evacuation and relocation.

8. Tax adjustments to encourage wise land use.

9. Construction financing by private and Federal institutions to control floodplain development.

10. Urban development (renewal).

Chart 4 is adapted from the NAR Report[1] and provides a prediction into the future with respect to projected flood damages with and without structural or floodplain management practices designed to reduce flood damages. Data

[1] North Atlantic Regional Water Resources Study. Appendix E. Flood Damage Reduction and Water Management for Major Rivers and Coastal Areas. Appendix F. Upstream Flood Prevention and Water Management. 1972. North Atlantic Regional Water Resources Study Coordinating Committee.

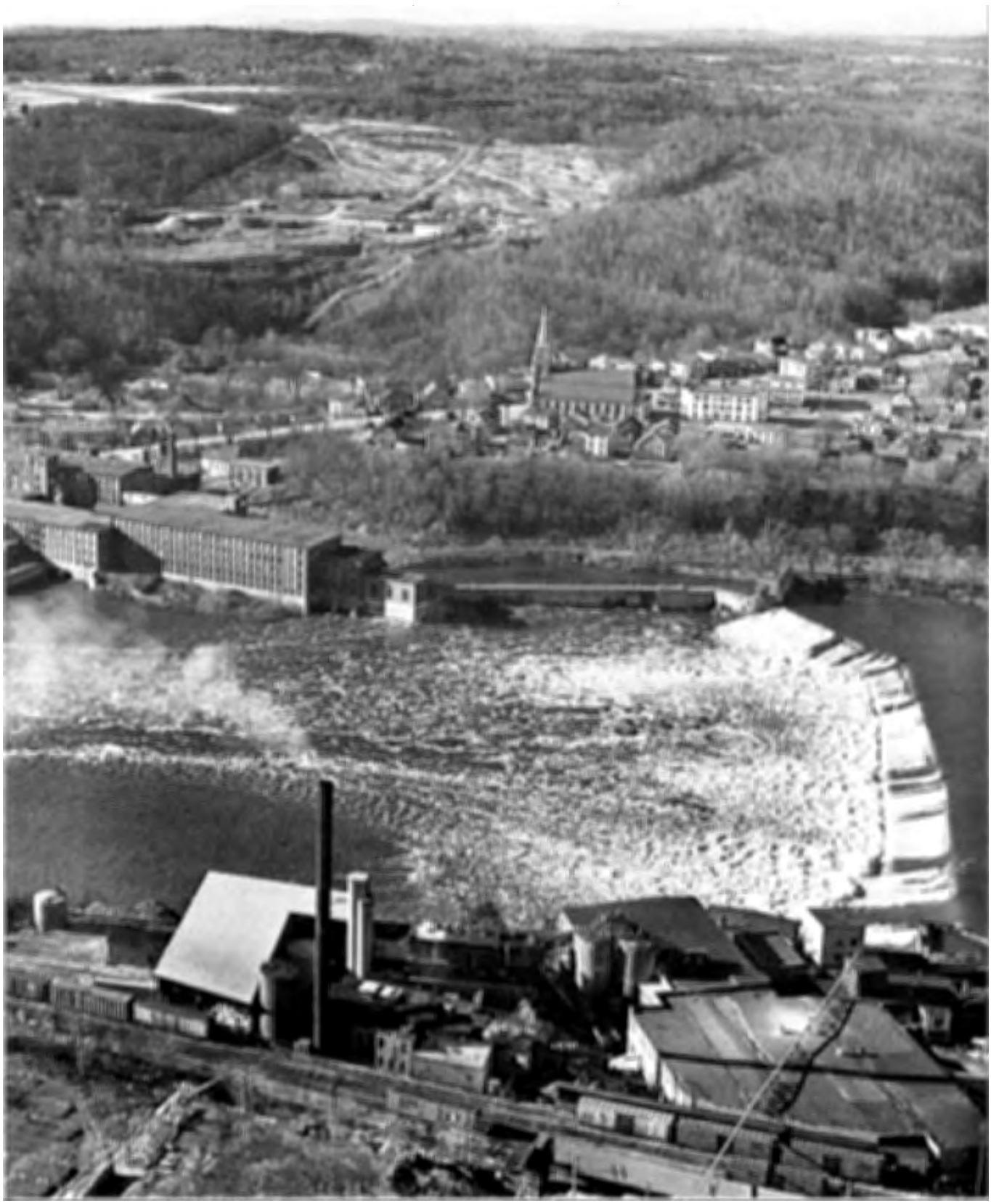
were totaled from the six major basin areas in Maine with some extension into New Hampshire. That damages are projected to rise sharply predicts that population increases and development along shorelands will be marked. Implied is the widespread adoption of both structural and management remedies since damages would otherwise rise to unacceptable levels. Reduction through structures on major rivers in this graph includes only the authorized Dickey-Lincoln School Lakes project on the Saint John River and the Pontook proposal for the Androscoggin River, which was reconsidered but not recommended in 1967. Practical storage for a fully developed water supply does include other projects (see chapter on water supply) on other basins that would reduce flood damages further if constructed. The reduction in damages through structures on the upland streams represents the total of the recommended projects primarily for flood control by the Soil Conservation Service. Total cost using a 1970 base would be approximately $133 million. Further reductions would be possible if projects for purposes other than primarily for flood control were constructed. In short, as development in river basins proceeds and larger flood damages are incurred to the point of unacceptability, floodplain management practices will be adopted and structural remedies selected from preliminary plans prepared by the Corps of Engineers and Soil Conservation Service.

DAM SAFETY

A problem relating to potential flood damage is that of dam safety. Under the liberality of the riparian doctrine and the past encouragement for dam construction under the "mill acts", thousands of dams were erected in the State for milling and other reasons and water storage for log driving. Once these activities ceased many dams were no longer used or maintained since there were no regulations requiring safety maintenance or of dismantling abandoned dams. Where dams are small or remote owners generally have abandoned them since water rights are of small value. Public safety is not appreciably threatened through a sudden breach or failure. Many small dams have been washed away reducing the number to approximately one thousand, according to an inventory conducted by the State Planning Office in 1972. Many of these are small, remote and their condition and knowledge of ownership is often difficult to obtain. Many others are larger, are not being used for any discernable purpose and may be deteriorating in condition through neglected or minimal maintenance. The water rights connected with these dams are far more valuable than the dams themselves, and for this reason they are being held possibly for speculation by their owners. It is for this group of dams that the lack of mandatory maintenance poses problems in public safety should any of them breach during storms or spring melt and release more flood waters onto floodplains.

Dams constructed for projects licensed by the Federal Power Commission are inspected annually for structural soundness by the Commission. Most large dams are included in this inspection. As an aid in the matter of Federal activities, Public Law 92-367, enacted in 1972, directs the U.S. Corps of Engineers to prepare an inventory of dams throughout the United States. A compilation is currently underway for dams in Maine. Inspection of other dams is under control of a State inspector, now currently employed by the Bureau of Civil Emergency Preparedness. While ownership of dams can usually be determined even for remote dams long abandoned, there is no legal

responsibility for owners to maintain dams in a safe condition. Information revealed by the recent inventories and enlargement of public safety powers regarding emergency operation of dams may stimulate proper legislative action toward solution of this problem.



Tom Jones/Maine Times

Map No. 21

	WATERSHED PROJECTS	
1	Presque Isle Stream	124,000 Acres
2	Libby Brook	23,992 Acres
3	Cold River	47,080 Acres
4	Nezinscot River	114,813 Acres
5	Limestone Stream	31,542 Acres
6	Stevens Brook	27,172 Acres
7	Violette Stream	41,618 Acres
8	E. Br. Mattawamkeag River	70,000 Acres
9	E. Br. Piscataqua River	13,300 Acres
10	W. Br. Piscataqua River	13,345 Acres
11	Prestile Stream	58,374 Acres
12	Royal River	91,827 Acres
13	Dunham-Davee Brook	5,156 Acres
14	Fish Stream	17,146 Acres
15	Twenty Five Mile Stream	92,637 Acres
16	Upper Carrabassett River	55,197 Acres
17	Austin Stream	58,680 Acres
18	Lower Carrabassett River	146,000 Acres
19	Salmon Stream	34,519 Acres
20	Whites Pond	5,950 Acres
21	Allen Stream	24,197 Acres
22	Medomak River	51,599 Acres
23	Little River	11,035 Acres
24	Upper Piscataquis River	169,392 Acres
25	Bond Brook	14,448 Acres
26	Sandy River	202,867 Acres
27	W. Br. Mattawamkeag River	173,486 Acres
28	Pushaw Stream	148,573 Acres

Status of Watershed Projects
As of June 1, 1974

- PROJECT COMPLETED
- AUTHORIZED FOR OPERATIONS ACTIVE
- AUTHORIZED FOR OPERATIONS INACTIVE
- AUTHORIZED FOR PLANNING
- NOT FEASIBLE

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STATE OF
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EXECUTIVE DEPARTMENT
MAINE STATE
PLANNING OFFICE

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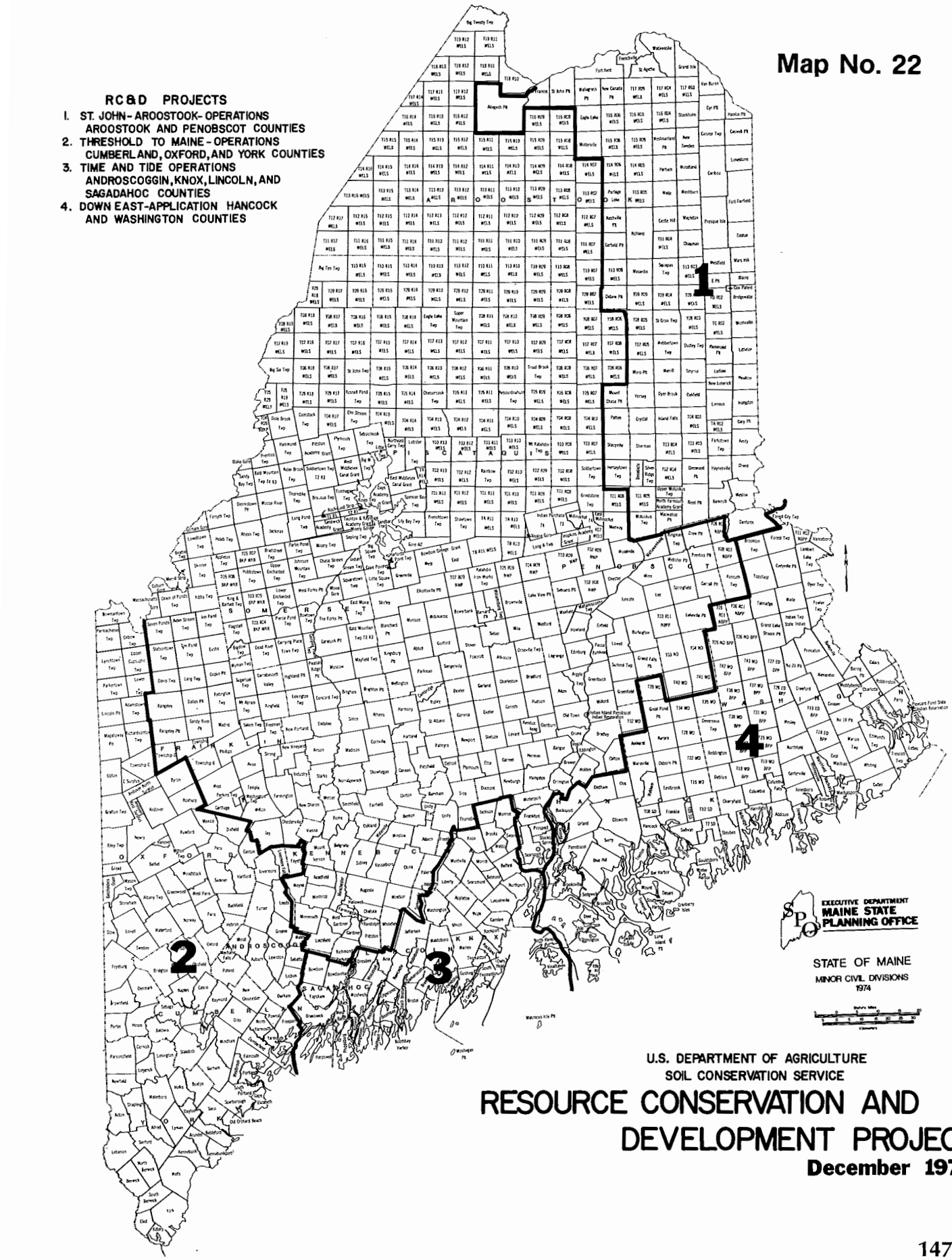
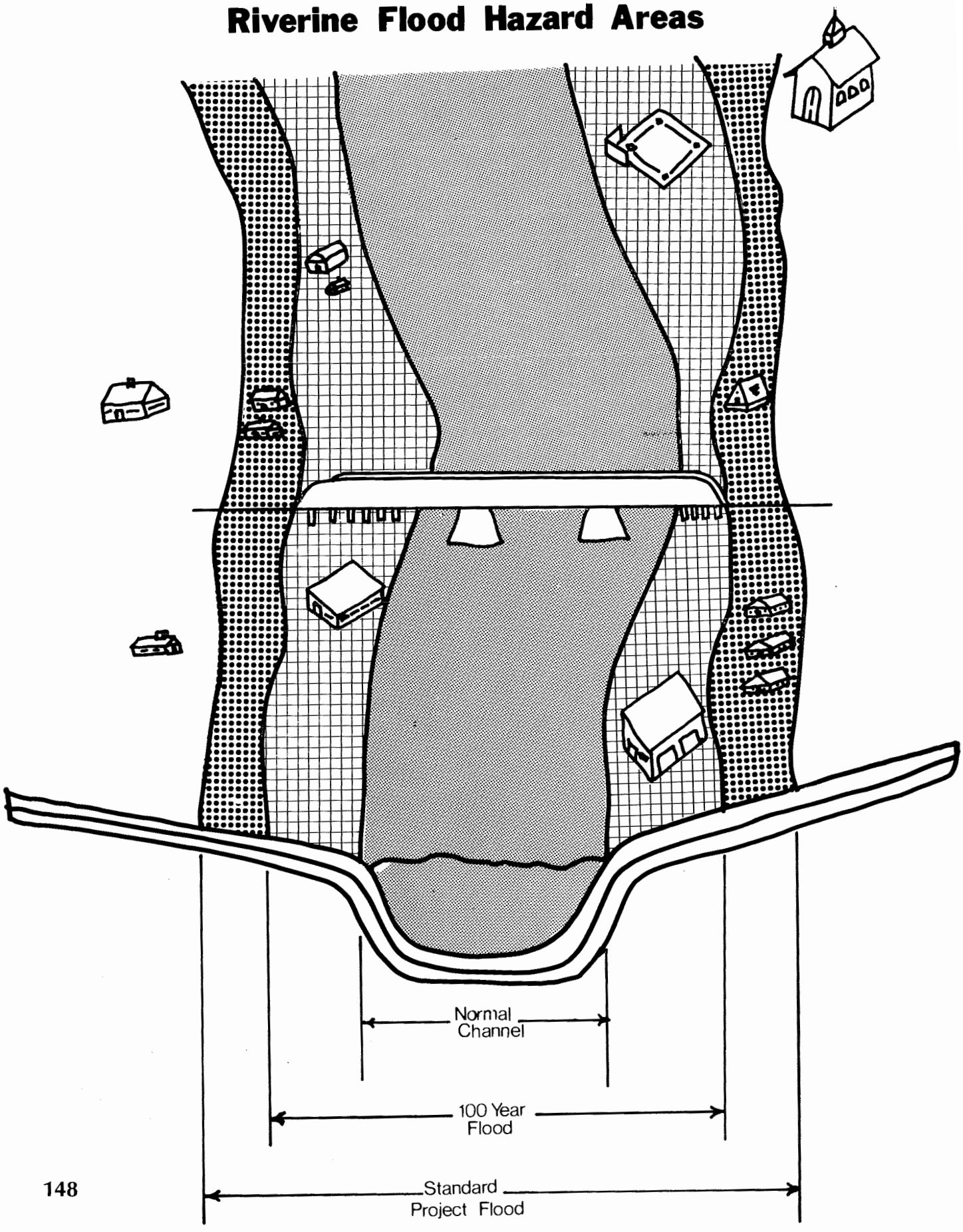
Miles

U.S. Department of Agriculture
Soil Conservation Service

Watershed Protection and Flood Prevention


Map No. 22
RC&D PROJECTS
1. ST. JOHN-AROOSTOOK-OPERATIONS AROOSTOOK AND PENOBSCOT COUNTIES
2. THRESHOLD TO MAINE-OPERATIONS CUMBERLAND, OXFORD, AND YORK COUNTIES
3. TIME AND TIDE OPERATIONS ANDROSCOGGIN, KNOX, LINCOLN, AND SAGADAHOC COUNTIES
4. DOWN EAST-APPLICATION HANCOCK AND WASHINGTON COUNTIES
1
2
3
4
EXECUTIVE DEPARTMENT
MAINE STATE PLANNING OFFICE
STATE OF MAINE
MINOR CIVIL DIVISIONS
1974
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
RESOURCE CONSERVATION AND DEVELOPMENT PROJECTS
December 1974

Riverine Flood Hazard Areas



Map No. 23

Status of Flood Hazard Analyses Studies
As of June 1, 1974

- Studies Completed
- Studies in Active Planning
- Studies with Completed Plans of Study
- Unserviced Applications
- Applications Returned

LIST OF PROJECTS

1	Royal River	Yarmouth
2	Crooked River	Casco, Naples, Harrison
3	Ellis River	Otisfield Andover, Rumford
4	Royal River	North Yarmouth
5	Stroudwater River	Portland, Westbrook
6	Nonesuch River	Scarborough
7	Pushaw Lake & Steam	Alton, Glenburn, Hudson, Orono, Oldtown
8	Webb River	Dixfield, Mexico
9	Sandy River	Farmington
10	Sabattus River	Lisbon
11	Little Ossipee River	Acton, Limerick, Limington Newfield, Shapleigh, Waterboro
12	Great Works River	North Berwick, Sanford, South Berwick
13	Presque Isle Stream	Presque Isle, Mapleton
14	Worthley Brook	Poland
15	Range Brook	Poland, Mechanic Falls
16	Blackwater River	Masardis
17	St. Croix River	Masardis
18	Caribou Stream	Caribou
19	Little Madawaska River	Caribou
20	Salmon Brook	Washburn
21	Beaver Brook	Castle Hill
22	Presumpscot River	
23	Webhannet River	

N

STATE OF
MAINE
EXECUTIVE DEPARTMENT
MAINE STATE
PLANNING OFFICE

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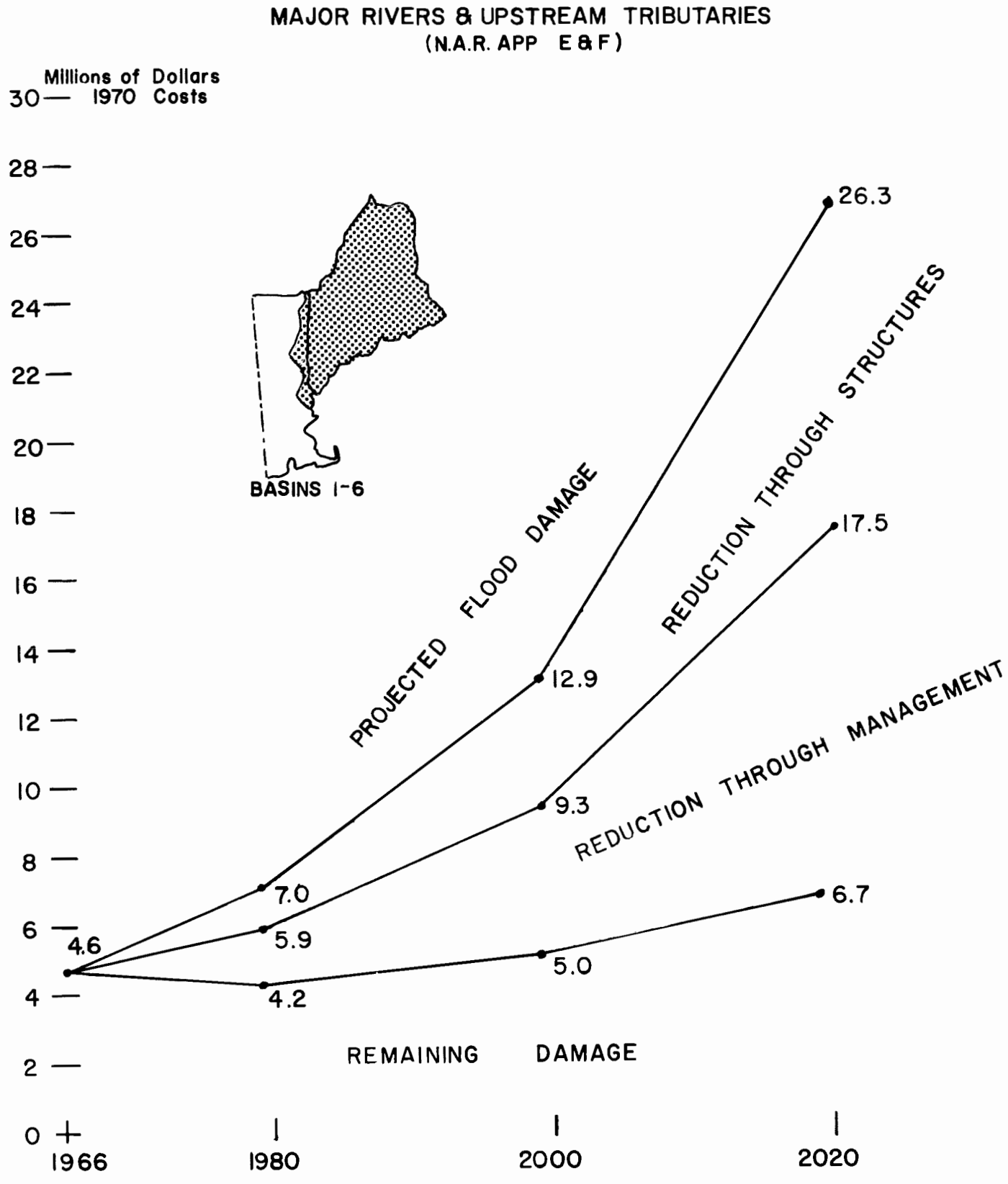
Miles

U.S. Department of Agriculture
Soil Conservation Service

Flood Hazard Analyses Program

PROJECTED FLOOD DAMAGE & REDUCTION

Chart 4



E. Land Use

Within the term "water resources and related land use", "related land use" means a collective summary of factors that influences both the quantity and quality of water falling on, flowing through and draining from land. Such a definition might be construed as indicating a very limited relationship of land use to water. For example, in consideration of building a large manufacturing plant covering many acres, the presence of buildings, paved roadways, service areas and parking lots would speed up surface drainage greatly, and during storms downstream waterways would experience greater peak flow than formerly. These streams would also undergo new low flow records at other times since absorption of groundwater at the plant site would be greatly reduced. Depending upon the amount of water used and the degree of wastewater treatment, impact upon surrounding water quality could vary considerably. But these influences upon water quantity and quality might be far less important to the scene than economic and social effects induced by the presence of the plant. In this sense this definition appears to favor negative planning - what not to do - leaving positive planning - what to do - to the vagaries of the free market of uncoordinated programs through public investment and of private enterprise. Within this respect such matters as erosion control, land drainage, underground liquid and solid waste disposal, control of vegetation, zoning and subdivision controls and environmental evaluation of site development are types of programs that essentially regulate land use with the goal of protecting land and minimizing effects of activities upon water quantity and quality. On the other hand consideration of land use can be employed to achieve positive planning goals and take water relationships into account. Data on land classification and capability or soil suitability properly serve as guides to shape activities to produce the best results, whether to grow crops, lay out new cities, or build new transportation ways. Fulfilling the goal of preserving or providing appropriate open space is another positive planning activity that can go hand in hand with maintenance of water quantity and quality.

LAND USE INVENTORIES

Inventories of land use have been conducted by the U.S. Department of Agriculture for a long time. There is orientation toward agriculture and forestry in this program, but since most all of the land in the United States, especially in Maine, is in farm or forest use, this bias should not be overwhelming or render data from this source incomprehensible to other agents of land use. An edition of the Conservation Needs Inventory[1] was published in 1970 covering the land area of Maine. A similar inventory[2] was made in 1972

[1] Conservation Needs Inventory in Maine. 1970. U.S. Department of Agriculture.

[2] North Atlantic Regional Water Resources Study. 1972. Appendix G, Land Use & Management, North Atlantic Regional Water Resources Study Coordinating Committee.

aggregating data by river basin areas in the State and a portion of New Hampshire. Comparison of these reports shows that while categories of the data differ somewhat, values given agree substantially. Tables 18 and 19 are adapted from the NAR report and display percentage of land in each of several major land use categories. Using 1964 as a base year, predictions are shown for benchmark years in the future about changes in land use among these categories. The definition of "farm forest" is woodlots within farm areas; "other farm land" refers to area covered by buildings and feedlots; "other land" in the nonfarm classification means rural nonfarm residences, churches, schoolgrounds or idle land.

From reading Table 18, most would likely be surprised at how little land is used for habitation and farming and how preponderant is the proportion in forest. Also predicted trends appear to contradict general forecasts of considerable population increase and a concomitant need to increase agricultural production. Forest land will not only hold its own (at the highest percentage in any state of the nation) but increase as cropland and pasture continue to be abandoned and begin to grow trees. Many farm woodlots will remain and shift in classification to nonfarm forest as surrounding crop and pasture land change into forest. The small percentage of urban and other nonfarm land shown in the Table tends to obscure the fact that there will be substantial increase of these land uses by the year 2020.

That nine-tenths of Maine's land is likely to remain covered with forest for the next fifty years is of significance to water resources, since forest land provides the most favorable condition for interception of precipitation and preservation of water quality and maintenance of equable quantity through the runoff phase of the hydrologic cycle. A considerable portion of rainfall may be evaporated back into the air from the surface of vegetation. Rainfall is readily absorbed into the soil by the forest-type land surface. Soil erosion through runoff is further inhibited by the holding action of the intensive root systems of trees. Temperatures in streams remain low through shading of the land and water surface.

The continued diminution of land devoted to crops and pasture will tend to reduce the base subject to erosion and result in better water quality in surface runoff. It is assumed that land phasing out of crop production and pasture will be of lower class more naturally subject to erosion and which probably has not received land treatment measures designed to minimize erosion. Conversely, the better classes of land are likely to be retained in crop production and to have had appropriate land treatment measures to conserve soil and maintain high water quality. This prediction also assumes free market conditions for crop production with attendant attrition to farming on marginal lands.

It is the urban and rural nonfarm land use that is currently receiving the most attention, for what happens on land in these classes of use can be so varied and have such far-reaching effects as to warrant much study to appraise

problems and devise controls. It is no accident that development of zoning, subdivision and building codes, and floodplain management plans have been concentrated on urban and rural nonfarm land. As cities develop with concentration of population and physical property, they quickly lose land and water self-sufficiency and exert increased influence on land and water use in surrounding areas. That the percentages of urban and rural nonfarm land use are predicted to increase markedly indicates continuation of these manifold activities in and around Maine's cities and larger towns, pointing up the need for analysis of problems created and devices for their solution.

SUMMARY LAND USE PROJECTIONS

TABLE 18

Percent of Total Land Areas
Basin Areas 1-6
FROM NAR APPENDIX G LAND USE

Land Use	1964	1980	2000	2020
Farmland				
Cropland	6.1	2.8	1.7	0.9
Pasture	1.1	0.7	0.3	0.1
Farm Forest	7.2	4.4	2.4	1.2
Other Farm	0.7	0.4	0.3	0.1
Non-Farm Land				
Urban	3.2	3.2	3.6	4.2
Other Non-Farm	1.7	2.6	3.7	4.9
Non-Farm Forest	80.1	85.9	88.2	88.5

The soil survey underway in Maine by soil scientists of the Soil Conservation Service forms the basic building block for generating land use information. From identification of soils and determination of slopes, general capability classes have been derived ranging from deep, stoneless, well-drained soils or level land to areas of beach sand or exposed ledge. Capability among these major classes is generally indexed toward agriculture and forestry. The Class I lands are indicated as prime land for crop agriculture (regardless of present land use) with exposed ledge having no agricultural value. This land classification system is described below.

Class I. Very good land that can be cultivated safely and easily with ordinary farming methods.

Class II. Land that can be cultivated safely with moderate conservation treatments. These soils may be slightly erodible or may have water or climate problems.

Class III. Soils with considerable limitations in use and that require intensive conservation treatments. Erosion, droughtiness, excessive wetness, overflow, or salinity may be the causes of the problem.

Class IV. Soils that are severely limited in use. They can be cultivated only occasionally and with extreme care. These soils may be erodible, droughty, wet, overflowed, or saline, so that the kinds of cultivated crops that can be grown as well as the number of years favorable for crop production are very limited.

Class V. Nearly level land that is best suited to permanent vegetation. These soils are often stony, wet, subject to damaging overflow, or have a short growing season.

Class VI. Land that is suited for grazing or forestry, with minor limitations. These soils are usually steeply sloping; some class VI land may be severely eroded, shallow, wet, subject to damaging overflow, or droughty.

Class VII. Soils in this class are severely limited in use. The severity of the conservation problems exceeds those in class VI. They may be steep, stony, shallow, droughty, wet, subject to damaging overflow, or eroded. These soils are best protected by natural vegetation and are limited in use.

Class VIII. Very steep and rocky and sandy or wet land. Useful for wildlife food and shelter areas or for recreational or water-yielding purposes. Not suited for commercial production of crops.

In addition to the land-use-capability units, capability subclasses have been established to indicate the major land-use problems such as erosion and runoff, excess water, root-zone limitations and climatic limitations.

During recent years the Service has created a refined capability classification based upon the individual soils identified in the soil survey. From a thorough analysis of the properties of each soil, a work sheet has been prepared listing numerous suitabilities for this soil. Since the soil survey is site specific, many soil suitabilities for a site are revealed by simple inspection. Maps of major soil suitability categories have been prepared for many minor civil divisions. Town planning boards are equipped with these maps and are aware of their use as a tool to private proper land use activities in their towns.

The U.S. Department of Agriculture land classifications have no direct correlation with land activity, which is of paramount interest for planning in urban areas where there are literally hundreds of activities sometimes requiring three-dimensional mapping. A rational classification of these activities is very useful. In 1965, in a joint effort by the Department of Housing and Urban Development and the Bureau of Public Roads, then located within the Department of Commerce, a land use classification[1], featuring land activity was devised and given coding for use in data processing systems. The system is hierarchical and of four levels. The first level is listed as follows:

Code	Category
1	Residential
2	Manufacturing
3	Manufacturing
4	Transportation, Communications and Utilities
5	Trade
6	Service
7	Cultural, Entertainment and Recreational
8	Resource Production and Extraction
9	Undeveloped land and water areas

In 1972, representatives of the natural resources agencies of Maine State government met to consider standardization of land use classification and coding. The HUD-BPR code was adopted and fleshed out in the fourth level

[1] Standard Land Use Coding Manual. 1965. U.S. Government Printing Office. Washington, D.C.

with the addition of approximately 50 categories of significant activities generally peculiar to Maine. During discussion it became apparent that this classification focusing upon activities was insufficient for detailed classification of relatively undeveloped land, which makes up most of the State. The concept of land cover became the point of reference and departure, and a classification based upon three levels of detail was prepared.

During 1974 it was determined that this code needed revision for best use and application to mapping of the coastal zone by the Coastal Planning Division of the State Planning Office. Also, the Federal government created an Inter-Agency Committee on Land Use Information and Classification in order to use data gathered by the ERTS satellite and U-2 aerial photography programs of the earth's lands. Interestingly, this Committee also decided that land activity and land cover were frames of reference that were best classified separately, and issued a preliminary classification outline[1]. In anticipation of a nationally standardized land use code by the Federal government that would be mandatory for regional and state input into land use research and in reporting projects funded federally, the State group was revived by the State Planning Office and revised the land cover codes[2] to fit the needs and adjust to the Federal proposals. The fundamental first-level classes of land cover for this code are as follows:

Code	Category
1000	Forest Land
2000	Agricultural Land
3000	Wetlands
4000	Surface Water
5000	Barren Land
6000	Urban or Built-up Land
7000	Miscellaneous

It is the intent of the State natural resources agencies to map the State according to this code at all three levels of detail. The Division of Coastal Planning in the State Planning Office, the Bureau of Public Lands in the Department of Conservation and the Department of Inland Fisheries and Game are agencies that have begun to use this code in mapping specific areas within their concern. For greater benefit to resources planning generally, a special land cover inventory project should be undertaken for the entire State. Cost savings, more uniform display standards and more timely benefit and applicability would be the advantages of a unified, Statewide project over the present piecemeal compilations by various agencies. This inventory deserves priority in any funding designed to provide land use information.

[1] A Land Use Classification System for Use With Remote-Sensor Data. 1972. James R. Anderson, Ernest E. Hardy and John T. Roach, U.S. Geological Survey, Circular 671, Washington, D.C.

[2] Standard Classification System for Land Cover in Maine. 1974. State Planning Office.

LAND USE REGULATIONS AND POLICIES

A major reason for land use inventory and classification is to summarize information about undesirable land use conditions or activities and formulate programs for improving these conditions and activities. These improvements, called land treatment, are intended to (1) conserve soil, (2) maintain water quality, (3) smooth out peak and low streamflow rates, and (4) improve land capability so that land use activities occur under optimum conditions and bring about maximum "return" to land users. Both the CNI Inventory and the NAR report give summary statistics about the extent of land treatment needed to meet conservation and land use objectives according to the following matrix:

Land Use	Problems
Cropland	Erosion
Pasture	Excess Water
Forest	Unfavorable Soil Conditions
Other Land	Few Limitations
Urban	Management Protection

With so much of the State in forest cover and croplands dispersed into small fields, there is obviously far less loss of soil and contamination of water from non-point sources than in other parts of the nation, especially the Mississippi River Valley. There is, however, little room for complacency about soil and water conservation. Maine streams that turn mud-colored after each storm have reduced fishery values, filled reservoirs with silt, and smothered shellfishery areas. It probably comes as a surprise to learn that about two-thirds of Maine's cropland needs land treatment measures. Most pasture-land could be improved considerably and one-third of "other" land is in need of treatment. About 75% of the commercial forest land is considered in need of treatment, mainly in timber stand improvement.

A program of long standing to improve land management and upgrade water quality has been conducted by the Soil Conservation Service in cooperation with Soil & Water Conservation Districts in response to the needs pointed out by the Conservation Needs Inventory. Technical assistance has been provided to thousands of landowners to undertake appropriate land treatment to correct improper land use practices. While attention was first devoted to agricultural and forest lands, in more recent times assistance has increased to owners of land in nonfarm use. The success of the program with respect to interaction with municipalities and the need to improve nonfarm land management is beginning to take hold as municipalities enact ordinances using principles of soil suitability and good land management.

Recently, Maine has enacted three major programs relating to land use that carry regulatory powers. (1) In 1969, the Land Use Regulation Commission was established to control land use in that part of the State lacking standard

municipal government. (2) In 1970, a Site Location Law was enacted by the Legislature authorizing the Department of Environmental Protection to license proposals of large-scale developments. (3) In 1971 and 1973 Mandatory Shoreland Zoning and Subdivision Controls became required for lands abutting tidal water, and major lakes and streams.

Because these regulatory programs essentially provide control or constraint upon ongoing or proposed activities, they do not serve well the area of positive planning for Maine's future. Considerable discussion about this deficiency actually points not to defects in the programs as enacted and administered but instead to the lack of a general land use policy for the State. It is suggested that the development of a State land use policy would be an important element in the general planning process, linking water and related land resources planning with consideration of other human service activities to achieve broad social and economic betterment. This policy should be developed through participation by all elements of Maine's society so that proposed activities resulting from such policy be in harmony with broad public consensus. Too often, "master plans" are drawn, replete with mapping, to suggest rigid approaches imposed by government. Recent experience in Hawaii and Vermont, where there has been a backing away from "master plans", might show that positive planning might proceed better through operation from a policies basis.

The State Planning Office has developed several tentative elements of a land policy for consideration by all principals involved in land use.

1. State government should take the responsibility for identifying areas of critical concern and to regulate those areas in the public interest.

2. There is a need to formulate policy and implement programs for urban areas and other communities through regional planning.

3. There should be clear and coordinative policy, performance standards and criteria at the State level for the guidance of State, Federal and local governments and private developers for effective implementation and coordinative land use planning and control.

4. There should be a method of review and coordination of land acquisition plans and proposals of all State agencies.

5. The use of taxation should be encouraged at both State and local levels to reinforce and support land management goals and objectives.

6. There should be provided up-to-date institutions and organizations to effectively plan and control water and land use in the State.

It is clear that the State is not at point zero with respect to these policy elements. All of them are in operation to a greater or lesser extent, whether or not they originated primarily from the State Planning Office, and are beginning to bring forward a promising approach toward resolution of the problems of land use.

TABLE 19

LAND USE PROJECTIONS

Percent of Total Land Areas (Basin Areas 1-6 see Map No. 10)

FARMLAND

CROPLAND

Basin Area	1964	1980	2000	2020
1	5.2	4.3	2.9	1.8
2	3.9	1.3	0.6	0.3
3	8.0	2.7	1.5	0.8
4	6.2	3.0	1.7	1.0
5	6.2	2.3	1.6	0.9
6	6.9	3.4	1.6	0.7
Average	6.1	2.8	1.7	0.9

PASTURE

1964	1980	2000	2020
0.6	0.3	0.1	0.0
0.8	0.3	0.1	0.0
2.0	0.8	0.4	0.2
1.2	1.2	0.6	0.3
0.4	0.6	0.4	0.2
1.4	1.0	0.4	0.1
1.1	0.7	0.3	0.1

FARM FOREST

1	5.0	3.6	2.1	1.2
2	3.8	2.2	1.0	0.4
3	7.9	4.3	2.3	1.2
4	8.2	6.6	3.6	2.0
5	9.5	4.6	3.0	1.6
6	8.9	4.8	2.1	0.9
Average	7.2	4.4	2.4	1.2

OTHER FARM

0.7	0.5	0.3	0.2
0.3	0.2	0.1	0.0
0.7	0.4	0.2	0.1
0.4	0.3	0.2	0.1
1.5	0.7	0.5	0.3
0.7	0.4	0.2	0.1
0.7	0.4	0.3	0.1

NON-FARMLAND

URBAN

1	0.8	0.8	0.9	1.0
2	1.9	1.9	1.9	1.9
3	2.7	2.7	2.7	2.7
4	4.1	4.1	4.2	4.2
5	3.6	3.7	3.8	3.9
6	5.8	6.0	8.1	11.2
Average	3.2	3.2	3.6	4.2

OTHER NON-FARM

0.0	1.5	1.9	3.1
1.0	1.8	2.3	3.0
0.0	1.6	2.8	3.9
1.3	1.7	2.8	3.9
2.5	3.8	4.5	5.7
5.5	5.2	7.7	9.9
1.7	2.6	3.7	4.9

NON-FARM FOREST

1	87.7	89.0	91.8	92.7
2	88.3	92.3	94.0	94.4
3	78.7	87.5	90.1	91.1
4	78.6	83.1	86.9	88.5
5	76.3	84.3	86.2	87.4
6	70.8	79.2	79.9	77.1
Average	80.1	85.9	88.2	88.5

Source: NAR Water Resources Supply, NARWRS Coordinating Committee, May 1972, Appendix G, pp 181-184.

F. Power

MAINE'S ELECTRIC POWER SYSTEM

The production of electric power is intimately related to water resources management, especially in Maine since present flow regulation of major rivers is managed primarily for the production of power. Very large quantities of water are involved, sometimes the entire flow of a river, but it is essentially nonconsumptive. Use is made only of the energy in water as it flows downstream to be converted into electricity or directly into mechanical energy for industrial use. Water is used for cooling purposes in more modern electric generation plants to condense steam for the most efficient operation of the plant.

The early development of Maine recorded the construction of many dams, each to raise a head of water to provide a better energy source for conversion into mechanical power for many purposes. Industrial development requiring energy to drive machinery was confined to sites along major rivers and streams suitable for dam building. The earliest were small for milling grain or running sawmills, but in the latter part of the last century, when industrial development expanded rapidly and the age of electricity began, the deveopment of major rivers enlarged with construction of larger dams on major rivers and power plants. Construction of major hydroelectric power facilities occurred throughout the first half of the 20th century, the last notable being a generating plant below Ripogenus Dam by Great Northern Paper Company and Harris Dam Station on the Upper Kennebec by Central Maine Power Company both during the 1950's.

There has been considerable attrition with abandonment of most small sites. The once highly successful series of dams and hydromechanical power plants and industrial concentration in Gardiner, for example, has nearly gone with only one remaining hydromechanical power station to pump water for the Gardiner Water District.

The accompanying inventory (Table 20) of Maine's hydropower plants shows few of the small plants remaining. The great majority of plants are for hydroelectric generation by public utilities and for hydroelectric and hydromechanical power by industrial concerns. It is projected that most of these plants will remain in operation indefinitely. The remaining small plants would normally be expected to be phased out, but there is some evidence that a few may be kept in operation for romantic reasons.

Sometime ago the hydroelectric power system fell short of capacity to satisfy rapidly increasing demand for power. Since there were considered no more good sites, attention was devoted to other means of producing power. During the second third of this century the application of increased technology has led to the construction of increasingly larger plants powered by combustion

of fuel to provide energy to be transferred into electric energy. Table 21 lists the major generating stations constructed in Maine during this period. Steam generating plants, in which fuel provides energy to make steam that drives generators, form the largest addition to capacity, especially the Maine Yankee Atomic Power Plant which by itself increased generating capacity in the State by 60%. This type of plant requires cooling water to condense the steam after it passes through turbines in order to create a low pressure in the receiving chamber and increase the efficiency of the steam driving process. Approximately 1-1.25 cubic feet per second of water are needed per megawatt of plant capacity for proper cooling when water is passed through once. Since economies of scale and rapid increases in demand force construction of plants of large capacity, ranging usually from 500-1000 megawatts, the problem of heat disposal of discharged cooling water has become the most important environmental impact of these stations. The diesel and gas generating stations burn fuel to drive engines that are coupled directly to generating turbines. Little or no cooling water is required and waste heat is that from burned fuel and is discharged into the air. Capacity of these plants is relatively limited, being governed by present technology of engines. There are some small stations usually not listed, on islands or within industrial plants where process steam is run through turbines to produce electricity as a by-product to the process using steam.

Tom Jones/Maine Times

FUTURE POWER DEMAND

Projections of future demand for electricity depend upon a number of factors none of which is clearcut in nature. Population increase is the most fundamental, and despite considerable study, certitude in forecasting is tempered by unforeseen shifting of birthrates. Just several years ago much information was published about a future society based upon the U.S. Census Series C rate of increase. Since that time the birth rate has dropped drastically rendering these forecasts obsolete and forced a revised report on the Series E rate of increase. That in Maine economic development is relatively low compared with the national average causing considerable outmigration, and that the attractiveness of the State for tourists raises a high peak seasonal populations, are two additional factors that make population projections fuzzy. During this period a national increase in electric power demand of 9% was noted and if projected 100 years, production would be 8,000 times that of 1970. Waste heat from this level would be about 15% of incoming solar radiation, an amount reasonably assumed to cause irreparable environmental damage.[1]

A very important factor is the large percentage of petroleum product usage to supply energy needs in the State. Space heating particularly is accomplished by burning of petroleum and there is much speculation that this source for space heating will be under economic pressure for conversion to other sources. Generally it is well known that there is a trend toward use of electricity for energy since energy use increases about 3.5% annually while electric power use increases about 7%. The recent unpredicted increases in petroleum prices can cause acceleration in shifts from petroleum to electricity as energy sources in a region top-heavy in reliance upon petroleum for energy, provided that petroleum used for power generation tends to decrease in that region. If an estimate of total energy demand can be forecast and the various sources of energy means to meet demand delineated, possible variation among these sources can be plotted and alternative energy mixes contemplated. Shipman and Veazie in a thorough review[2] of the role of energy in Maine's future have traced these sources of energy and the amounts used in the ultimate unit, the British thermal unit. Projections of demand have been projected to the year 2000, and probable ranges of an energy mix to fulfill demand plus means to meet demand are given. Chart 5 summarizes the authors' tentative estimates of total energy use to the year 2000. It is interesting to note that the recent past and present period shows the highest growth rate of energy use while toward the end of the century lower rates of increase are projected. That portion of energy use as electricity is summarized in Table 22.

[1] Will the Earth Reach an Energy Ceiling? January 6, 1971. John G. Wells. The Wall Street Journal.

[2] William D. Shipman and Carl E. Veazie, 1973. Energy Policy for the State of Maine. Public Affairs Research Center, Bowdoin College, Brunswick, Maine

PROJECTIONS OF ELECTRICITY USE IN MAINE, 1950 - 2000 **TABLE 22**

(Millions of Kilowatt hours)

Final Use	1950	1960	1970	1980	1990	2000
All Uses:	1,931	3,422	5,826	9,878	15,285	20,789
Residential	410	967	1,722	3,387	5,517	7,414
Commercial	226	331	970	2,064	3,698	5,107
Industrial	1,248	1,959	2,911	4,167	5,773	7,930
By Utilities	658	1,067	1,968	3,167	4,773	6,930
By Non-Utilities*	590	892	943	1,000	1,000	1,000
Miscellaneous	47	165	223	260	297	338

*Hydro-electric power only

After Shipman & Veazie

MEANS TO MEET POWER DEMAND

Up to the year 2000 the methods used to generate electric power will not change, according to most authorities, since it will simply require 25 years or more to bring new methods demonstrated in laboratories or proposed theoretically as possible into large-scale production. The increase in technology from the first basket-sized generators to provide power for street lights in Waterville in the 1880's to the completion of the Maine Yankee Atomic Plant has been incredibly impressive and dynamic. Despite great technological resources, the complexities of the problems to find new sources of energy and to do away with so much waste heat during generation have forced a plateau and a continuation of present methods. It is certain that siting, financing, and construction of new conventional plants will entail considerable difficulty, but during the 25-year plateau period (now to the year 2000) ways will have to be found to virtually eliminate combustion of hydrocarbon or fossil fuels since they will become too valuable to burn and air pollution will become too great to avoid irreparable environmental damage, assuming that continued increase in atmospheric carbon dioxide will render the planet less fit for habitation. The problem of waste heat in steam generating plants must be resolved as well. While the citation given above for the year 2074 can be viewed as fanciful, estimation for the waste heat from all sources, of which power-generation is the major factor, in the North Atlantic State Region for the year 2000 ranges from 20-40% of incoming solar radiation depending upon the season of the year.[1]

Conventional hydroelectric power generation is likely to continue indefinitely since the plants now in service are fairly large and modern and can be kept in operation without incurring undue new costs. The New England-New York Interagency Committee in 1955, proposed a considerable number of new hydroelectric plants including new storage reservoirs to meet demand by 1975. That 1975 is here with only two of the proposed plants constructed shows that benefit/costs for power generation only were insufficient to interest investor-owner utilities in constructing these facilities.

[1] An Evaluation of Energy Growth and Use Trends as a Potential Upper Limit in Metropolitan Development. 1971. R.T. Jaske. Proceedings Second Thermal Power and Hydraulic Conference. Washington State University.

Development of these projects primarily for generation of electric power is very costly as can be seen from Table 23. Environmental impact upon recreation, fish and wildlife for some projects would be of major proportions. They are listed here as a catalog of sites determined to be the best to complete in a practical way the full development of water resources in the major basins in terms of supply, flood control, power generation and in some instances recreation and fish and wildlife (Map 24).

The proposed Rankin Rapids site on the upper Saint John River was recommended by the NENYIAC Committee. It was again recommended in 1959 as an increment of the International Passamaquoddy Tidal Power Project. This was superseded by the Dickey-Lincoln School Lakes Project in a report[1] made by the request of President Kennedy. The storage impoundment behind Dickey Dam would be located upstream from the Allagash River and would collect all floodwater to serve as a peaking power project. A lower pool created by Lincoln School Dam would contain the surge of water released through Dickey Dam power units during the peaking power generation period. Lincoln School Dam, located 11 miles downstream of Dickey Dam, would re-regulate flows and include a power plant for production of base load power during stream regulation. This multi-purpose project (power, flood control, recreation and low flow regulation) was authorized in 1965 by Congress. Preconstruction planning was initiated in 1965, but terminated in 1967 due to lack of Federal funding. The project was funded in late 1974 to resume preconstruction planning and design.

Pumped storage is a form of hydroelectric power in which water must be pumped from a low to a high pool for release during peak demand hours. Through loss of energy for many reasons this process creates a net loss of total energy -- more must be used to pump water than is regained from the return flow -- but the timely production of large amounts of power has made it practical and several plants are on line in New England. Some time ago Central Maine Power Company announced that it was considering construction of a pumped storage plant using Wyman Lake as a low pool and Rowe Pond as a high pool. Since the Company has joined with other New England utilities for planning future generating plants, consideration of this site has been heightened and the size enlarged. In a preliminary way the New England River Basins Commission has inventoried possible sites for New England including several in Maine.[2]

The presence of high tides in the Bay of Fundy has long raised the intriguing possibilities of converting tidal flow into electricity. The interest by President Roosevelt and subsequent start of a tidal power project during the

[1] Supplement to the July, 1963 Report. International Passamaquoddy Tidal Power Project and the Upper Saint John River Hydroelectric Power Development. 1964. U.S. Department of Interior.

[2] An Environmental Reconnaissance of Alternative Pumped Storage Sites in New England. 1972. New England River Basins Commission.

1930's in the Eastport area is well known. The original alternative projects involving Cobscook Bay and Passamaquoddy Bay are summarized in the NENYIAC report.[1] In fulfilling a request by President Kennedy, the U.S. Department of Interior issued a revised plan[2] to produce coordinated bulk power through construction of enlarged tidal and Saint John River projects. There has been no subsequent action on a tidal project in view of the great costs, technical problems, and diplomatic matters. Because tides occur at different time each day, base load generation is impossible and adjustment of normally fluctuating production to fit preferred peak load times forces a great sacrifice in system efficiency. Interestingly, officials in the Canadian Maritimes have recently raised the possibilities of tidal power farther up the bay in Canadian territorial waters where tides are the highest in the world. It is far too soon to assess construction probabilities since no engineering studies have been announced.

Steam generation of electricity fueled either by petroleum or coal or by nuclear fission will be the major method up to the year 2000. These plants will be few in number and large, ranging usually from 500-1,000 megawatts of base load. Maine Yankee in Wiscasset is a prime example of a modern base load steam generation plant that requires large investment and up to ten years to complete beginning with design plans up to final testing. A visitor touring the plant is thoroughly convinced of its complexity and wonders if he has taken a trip into the future similar to that when viewing television or motion picture science fiction programs. The use of nuclear fuel requires highly elaborate operating and safety features not present in fossil-fueled plants. Presently there appears to be no clearcut advantage of selecting either fossil or nuclear fuel since both are now used and are intended for future plants, although a current review and reappraisal of safety features in nuclear plants may induce uncertainty and a preference shift toward fossil fuels. An inescapable by-product of these plants is a large amount of waste heat discharged through water used to cool condensors. As a general rule it would appear that for most ocean sites the open system that discharges the cooling water, heated usually from 80-100F, directly into a receiving water will not cause excessive environmental damage. For such plants to be located along major river banks or at highly protected coastal sites, it appears that such a direct discharge would be environmentally damaging and that much of the heat instead should be discharged into the air. The general problems of siting these plants is perhaps much greater than those in the engineering design and plant construction. It is one for resolution during the remainder of the century, when several plants will be constructed in Maine, and of considerable importance, for after the year 2000 a rapid increase in construction is forecast.

[1] The Resources of the New England-New York Region. 1955. Special Subjects Region A, Part 2, Chapter XI. The New England-New York Interagency Committee.

[2] International Passamaquoddy Tidal Power Project and the Upper Saint John River Hydroelectric Power Development. 1963. U.S. Department of Interior.

In addition to steam plants for base load, construction of large pumped storage plants is the most likely method to provide peaking power to supplement base load. Construction of diesel or gas-fired generation plants may continue depending upon supplies and costs of petroleum. These plants serve admirably for peaking power or for standby since they are started quickly.

Table 24 from the Shipman & Veazie report summarizes peak loads up to the year 2000 according to three assumed annual growth rates until that time.

TABLE 24 *ESTIMATED ELECTRIC UTILITY PEAKLOAD PROJECTIONS FOR MAINE*

	1970	1980	1990	2000
Estimated peak load: (megawatts)				
Variant A[1]		1950	3836	7446
Variant B[2]	973	1878	3363	5478
Variant C[3]		1878	3059	4111

[1] Variant A: annual rate of growth, 7.5% 1972-1980; 7.0% 1980-2000
[2] Variant B: annual rate of growth, 7.0% 1972-1980; 6.0% 1980-1990; 5.0% 1990-2000
[3] Variant C: annual rate of growth, 7.0% 1972-1980; 5.0% 1980-1990; 3.0% 1990-2000

Table 25 summarizes future capacity to meet Variant B peak load conditions.

TABLE 25 *ESTIMATED CAPACITY PROJECTIONS FOR MAINE*

	1970	1980	1990	2000
Capacity: (megawatts)				
Hydro, conventional	365	365	360	1150
Hydro, pumped storage			850	850
Steam, fossil fuel	478	1050	1000	1000
Steam, nuclear		855	2000	3000
Gas turbine, other	123	120	200	800
TOTALS*:	966	2,390	4,410	6800

* based on Variant B load growth

To meet these loads Shipman and Veazie assume plant construction to meet Maine's power needs only. The following plants have been proposed or can be predicted to provide for the load capacities called for in Table 25.

1. Central Maine Power Company is presently seeking site approval to install a 600 megawatt steam generation addition to the Wyman plant at Yarmouth, to be fueled by oil. Announcement of this intention was made in September 1972, and the plant should be on line in 1978.

2. This company has contracted for power to be imported from New Brunswick during the 1976-1980 period when it is expected that a new plant on line at that time will continue to keep that Province in a surplus power condition.

3. Central Maine Power has announced intention to construct a large nuclear plant presumably in the Penobscot Bay area scheduled for completion during the early 1980's.

4. A pumped storage plant could be constructed on an upstream site during the 1980's to provide substantial peaking power for the State.

5. During the 1990's the Dickey-Lincoln School Lakes project is predicted to be completed providing substantial peaking power and base load capacity.

6. One nuclear plant must be constructed to provide enough base load capacity by the year 2000.

7. Construction of diesel and gas-fired generators is predicted to continue steadily.

IMPLEMENTATION OF THE CONSTRUCTION PROGRAM

In New England construction of power generation facilities is undertaken by investor-owned utilities who market most of the power produced to retail customers. There are some municipal and cooperative nonprofit systems that purchase power from these producing companies and sell retail (see Map 25). While in the remainder of the nation there is a considerable portion of power produced by public or quasi-public authorities, this has yet to occur in New England, and it is difficult to predict if and when this situation will change. It is possible that construction of the hydroelectric projects listed in Table 23 might occur through the auspices of regional authorities empowered to undertake multipurpose water resources projects to improve supply, protect against floods, maintain water quality, provide recreational facilities and produce power in a manner that will neither pollute the air, heat water nor consume fossil fuels. Given the present alternatives, the cost of producing power from standard hydroelectric plants compares unfavorably. However, it is possible to predict that the costs of fuels and the costs resulting from environmental damage through smoke and heated cooling water might increase to the point where hydroelectric power generation cost might again compare favorably.

The major utilities in New England have joined together to pool the production of bulk power (NEPOOL) and to distribute it (NEPEX) according to agreements made by member companies. Representatives of each company comprise a committee (NEPLAN) to plan construction of future plants. Annual reports of member companies usually describe this program and list those new plants under construction or those whose sites are secured. Longer range plans are not usually released.

Some hint for the future might be gleaned from comparing the power capacity outlined in Table 25 that fits the needs of Maine's power demands with that prepared by Federal Power Commission personnel for the North Atlantic Region Water Resources Study (Appendix P, Power) in 1972 and listed as follows.

TABLE 26 *FEDERAL POWER COMMISSION PROJECTIONS OF ESTIMATED COMPOSITION OF MAINE AND COASTAL NEW HAMPSHIRE POWER SUPPLY - MEGAWATTS*

River Basin Area	1980	2000	2020
1	120	1050	5900
2	270	850	5930
3	240	2250	7380
4	170	190	3170
5	1095	8635	25020
6	1407	8729	24045
	3302	21704	71445

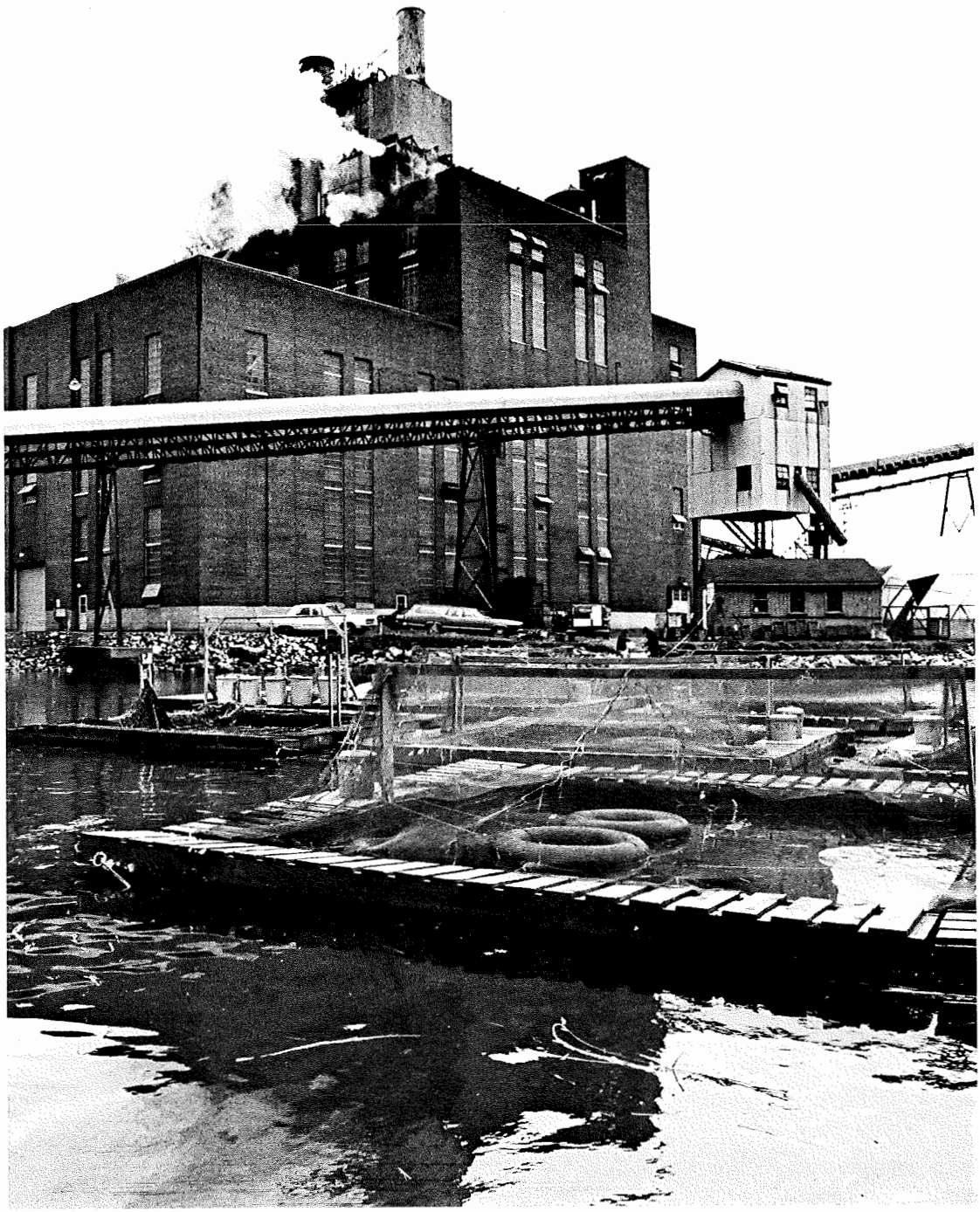
Data in this Table are summarized by river basin with some of areas 4 & 6 being in New Hampshire. For 1980 it would appear that Maine Yankee and the Public Service Company of New Hampshire nuclear plant at Seabrook are the only new plants. For the year 2000 a substantially greater capacity than is necessary to meet Maine's demand is listed especially for the coast, and for the year 2020 a tripling of production capacity is forecast over the year 2000. Apparently this is a prediction that Maine will be selected for sites to provide power for lower New England, this possibility first noted in a New England River Basins Commission Report on the Maine Coast.[1] Like water export this is a matter of public concern to safeguard State interests lest costs are borne here with benefits bestowed elsewhere without proper yardsticks for just compensation.

The lack of specific information about long range planning for new power plants puts Maine at a disadvantage and possibly explains in some measure an often severe reaction to proposals offered. By contrast attention is invited to

[1] Regional and National Demands on the Maine Coastal Zone. 1971. New England River Basins Commission.

a public information booklet [1] by the Public Service Company of New Hampshire outlining the near future for power demand and means to meet demand. The company projects its demand for 2000 to be ten times that of 1970, and proposes to meet demand by construction of five base load plants on sites already acquired in coastal waters plus a pumped storage plant on an unknown upstream site. This booklet may assist materially in the resolution of siting problems and getting these plants on the line for service through its timely release.

[1] Planning For The Year 2000. 1971. Public Service Company of New Hampshire.



Tom Jones/Maine Times

TABLE 20 *INVENTORY OF EXISTING HYDRO-POWER PROJECTS*

ANDROSCOGGIN RIVER BASIN

PROJECT NAME	LOCATION	OWNER CLASS	OWNER	ELECTRIC POWER KW	HYDRO-MECHANICAL POWER KW	TOTAL POWER CAPACITY KW	USABLE STORAGE * IN ACRE FEET
Brunswick	Brunswick	U	Central Maine Power Co.	1470	0	1470	0
Topsham	Topsham	U	Central Maine Power Co.	900	0	900	0
Pejepscot	Topsham	I	Pejepscot Paper Co.	1500	3800	5300	0
Lisbon Falls	Lisbon Falls	I	Max Muller Co.	900	0	900	0
Lewiston Falls	Lewiston	U	Union Water Power Co.	0	30	30	0
Lewiston	Lewiston	I	W. S. Libby Co.	750	0	750	0
Lewiston	Lewiston	I	P. Hall Enterprises, Inc.	1780	0	1780	0
Lewiston	Lewiston	I	Bates Manufacturing Co.	4800	0	4800	0
Hill Division	Lewiston	I	Bates Manufacturing Co.	2160	0	2160	0
Androscoggin	Lewiston	I	Bates Manufacturing Co.	2780	0	2780	0
Continental	Lewiston	U	Central Maine Power Co.	2000	0	2000	0
Lewiston	Lewiston	M	Lewiston Public Works	700	0	700	0
Deer Rips	Auburn	U	Central Maine Power Co.	6440	0	6440	760
Androscoggin No. 3	Lewiston	U	Central Maine Power Co.	3600	0	3600	0
Gulf Island	Lewiston	U	Central Maine Power Co.	22000	0	22000	19,200
Livermore Mill	Livermore Falls	I	International Paper Co.	4540	3580	8120	80
Otis	Jay	I	International Paper Co.	2880	6820	9700	9700
Rumford Lower	Rumford	I	Rumford Falls Power Co.	12800	0	12800	0
Rumford Upper	Rumford	I	Rumford Falls Power Co.	21790	0	21790	720
Shelburne	Shelburne, N.H.	I	Brown Co.	3720	0	3720	0
Gorham	Gorham, N.H.	U	Public Service Co., N.H.	2150	0	2150	0
Gorham	Gorham, N.H.	I	Brown Co.	4800	0	4800	0
Cascade	Gorham, N.H.	I	Brown Co.	7200	0	7200	0
Cross Power	Berlin, N.H.	I	Brown Co.	3200	0	3200	0
J. Brodie Smith	Berlin, N.H.	U	Public Service Co., N.H.	15000	0	15000	0
Riverside	Berlin, N.H.	I	Brown Co.	8000	0	8000	0
TOTALS				137860	14230	152090	30,460

U = Privately Owned Utility
I = Industrial
M = Municipal

* Only Storage in project power pool listed

KENNEBEC RIVER BASIN

PROJECT NAME	LOCATION	OWNER CLASS	OWNER	ELECTRIC POWER KW	HYDRO-MECHANICAL POWER KW	TOTAL POWER CAPACITY KW	USABLE STORAGE * IN ACRE FEET
Cobbosseecontee	Gardiner	M	Gardiner Water District	0	750	750	0
Edwcrds	Augusta	I	Bates Manufacturing Co.	340	3160	3500	0
Augusta	Augusta	I	Statler Tissue Corp.	370	0	370	0
Messalonskee 5	Waterville	U	Central Maine Power Co.	1500	0	1500	0
Messalonskee 4	Waterville	U	Central Maine Power Co.	800	0	800	0
Messalonskee 3	Oakland	U	Central Maine Power Co.	1600	0	1600	0
Messalonskee 2	Oakland	U	Central Maine Power Co.	2800	0	2800	0
Sebasticook No. 4	Winslow	U	Central Maine Power Co.	1500	0	1500	0
Waterville	Waterville	I	Millstar Manufacturing Co.	4800	0	4800	0
T & A Mills	Winslow	I	Scott Paper Co.	3730	670	4400	0
Shawmut	Fairfield	U	Central Maine Power Co.	4650	0	4650	5000
Weston	Skowhegan	U	Central Maine Power Co.	12000	0	12000	3000
Norridgewock	Norridgewock	M	Madison Electric Works	450	0	450	0
Abenaki	Madison	I	Kennebec River Pulp and Paper Co.	3650	6790	10440	0
Anson	Anson	I	Kennebec River Pulp and Paper Co.	6000	0	6000	0
Williams	Embden	U	Central Maine Power Co.	13000	0	13000	3050
Wyman	Moscow	U	Central Maine Power Co.	72000	0	72000	66700
Harris	Indian Stream T1R6 BKP EKR	U	Central Maine Power Co.	76400	0	76400	20000
— —	Eustis	U	Rangeley Power Co.	250	0	250	0
— —	Wilton	I	Forster Mfg. Co.	115	0	115	0
— —	Wilton	I	G. H. Bass Co.	90	0	90	0
TOTALS				206045	11370	217415	97750

INVENTORY OF EXISTING HYDRO-POWER PROJECTS (continued)

PENOBSCOT RIVER BASIN

PROJECT NAME	LOCATION	OWNER CLASS	OWNER	ELECTRIC POWER KW	HYDRO-MECHANICAL POWER KW	TOTAL POWER CAPACITY KW	USABLE STORAGE * IN ACRE FEET
Bangor	Bangor	M	City of Bangor	500	0	500	0
Veazie	Veazie	U	Bangor Hydro-Electric Co.	8400	0	8400	0
Orono	Orono	U	Bangor Hydro-Electric Co.	2300	0	2300	0
Stillwater	Old Town	U	Bangor Hydro-Electric Co.	2000	0	2000	0
Great Works	Old Town	I	Diamond Alkali	5550	0	5550	0
Milford	Milford	U	Bangor Hydro-Electric Co.	6400	0	6400	0
Howland	Howland	U	Bangor Hydro-Electric Co.	4000	0	4000	0
Stanford	Enfield	U	Bangor Hydro-Electric Co.	3800	0	3800	0
Weldon	Mattawamkeag	I	Great Northern Paper Co.	19200	0	19200	3000
Medway	Medway	U	Bangor Hydro-Electric Co.	3440	0	3440	0
East Millinocket	East Millinocket	I	Great Northern Paper Co.	0	7370	7370	0
Dolby	East Millinocket	I	Great Northern Paper Co.	14100	0	14100	4000
Millinocket	Millinocket	I	Great Northern Paper Co.	8000	23500	31500	1200
North Twin	Indian Township 3	I	Great Northern Paper Co.	8200	0	8200	344000
Ripogenus	T3 R11 WELS	I	Great Northern Paper Co.	36000	0	36000	688000
TOTALS				121890	30870	152760	1040200

PISCATAQUA RIVER BASIN

North Rochester	Rochester, N.H.	I	Spaulding Fibre Co.	300	0	300	0
Milton	Milton	I	Spaulding Fibre Co.	250	0	250	0
TOTALS				550	0	550	0

PRESUMPSCOT RIVER BASIN

PROJECT NAME	LOCATION	OWNER CLASS	OWNER	ELECTRIC POWER KW	HYDRO-MECHANICAL POWER KW	TOTAL POWER CAPACITY KW	USABLE STORAGE * IN ACRE FEET
Saccarappa	Westbrook	I	S. D. Warren Co.	1350	0	1350	0
Dundee	Gorham	I	S. D. Warren Co.	2400	0	2400	0
North Gorham		U	Central Maine Power Co.	2250	0	2250	0
Eel Weir	Standish	I	S. D. Warren Co.	1800	0	1800	0
——	Windham	—	Lawrence Smith	25	0	25	0
TOTALS				7825	0	7825	0
			SACO RIVER BASIN				
Saco	Saco	I	Saco Tanning Co.	900	0	900	0
Cataract	Biddeford	U	Central Maine Power Co.	6650	0	6650	730
Skelton	Dayton	U	Central Maine Power Co.	22000	0	22000	3630
Bar Mills	Hollis	U	Central Maine Power Co.	4000	0	4000	0
West Buxton	Buxton	U	Central Maine Power Co.	6600	0	6600	0
Bonny Eagle	Standish	U	Central Maine Power Co.	7200	0	7200	2320
Kezar Falls	Parsonsfield	I	Ye Olde Woolen Shoppe - John Garner	350	0	350	0
Hiram	Baldwin	U	Central Maine Power Co.	2400	0	2400	0
——	Newfield	I	Rockhaven Realty Co.	45	0	45	0
TOTALS				50145	0	50145	6680
			SAINT CROIX RIVER BASIN				
Milltown	Saint Stephen, New Brunswick	U	New Brunswick Power Commission	3000	0	3000	0
Woodland	Baileyville	I	St. Croix Paper Co.	2250	7700	9950	0
Grand Falls	Baileyville	I	St. Croix Paper Co.	9650	0	9650	88000
TOTALS				14900	7700	22600	88000

INVENTORY OF EXISTING HYDRO-POWER PROJECTS (continued)

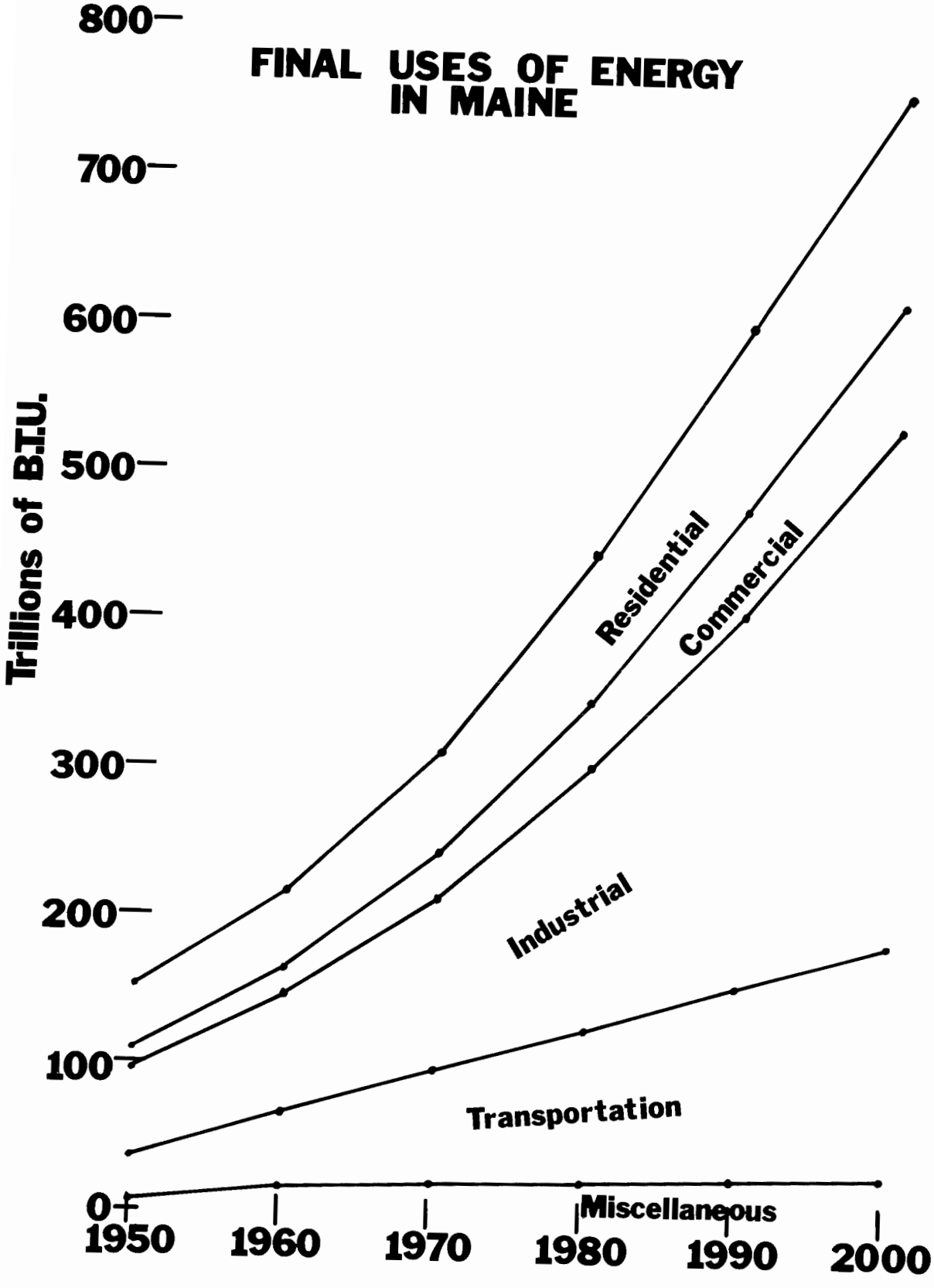
SAINT GEORGE RIVER BASIN

PROJECT NAME	LOCATION	OWNER CLASS	OWNER	ELECTRIC POWER KW	HYDRO-MECHANICAL POWER KW	TOTAL POWER CAPACITY KW	USABLE STORAGE * IN ACRE FEET
— —	Union	I	Thurston Brothers	80	0	80	0
TOTALS				80	0	80	0
			SAINT JOHN RIVER BASIN (Aroostook River)				
Tinker	Aroostook, New Brunswick	U	Maine Public Service	34640	0	34640	0
Caribou	Caribou	U	Maine Public Service	800	0	800	0
Squapan	Masardis	U	Maine Public Service	1500	0	1500	58600
TOTALS				36940	0	36940	58600
			UNION RIVER BASIN				
Ellsworth	Ellsworth	U	Bangor Hydro-Electric Co.	9000	0	9000	0
TOTALS				9000	0	9000	0
GRAND TOTALS				585235	64170	649405	1321690

Major Steam Generating Stations

Owner	Station	Location	Capacity KW.
Maine Yankee Atomic Power	Maine Yankee	Wiscasset	855,000
Central Maine Power	Cape	South Portland	21,000
	Mason	Wiscasset	130,000
	William F. Wyman	Yarmouth	340,000
Bangor Hydro-Electric	Graham	Veazie	48,000
Maine Public Service	Caribou	Caribou	17,000
			1,411,000
	Major Diesel Generating Stations		
Central Maine Power	Islesboro	Islesboro	300
	Rockland	Rockland	1,900
	Peaks Island	Portland	1,600
Bangor Hydroelectric	Milford	Milford	2,000
	East Machias	East Machias	2,000
	Eastport	Eastport	4,000
	Medway	Medway	8,000
	Bar Harbor	Bar Harbor	8,000
Maine Public Service	Caribou	Caribou	8,000
	Houlton	Houlton	1,000
	Flo's Inn	Presque Isle	5,000
			41,800
	Major Gas Turbine-Generating Stations		
Central Maine Power	Cape	South Portland	32,000
	Farmingdale	Farmingdale	4,500
Bangor Hydroelectric	Graham	Veazie	12,000
			48,500
		Grand Total	1,501,300

Chart 5



AFTER: Shipman & Veazie

TABLE 23 *DATA ON UNDEVELOPED HYDRO-ELECTRIC POWER PROJECTS*

†: Engineering News Record, cost index. March 21, 1974 pp. 62-63

* Data are not provided by NENYIAC. Source is unpublished fact sheet, U.S. Army Corps of Engineers.

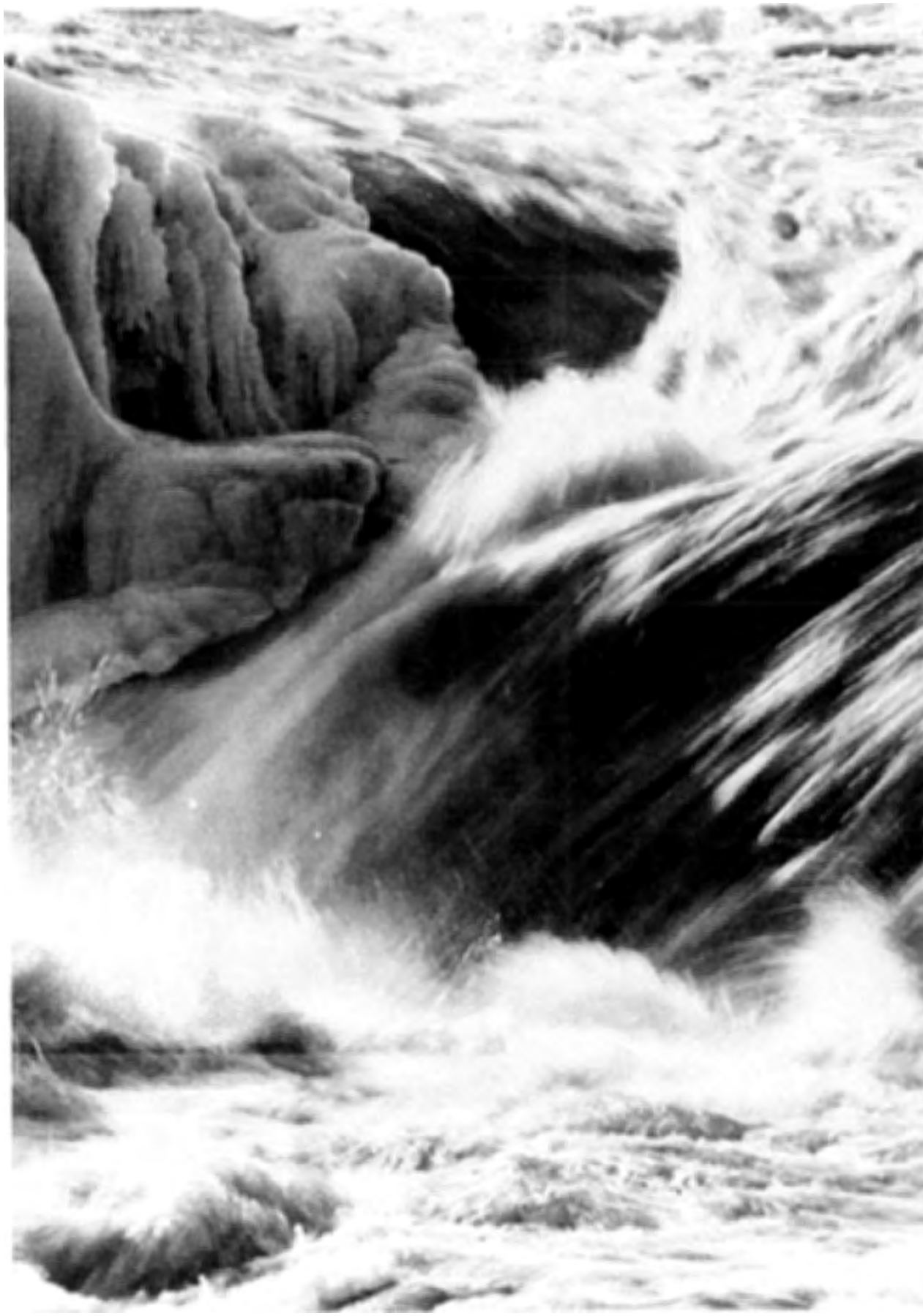
Source NENYIAC Subregion A

BASIN PROJECT	CAPACITY IN MEGAWATTS	ANNUAL GENERATION GIGAWATT HRS	PERCENTAGE LOAD FACTOR	FIRST COSTS 1949 BASE ENR†= 475 (Thousands $)	FIRST COSTS 1974 BASE ENR†= 1950 (Thousands $)
SAINT JOHN RIVER BASIN					
Dickey*	760.0	800.0	12	——	419,000
Lincoln*	70.0	420.0	68	——	
Fish River Lake (Storage)	——	——	——	2,120	8,700
St. Froid Lake (Storage)	——	——	——	2,605	10,600
Fish River Falls	7.5	31.7	48	3,110	12,700
Masardis (Storage)	——	——	——	8,120	33,000
Castle Hill	18.0	70.7	45	5,885	24,000
TOTAL	855.5	1302.4	57	21,840	508,000
PENOBSCOT RIVER BASIN					
Arches	22.5	94.3	78	10,092	41,000
Sourdnahunk	24.0	109.5	52	11,386	47,000
Debsconeag	15.0	69.0	53	8,774	36,000
Allagash Lake (Storage)	——	——	——	547	2,000
Grand Pitch	5.0	22.3	51	2,878	12,000
Grand Lake	15.0	58.9	45	12,849	55,000
Grand Falls	6.0	28.1	54	2,989	12,000
Whetstone Falls	30.0	116.7	45	28,739	119,000
Meadow Brook	12.0	48.6	46	7,589	31,000
Stratton Rips	40.0	170.1	49	44,222	180,000
Bonnie Brook	20.0	76.5	44	13,611	54,000
Winn	12.0	89.2	85	8,701	36,000
Mohawk Rapids	8.0	61.6	88	9,711	39,000
Bangor Diversion	——	——	——	52,259	215,000
Sunkhaze	12.0	94.6	90	——	——
Diversion	40.0	223.0	64	——	——
Basin Mills	12.0	93.2	89	6,888	28,000
TOTALS	273.5	1,355.6	57	221,235	907,000

DATA ON UNDEVELOPED HYDRO-ELECTRIC POWER PROJECTS (continued)

Source NENYIAC Subregion A

BASIN PROJECT	CAPACITY IN MEGAWATTS	ANNUAL GENERATION GIGAWATT HRS	PERCENTAGE LOAD FACTOR	FIRST COSTS 1949 BASE ENR = 475 (Thousands $)	FIRST COSTS 1974 BASE ENR = 1950 (Thousands $)
KENNEBEC RIVER BASIN					
Moosehead	24.0	66.7	32	10,093	41.000
Cold Stream	90.0	259.4	33	29,799	120,000
The Forks	48.0	166.3	40	28,180	115,000
Grand Falls (Storage)	— —	— —	— —	11,902	48,000
Pierce Pond	180.0	459.0	29	49,102	200,000
North Anson	10.0	54.3	60	6,405	26,000
Madison	24.0	146.8	70	7,772	32,000
Greenleaf	10.0	41.6	48	11,329	46,000
TOTALS	386.0	1,194.1	35	154,582	628,000
ANDROSCOGGIN RIVER BASIN					
Aziscohos	10.0	49.1	57	3,558	15,000
Errol	24.0	56.8	37	14,687	60,000
Norridgewock	22.5	53.6	37	8,840	36,000
Pontook	12.0	88.4	74	6,457	26,000
Pulsifer Rips	6.0	42.6	81	3,555	15,000
Gilead	8.0	56.6	81	8,818	36,000
Dixfield	10.0	49.3	56	7,061	29,000
TOTALS	92.5	396.4	49	52,976	217,000
SACO RIVER BASIN					
Great Falls	40.0	87.2	40	26,866	109,000
Steep Falls	15.0	47.7	27	7,248	30,000
TOTALS	55.0	134.9	28	34,114	139,000
UNION RIVER BASIN					
Ellsworth Falls	4.0	10.2	29	2,449	10,000
TOTAL	4.0	10.2	29	2,449	10,000
GRAND TOTALS	1666.5	4,393.6	33	487,196	2,391,000



Tom Jones/Maine Times

ST. JOHN RIVER BASIN
1. Dickey-Lincoln School Lakes
2. Fish River Falls
3. Castle Hill

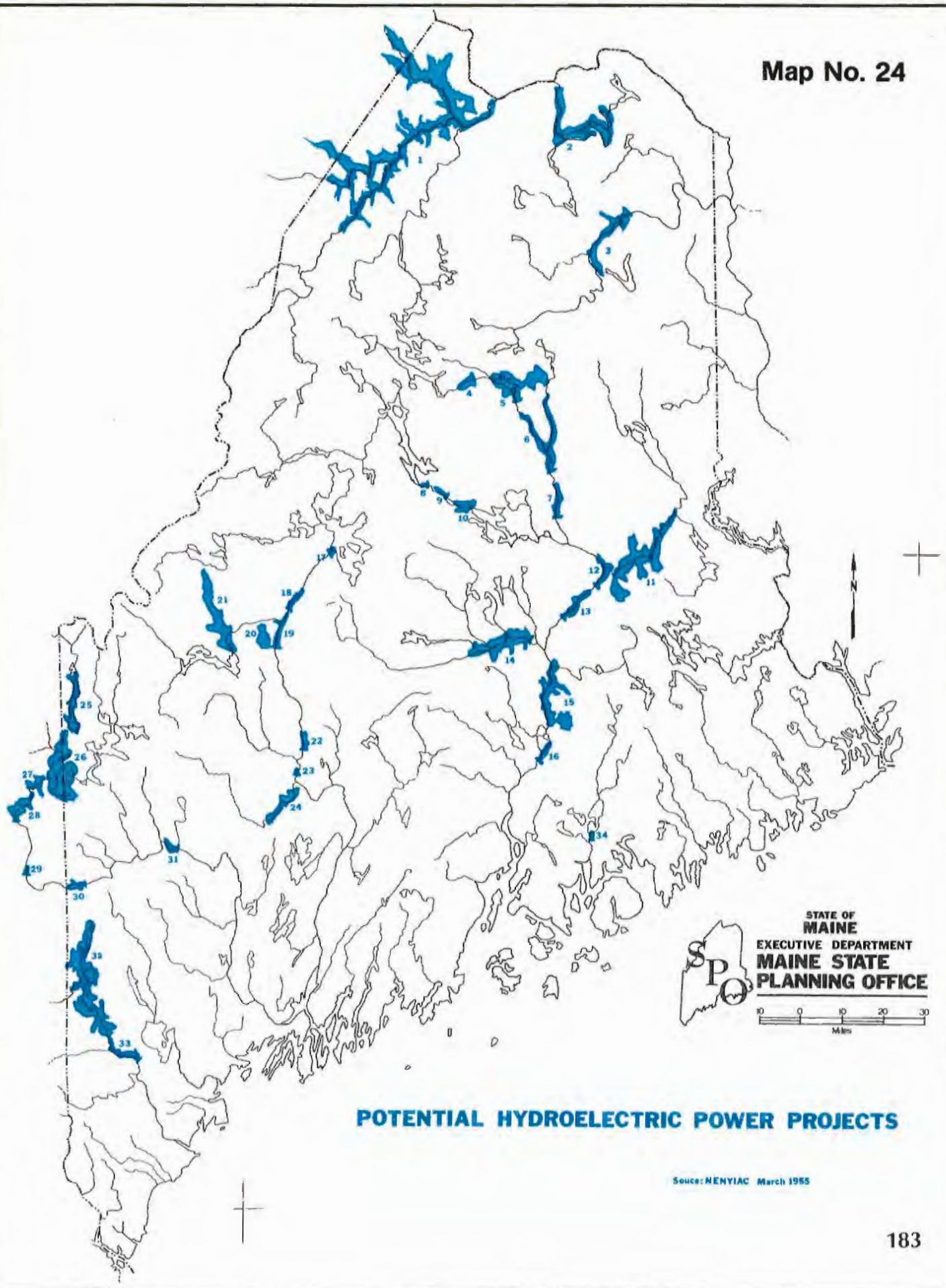
PENOBSCOT RIVER BASIN
4. Grand Pitch
5. Grand Lake Diversion
6. Whetstone Falls
7. Meadow Brook
8. The Arches
9. Sourdnahunk
10. Debsconeag
11. Stratton Rips
12. Winn (Five Islands)
13. Mohawk Rapids
14. Bonnie Brook
15. Bangor Diversion
16. Basin Mills

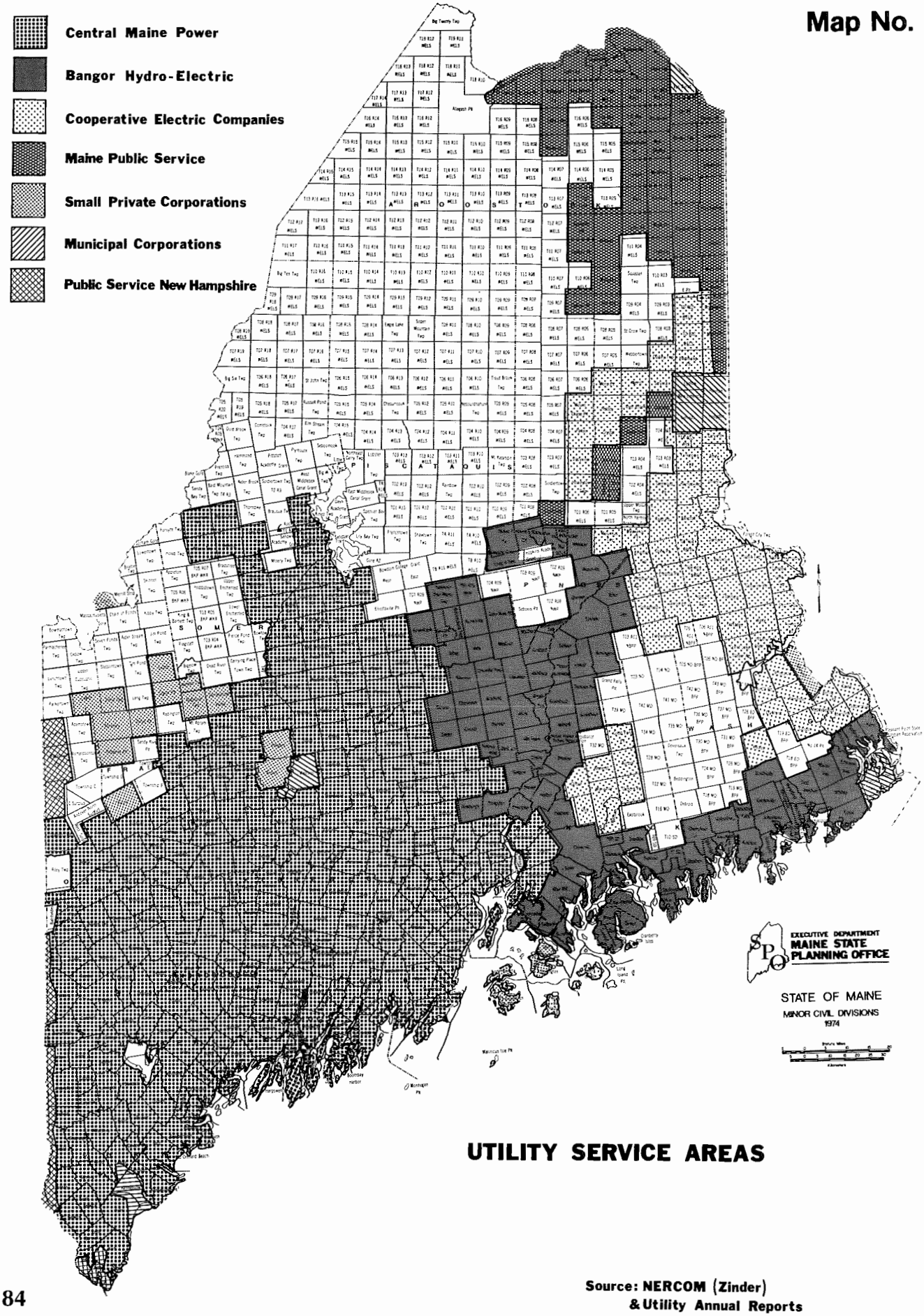
KENNEBEC RIVER BASIN
17. Moosehead Lake
18. Cold Stream
19. The Forks
20. Pierce Pond
21. Grand Falls
22. North Anson
23. Madison
24. Greenleaf

ANDROSCOGGIN RIVER BASIN
25. Aziscohos
26. Errol
27. Mollidgewock
28. Pontook
29. Pulsifer Rips
30. Gilead
31. Dixfield

SACO RIVER BASIN
32. Grand Falls
33. Steep Falls

EASTERN COASTAL AREA
34. Ellsworth Falls


Map No. 24
STATE OF
MAINE
EXECUTIVE DEPARTMENT
MAINE STATE
PLANNING OFFICE
SPO
10 0 10 20 30
Miles
N
POTENTIAL HYDROELECTRIC POWER PROJECTS
Souce: NENYIAC March 1955



UTILITY SERVICE AREAS

Source: NERCOM (Zinder)
& Utility Annual Reports

UTILITY SERVICE AREAS

POWER CORPORATIONS — Source: Utility, Annual Report

1. -Bangor Hydro-electric Co. -Bangor
2. -Carrabassett Light & Power Co. - North Anson
3. -Central Maine Power Co. - Augusta
4. -Maine Public Service Co. - Presque Isle
5. -Matinicus Light & Power Co. - Vinalhaven (Matinicus)
6. -Public Service Co. of New Hampshire - Manchester, N.H.
7. -Rangeley Power Co. - Rangeley
8. -Stonington & Deer Island Power Co. - Stonington
9. -Vinalhaven Light & Power Co. - Vinalhaven
10. -Woodland Water & Electric Co. - Baileyville

COOPERATIVE ELECTRIC COMPANIES

11. -Eastern Maine Electric Coop, Inc. - Calais
12. -Isle Au Haut Power Co. - Isle Au Haut
13. -Swans Island Electric Coop - Minturn, Me. (Swans-Isle)
14. -Union River Electric Coop - Aurora

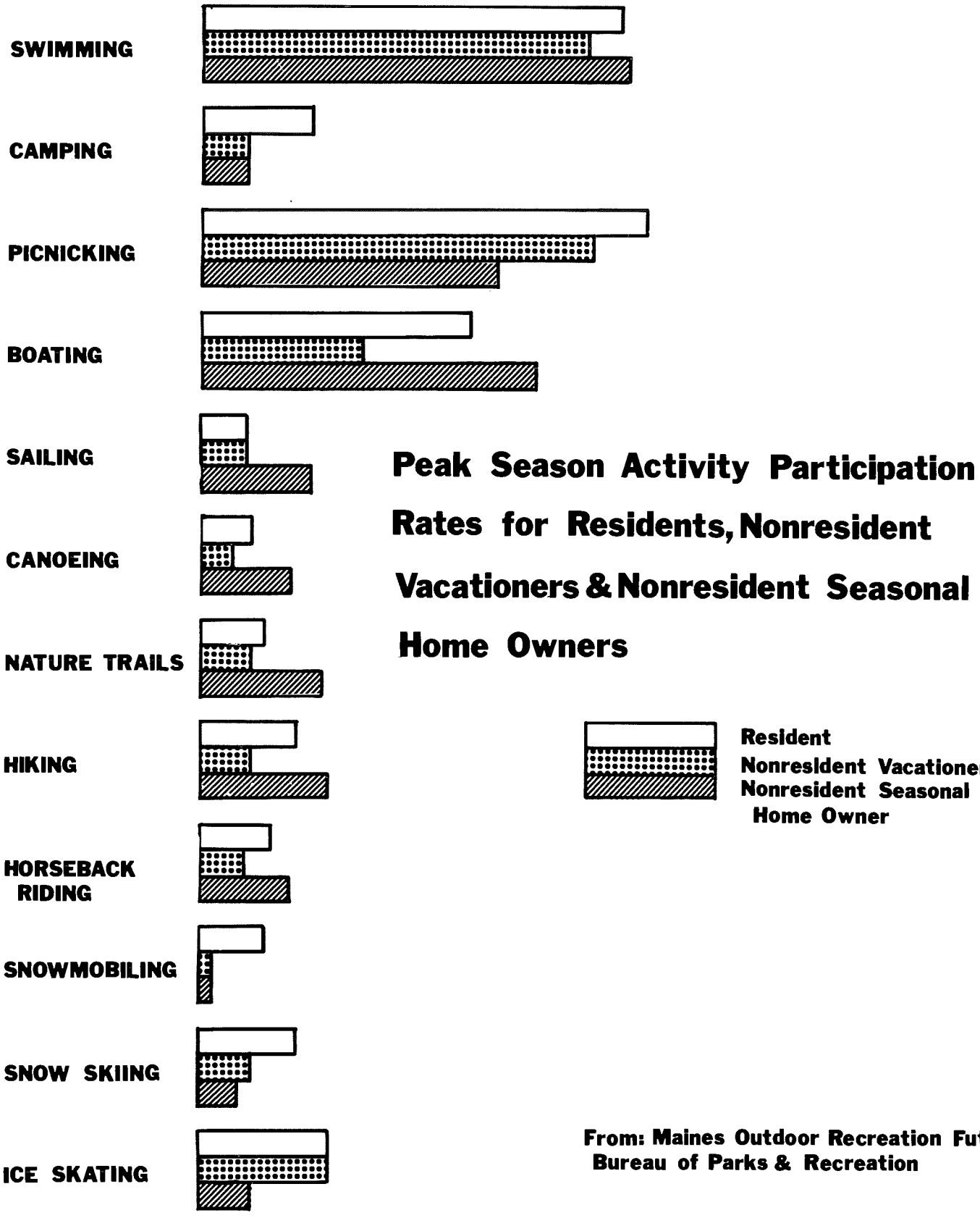
QUASI-MUNICIPAL CORPORATIONS

15. -Houlton Water Co. - Houlton
16. -Lubec Water & Electric District - Lubec
17. -Squirrel Island Village Corp. - Squirrel Isle
18. -Van Buren Light & Power District - Van Buren

MUNICIPAL DEPARTMENT

19. -Kennebunk Light & Power District - Kennebunk
20. -Madison Electric Works - Madison

Chart 6



Peak Season Activity Participation Rates for Residents, Nonresident Vacationers & Nonresident Seasonal Home Owners

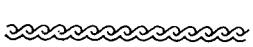
From: Maines Outdoor Recreation Future
Bureau of Parks & Recreation

G. Recreation

To many people living in the northeastern states, Maine is regarded as the premier place for recreation as evidenced by the peak-seasonal population generally running 50% over the resident population and with total out-of-state visitor days now over 11,000,000 annually. The summer period of intense nonresident visitation for recreational purposes is well known to all residents (and not without mixed feelings and occasional remarks about the "summer complaint"). The service of recreation is big business and is second only to the forest products industry. The qualities of climate, landscape and water combine to create a superior setting for recreation of all kinds. Climate is clear-cut into four seasons, which greatly enhances recreational activities. The coastal and inland landscapes are of the highest quality in the North Atlantic Region.[1] People seeking recreation are especially attracted to water and seek to be in approximation to the coast and inland lake areas, for which Maine is specifically renowned. Recreation, therefore, deserves important consideration within the concept and framework of water resources planning.

Recreation broadly defined is activity or planned inactivity through one's volition rather than compulsion or necessity. Outdoor recreation is of chief concern with respect to water resources, and in this chapter, fishing and hunting are essentially excluded to be discussed in the following chapter.

Chart 6 summarizes outdoor recreation activity for residents, nonresident vacationers and nonresident seasonal home owners for 1970. It is apparent that all of these activities require a proper land and/or water setting. Some require rather specialized facilities while others make us of generally undeveloped land and access to appropriate lakes and streams. Some require small land or water areas such as camping and swimming while others require large areas such as hiking, snowmobiling, and boating and canoeing. A very thorough description[2] of outdoor recreation in Maine has been prepared by the Bureau of Parks and Recreation in the Department of Conservation. The present setting is described, needs defined and proposals to meet needs offered to meet requirements of Federal, state, local and private recreational programs. The plan projects to 1980, noting that $114 million are needed for Federal, state and locally sponsored projects designed to fulfill recreational needs. Funding for these programs is estimated to be about one-half this amount, signaling the distinct prospect that satisfaction of demand will fall behind significantly by 1980.



[1] North Atlantic Regional Water Resources Study. 1972. Appendix N. Visual & Cultural Environment, North Atlantic Regional Water Resources Study Coordinating Committee.

[2] Maine's Outdoor Recreation Future (Summary Report), and Maine Comprehensive Outdoor Recreation Plan. 1972. Department of Parks & Recreation, State of Maine.

There are many elements of Maine society besides recreation planners and managers that deplore this situation in part because recreational needs will not be satisfied and in part because land not devoted for these purposes might be developed for other purposes, diminishing the open space character of the State. While on one hand an extreme group would oppose land acquisition by public and private managers for recreational purposes on the grounds that it would increase the now considerable "summer hordes", a far larger segment favor such acquisitions as a means to preserve the rural character of the State; that is, a feeling that it should be preserved because it is there. The technical analysis by the researchers on visual and cultural environment in the NAR report to show that much of Maine is of high-quality landscape is fully understood by most Maine people as a commonsense conclusion from observation of surroundings. A similar viewpoint is implied in the summary report of the State Comprehensive Outdoor Recreation Plan (SCORP) when noting the gap in projected funding to fill projected needs by the statement "that the Federal government increase their allocation to Maine for the acquisition and development of new Federal park areas and/or expansion of existing areas...and has this responsibility because of the abundance of nationally significant areas in Maine".

Land areas significant to recreational activities of the sort shown in Chart 6 are necessarily developed as service areas for these activities ranging from intensely managed swimming beaches or camping and picnic areas to simple trails for hiking. There is considerably more land of unique significance only if it remains preserved in its present state to retain functional and cultural quality setting for recreation. The several categories are as follows:

1. Unique Natural Areas
2. Wilderness Areas
3. Coastal and Inland Islands
4. Coastal Shoreline
5. Historic and Archaeological Sites
6. Wildlife Areas

There are programs involving both public and private investment for the purpose of acquiring or otherwise securing these lands for management to protect or enhance their specific features. The U.S. Forest Service can acquire land for National Forest and relegate certain portions to wilderness. A first inventory of unique natural areas was prepared in 1972 and was the basis for the passage of the "Act Establishing a State Register of Critical Areas" in 1974 which assigned responsibility for compilation to the State Planning Office. Nature Conservancy or other private organizations have made significant island acquisitions. Federal appropriations are granted specifically for acquisition and protection of major coastal wetlands and also for purchases of noted historic sites. That a deficit in public investment to meet recreational needs for 1980 is forecast probably means that this class of sites mainly for satisfaction of passive recreation will be underfunded and priority given for acquisition of areas for active recreation sites. But the program proposed for this class of sites would be a small fraction of what should be preserved, in the

opinion of many, in terms of what is available presently of such high quality. Just who are the many, desiring a very strong environmental quality objective be met, is presently difficult to determine from which to make public policy. A significant move in this direction would require massive Federal funding for the large land acquisitions required. A consequence of this prospect would be a formal designation of Maine as a recreational playground for the northeastern states.

Part of the problem is the postulate that proper protection for the use desired of recreational land can come only through fee simple acquisition. The attitudes favoring fee simple acquisitions for recreation run into the overwhelming fact that most undeveloped land is in private ownership and managed primarily for harvest of trees for processing and manufacture of forest products. In spite of this situation Maine has lagged behind other states in developing formal policy of partial acquisition such as easements to secure publicly desired land use on specific tracts, or to control land use through systems of zoning. However, public land acquisition is going on, using both fee simple and easement methods, shoreland zoning along lakes and streams has been established, the Land Use Regulation Commission has been established to set up zoning for unorganized territories and the major landowners have formal policies to allow recreational use of their land. It would often appear that ideological viewpoints and positions magnify disputes and obscure the fact that the groundwork has been laid for resolution of the large problem of maintaining the high visual and cultural quality of Maine as a setting for recreation without being forced to rely upon large sums for fee simple acquisition. Since it is unlikely that public funding of the magnitude deemed desirable will be forthcoming, the program of alternative approaches to the problem seems indicated.

Since great ponds (those over ten acres) are public property they are available for all recreational purposes. While access to great ponds is not to be denied to those who would walk through unimproved property to reach these ponds, it is evident that public investment is necessary to secure more practical means of access. This approach to the problem has been understood for a long time, and land acquisition for swimming and boating access has generally enjoyed a priority status and will continue to do so.

Protection of river fronts and securing access to rivers for recreational purposes does not enjoy the status of common law, as riparian landowners on rivers may have title to the "thread of the stream" or all of the stream bed if one owner owns both banks. It is well known that river fronts have been perversely protected because water quality in many rivers and streams is low enough to repel users seeking recreation. It is commonly agreed by many that once water quality is improved through installation of sewage treatment plants for major point sources of water pollution, recreational demand for river use will be created, as evidenced by increasingly heavy use of the Saco River located in a relatively dense population area in Maine, and a river that has not been subject to severe environmental degradation.

In 1966 the people of Maine voted to establish the Allagash Wilderness Waterway to secure the Allagash River for recreational use. A bond issue was authorized to acquire bankside land along the river and several major headwater lakes, including Allagash and Chamberlain Lakes which formerly drained into the Allagash River Basin. Management of the Waterway is conducted by the Bureau of Parks and Recreation in the Department of Conservation. While some wilderness purists have decried the designation and management of the river as inviting too much demand and defeating certain wilderness concepts, the program has succeeded in securing the river for recreational purposes and it serves its purpose for several thousand people annually.

Attention was directed to the Saco River in an attempt[1] to show the recreational potential of this river and determine means to develop this potential. Essentially a "river corridor" approach was proposed concentrating upon land use controls on significant river banks and could be used as a guide for similar approaches for other river systems. Out of this report came an "Act to Create the Saco River Environmental Advisory Committee" in 1971. This Committee through funding from the State Planning Office developed in more detail a specific program[2] for land use control on the Saco, Ossipee and Little Ossipee Rivers. Furthermore the Legislature created a formal Saco River Authority which is presently engaged in implementing the program recommended by the Advisory Committee. Also a Corridor Plan[3] for the Kennebec River has been published recently.

The Federal Wild and Scenic Rivers Act of 1968 (P.L. 90-542) is another means to protect and enhance recreational activities on rivers. Under this Act rivers may be studied and evaluated for possible inclusion into the national system to receive legal classification and protection according to appropriate action by the states. There are three classes of river areas as described in the Act representing three levels of wilderness and management objectives:

1. Wild river areas -- Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

2. Scenic river areas -- Those rivers or sections of rivers that are free of impoundments, with shorelines of watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

[1] Saco River Corridor Open Space and Recreational Potential. 1969. James S. Haskell, Maine Parks and Recreation Commission.

[2] The Saco River Corridor. 1973. Carl H. Laws, The Saco River Advisory Committee.

[3] Kennebec River Corridor Plan. 1974. E. Lyle Flynn, Jr. and Russell Jacobsen, North Kennebec Regional Planning Commission.

3. Recreational river areas -- Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundments or diversion in the past.

The State of Maine established the Allagash Wilderness Waterway in advance of this Federal Act which contained a specific provision that the Allagash be included in the national system should Maine so desire. This matter was accomplished.

The Federal Bureau of Outdoor Recreation was charged in the Act with responsibility to study a number of rivers as potential additions to the national system including the East and West Branches of the Penobscot River. The Bureau accomplished a field study of these rivers during the summer of 1974 and projects completion of its report by mid-1975.

Within the criteria of the Act a fairly long list of rivers could become designated based upon their present undeveloped character. It is unlikely that the Bureau of Outdoor Recreation could undertake study of more potential rivers within the foreseeable future in Maine. Such a study would be the responsibility of the State should it be determined that a state system of wild and scenic rivers be established. Throughout the nation those rivers so far studied and designated have flowed through public lands so that the matter of bankside land use control is assured. The study of the East and West Branches of the Penobscot River was the first involving rivers flowing through privately held lands, as would be the case for other rivers to be studied in Maine. Whether bankside lands should be acquired in fee simple as they were for the Allagash Wilderness Waterway, or otherwise subject to land use regulation to meet criteria as wild, scenic or recreation classification is a large matter. As in the case of other recreational land preservation proposals, the tools are at hand for accomplishing such land use controls for banks of some of our significant wilderness river systems.

H. Fish and Wildlife

Fish and wildlife are of fundamental economic and cultural importance in American society and form a significant element in any comprehensive consideration of water and related land resources. The term is generally confined to natural vertebrate fish, amphibian, reptilian, bird and mammal species and certain invertebrates such as clams, oysters, lobsters or shrimps, the invertebrates often classed collectively as "shellfish".

Fish and wildlife certainly bring economic benefits as sources of food. There is also an economic contribution from recreational hunting and fishing, even discounting the value of food obtained. A cultural contribution comes from a rather deep-seated psychological and philosophic evaluation of fish and wildlife as an element of our surroundings out of which may develop a refined reverence for life and a proper diminution of strongly held anthropocentric viewpoints. In this view all species of plants and animals are valued as intrinsic components of the living part of the planet and should not be destroyed through man's intentional or inadvertent activities upon the environment. Species extinction may or may not have major influence upon the remaining environment, but when brought about by man's activities it is considered a cultural disaster. The great attention to the welfare of the whooping crane, of which here are only four dozen or so, is an example of such philosophic concern. It would appear, however, that there is a policy to destroy certain insect parasites and bacterial species causing damage and disease to higher plants, animals and humans.

The thinly populated, largely undeveloped character of Maine appeals to many people in the northeastern states as a superb setting for fish and wildlife, as it does for other forms of outdoor recreation. The sharp climatic gradient from southeastern New England through Maine brings about a markedly different species composition of both plants and animals from that observed in the remainder of the northeastern states. Just to see wild stands of spruce and fir trees, for example, as one enters Maine offers a strikingly different and refreshing change of landscape. The loon, raven, great horned owl, bear, moose, fisher, marten, and landlocked and anadromous Atlantic salmon are other species whose presence creates enthusiasm for Maine among many people. It should be remembered that Maine is not a wilderness in the manner of Alaska, northern Canada, Siberia or the Amazon River Basin. While about 90% of the land is in forest, very little if any is primeval and nearly all is currently managed for harvest of trees for forest products. While settling by colonials and opening up the former climax forest of conifers may have been detrimental to the welfare of a number of species, the greater variety and dynamic character of succeeding subclimax vegetation that is now not allowed to go to climax has brought about considerable increase in the number of plant and animal species and greater population of many of these species.

Traditionally, public and private institutional attention to fish and wildlife has concentrated on management of commercial and recreational fishing, hunting and trapping to insure optimum returns for these activities. From the ocean are harvested a great variety of finfish and shellfish species with lobster fishing and clam digging gaining the most attention of the general public. Coming in from the ocean are species of fish that reproduce in inland waters. There is considerable interest in the annual runs of alewives into certain large lakes near the coast and of Atlantic salmon into several Maine rivers, the only ones in the United States used by Atlantic salmon. Recreational fishing of inland waters is a very large activity with more than 250,000 fishing licenses sold each year. Anglers have thousands of lakes and ponds and thousands of miles of rivers and streams available for their sport. Maine has by far the largest cold water fishery of any eastern state comprising essentially brook trout, lake trout (togue) and landlocked Atlantic salmon. The inland salmon fishery is nearly unique in Maine and the Canadian Maritimes despite attempts to establish these fisheries through stocking over much of the nation. Hunting for waterfowl, upland birds and especially deer is a major activity during the fall season. Map 26 shows the number of deer harvested in 1970 for each minor civil division. This harvest total is average for the past decade. The large amount of undeveloped forest land enables people to hunt under "classical" conditions. In these times of high population and intensive land use through much of the northeastern part of the nation, Maine offers a rare and unique experience.

Many people have always been interested in nonconsumptive forms of recreation relating to fish and wildlife. These interests range from simple aesthetic enjoyment of natural surroundings to complex scientific studies of fish and wildlife species and their relationships to the environment. Observation of birds and photography of all wildlife enjoys great popularity. While the Fish and Game Department was originally created to manage inland fish and wildlife species for the benefit of sport fishing and hunting, attention to the nonconsumptive aspects of fish and wildlife was not neglected. This agency was a leader in the matter of general conservation of natural resources. In Maine the Departments of Inland Fisheries and Game and Marine Resources have long held a policy favoring attention to conservation of all fish and wildlife species. In the modern age of environmental awareness, these departments have been increasingly recognized for their activities in this direction.

While many believe that Maine will remain relatively undeveloped for some time into the future, there is generally some complacency about the future welfare of fish and wildlife. However, there is certain to be greater development occurring in the State especially in the southern portions and on those lands adjacent to water where impact of changing land use will be significant to these waterways. Consequently, the land and water which provide food and shelter for fish and wildlife will decrease as man develops these areas. The area in which fish and wildlife is found is called habitat. Habitat quality is dependent upon the ability of an area to provide necessary

food, water, cover and spatial requirements. The building of roads, buildings and factories with land cleared in surrounding areas and relandscaped with mowed turf and scattered ornamental trees and shrubs destroys the quality of habitat for many native species. Unregulated timber harvests may cause the destruction of critical fish and wildlife habitat through siltation or removal of stream bank cover. Use of certain pesticides can result in direct losses of species at the time of spraying or can build up in the food chain causing population reductions years after the initial application. Pollution of rivers leads to pollution of ocean water and forces the closure of clam flats.

Management of inland fish and wildlife resources to insure their perpetuation and enjoyment by people is carried out by the Department of Inland Fisheries and Game and by the Department of Marine Resources for intertidal land and water and territorial ocean water. Both departments use licensing and regulations to control harvest. Up-to-date research and management techniques are also employed to assure species perpetuation.

Several of the major problem areas and programs for management are described as follows:

1. Fishing, Extraterritorial Waters. While beyond State and National jurisdiction, it is the foremost problem area in fish and wildlife management. Up to rather recent times most people believed that the ocean held an infinite fisheries resource which could be harvested to meet food needs without danger to the species involved. The decline in whales has been spectacular, and the diminution of the great fisheries of the historic fishing banks off Maine and the Canadian Maritimes has declined for some species to the point of no return, both through uncontrolled overharvesting. Resolution of this very important matter will require much research and international agreement on policy and regulations to regulate harvest to allow rejuvenation and indefinite perpetuation of these fisheries.

2. Fishing, Territorial Ocean Waters. Fishing within territorial waters out about 12 miles from land, according to international convention, is restricted to citizens of each nation abutting such waters. Maine residents have rights to fishing for some species out to the twelve-mile limit, but for most species rights extend only to the three-mile limit. Regulation is an imposition upon former policies of "freedom of the seas" and is not easy to implement where needed. The lobster industry is the prime example of a steadily increasing harvest pressure through heavy demand for Maine lobster upon a finite resource. This problem may become more acute in view of the prospect that natural production will fall to very low levels in response to a lowered mean water temperature during the next 15 years, brought about by rhythmic climate cycles, according to some authorities.[1]

[1] The Gulf of Maine as a Research & Experimental Area. 1968. Robert L. Dow. Conference Proceedings Aquacultural Advisory Committee, National Academy of Science.

3. Clam Digging, Intertidal Lands. The common law traditions permit free public access and harvest of various wildlife resources from intertidal lands, creating an obstacle to institution of public means to regulate harvest. However, this is modified by exclusive rights to town shellfisheries granted by the Legislature. Some towns restrict the fisheries to residents and regulate amount, location and time of harvest. Like lobster fishing, clam digging is almost entirely an individual enterprise, and at low tide a large number of people go digging in response to high demand for clams. The application of techniques to rear clams and lobsters in confined areas where management techniques could be applied to increase production greatly is a difficult undertaking in view of traditional common law promoting freedom of the seas. It is safe to predict that the legislative and judicial process to allow farming of the seas will continue to lag behind technologic means for its accomplishment.

4. Anadromous Fisheries. Settlement along the Maine coast and Canadian Maritimes region in precolonial times was possibly strongly dependent upon anadromous fisheries as a basic food resource. Anadromous fish are species that live in the ocean and ascend rivers and streams to reproduce. The productivity of the ocean permits greater growth and general production of these fisheries than would be possible in inland waters. Their dense concentration in rivers during a specific season of the year for spawning presents a convenience for harvesting uncommon among other fisheries. Atlantic salmon, striped bass, sturgeon, sea-run brook trout, shad, alewife and smelt were major anadromous fisheries in this region. All of them suffered spectacular decline when colonial settlement occurred, with construction of dams that blocked off spawning runs and later with pollution that rendered rivers uninhabitable to these fisheries.

Restoration of these fisheries in Maine has long been a goal because of the opportunity that anadromous fisheries offers for better sports fishing and especially for improvement of commercial fishing. Restoration appears possible since there are small to sizeable remnants of all these species that would increase once proper conditions were restored to rivers. Table 27 lists rivers and streams that have existing anadromous fisheries or have potential for restoration.

Restoration has been underway for some time, attacking the conditions that brought about the decline of these fisheries, namely blocking dams and poor water quality. The Department of Marine Resources has concentrated upon species other than Atlantic salmon and has installed eight fishways which have made available 5,600 additional acres of alewife habitat and increased the yield potential by 2.2 million pounds. The Atlantic Salmon Commission was created to direct restoration of Atlantic salmon to Maine rivers. Fishways have been installed in the major dams of the salmon rivers through a cooperative program by the Commission and dam owners, allowing passage to the major spawning areas upstream. Stocking is believed necessary for successful restoration of Atlantic salmon, and an expanding rearing and stocking program is in operation. The major rivers of Hancock and Washington counties are beginning to yield more salmon as the program continues. The Penobscot

River is the key river in the program and receives major attention because of the potentiality to restore a good part of the large salmon fishery formerly present. The major dams have had fishways installed and an increasing number of salmon are being reared and stocked into headwaters. Greater success awaits pollution abatement in the river since pollution loads during summer can drive oxygen levels below that in which salmon can survive. Full success will depend upon completing adjustment of river basin management to account for welfare of the salmon fishery. There is a State policy for restoration, but it is difficult to implement in the absence of a comprehensive river basin planning process.

5. Inland Fisheries. Management of inland fisheries is a large program since fresh water fishing is so popular and remains so in the recent period of environmental awareness and negative feelings about harvesting wildlife. Table 28 shows the magnitude of lake and pond fishing in Maine, these amounts and quality not possible in most other states.

The "easy" phase of management is the warm water fisheries of perch, pickerel and bass. While the native-born resident often spurns such fishing, nonresidents take to it readily, since fishing for these species is likely to be better in Maine than in their resident states. It is not widely known that bass were introduced into the state and took hold readily in whatever waters they were stocked. Bass are so prolific and aggressive that they perpetuate themselves often on introduction. It should be noted that there were only 93 bass stocked in 1973, being introduced into two ponds.

The type of fishing most sought in Maine is the cold water fisheries in lakes, ponds and streams of brook trout, rainbow trout, brown trout, lake trout, and landlocked salmon. Of special interest is the blueback trout, which in the United States is known only in 11 ponds throughout the northern part of the State. Protection of these ponds as suitable habitats is indicated since the ability to rear this species in the hatchery is as yet unknown. A very rare species is the Sunapee Trout, known worldwide in its native state only in Floods Pond in Otis, because in Lake Sunapee and other lakes it was lost when lake trout were introduced with which Sunapees can hybridize. Fortunately, this trout can be reared in the hatchery and several ponds receive stocking regularly. It is not known if these introductions will become permanent, making protection of the Floods Pond fishery imperative. The Bangor Water District received enabling legislation to withdraw water from Floods Pond for domestic supply and in addition permission to augment this supply through transfer of water into Floods Pond from other ponds. The best of these is Beech Hill Pond in Ellsworth, noted as a good lake trout fishery. Before any such transfers are permitted, safeguards against introduction of togue and warm water species should be installed.

Of interest is the practice of reclaiming ponds by killing existing fisheries with rotenone and restocking with a desired species, usually brook trout. In this manner some suitable habitat has been rendered better and these 135 ponds are very popular among fishermen.

Aside from losses of cold water fisheries through competition of introduced warm water species, habitat protection is the major problem. Water quality in lakes can become unsuitable for trout or salmon through relatively light pollution loads which consume dissolved oxygen and reduce it below the tolerance of these species. Eutrophication either through improper sewage disposal at lakeside developments or more insidiously from intensive land use practices in the lake's watershed can and does occur in Maine lakes with outright loss of trout and salmon fisheries. This is a serious problem with respect to cold water fisheries. In many instances corrective and even preventive measures are likely to be too costly, for it may well turn out that once these lakes become eutrophic to a certain level, reversal is either economically infeasible or physically impossible.

Regulation of harvest is important in cold water fisheries since they are not as prolific as warm water species, and the relatively infertile ponds they inhabit produce less poundage of fish per unit area. As an aid a large rearing and stocking program devoted almost entirely to cold water species is carried out and over 2,000,000 fish are stocked into lakes and streams annually (Table 29). Of note is the completion of a new hatchery in southern Maine for rearing brown trout for stocking in that region where fisheries are marginal for brook trout and salmon. The brown trout is more tolerant of variable water conditions and is likely to establish a more self-perpetuating fishery in such water, provided that good spawning and rearing areas are present.

6. Wetland Habitat. Eight inland and six coastal wetland types have been identified in Maine. Inland wetlands are important primarily as nesting, rearing and feeding areas for waterfowl, while the coastal wetlands serve waterfowl as resting areas for the spring and fall migration and as wintering areas. Although generally associated with waterfowl, wetlands also provide habitat for many wild animals. Mink, muskrat, beaver and otter as well as various fish depend directly on these areas for their food and shelter. Other species such as deer, hare and woodcock often inhabit areas bordering these wetlands. In addition to the previously mentioned game animals and furbearers, numerous non-game species depend on wetlands to supply some or all of their life requirements. In addition to their direct importance to fish and wildlife, wetlands serve as popular places for waterfowl hunting, bird watching, nature photography and other outdoor activities.

All coastal and inland wetlands have been inventoried and evaluated by personnel of the Department of Inland Fisheries and Game as to their importance to wildlife. Since only 16,000 acres of coastal marsh exist the Department of Inland Fisheries and Game, in conjunction with the Department of Marine Resources, supported the passage of a Coastal Wetlands Law. Although currently administered by the Department of Environmental Protection, both agencies are active in the administration and enforcement of this law.

Acquisition of coastal wetlands was initiated in the 1950's by both the Fish and Game Department and the U.S. Fish and Wildlife Service. When present acquisition projects are completed, approximately one third of the coastal salt marsh in Maine will be under State or Federal ownership.

Although Maine has in excess of 1,225,000 acres of inland wetlands (areas over ten acres in size), less than 10% of this total is considered to be quality breeding habitat for waterfowl. Increased land prices and demands for shorefront properties have encouraged filling, dredging, and other alterations of inland wetlands, which were once considered marginal development properties. Development on these marginal sites often results in reduced water quality through pollution, disruption of waterfowl breeding patterns, and loss of adjacent upland habitat as well as the direct loss of wetland wildlife habitat.

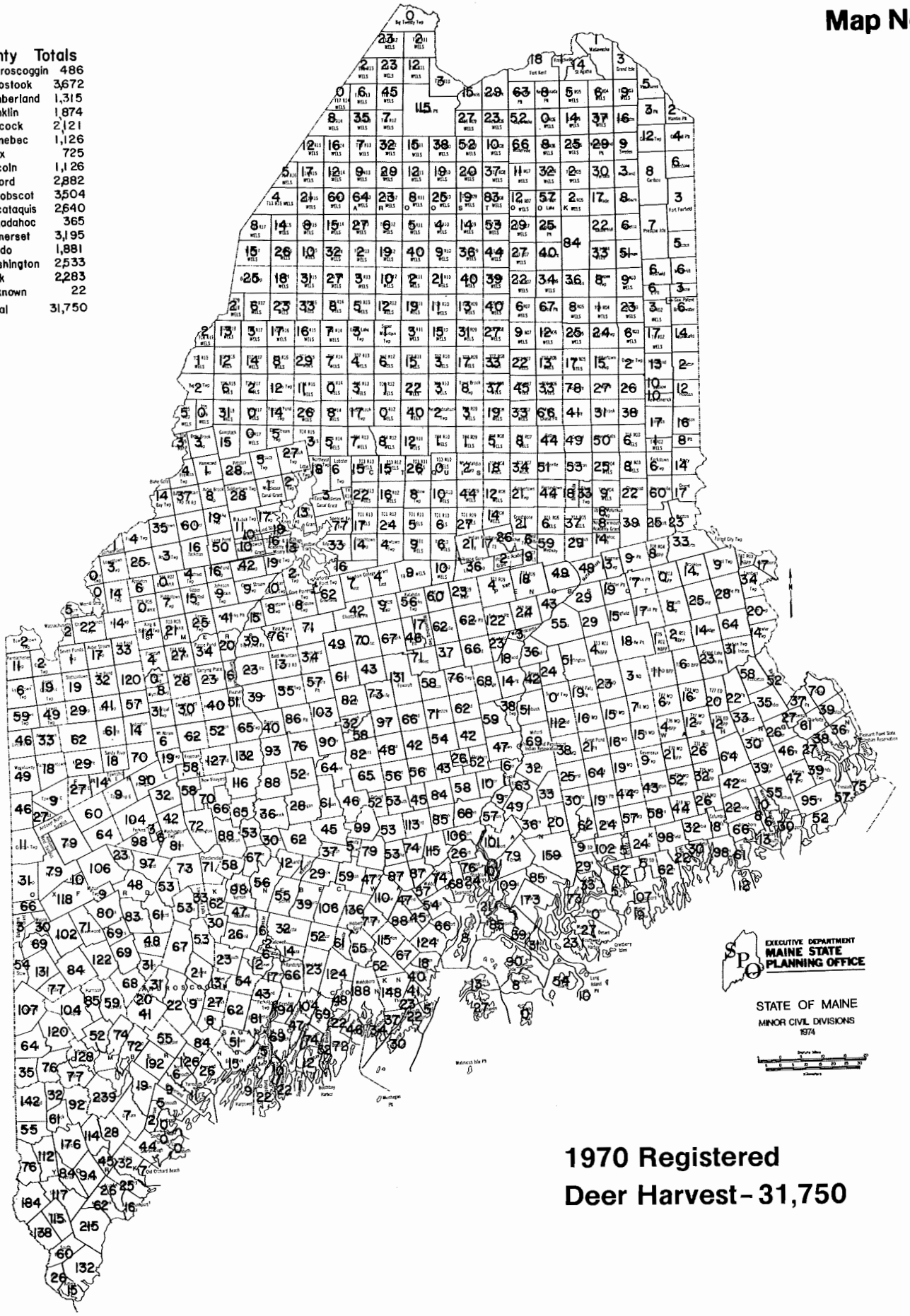
Although no specific inland wetland legislation exists, a means for protection is afforded to areas of high and moderate value through the shoreland zoning ordinance passed by the 105th Legislature, to all areas considered part of a Great Pond, and to areas covered by Title 12, the Stream Alteration Act. In addition, the Fish and Game Department owns or controls through leases over 10,000 acres of inland wetland types. Additional ownership of quality areas is needed, however, to insure future populations of wildfowl and other aquatic species.

In June, 1974, the people enacted through referendum a $4 million bond issue with which to acquire lands possessing favorable or potentially favorable habitat for wildlife. The Department of Inland Fisheries and Game is responsible for the administration of these funds and has developed plans for their disposition.

Unfortunately, little economic value is assigned to fish and wildlife resources. As noted in the earlier sections other land and water needs must be fulfilled in the future. It is likely that fish and wildlife habitat will be lost as our State develops further and the demand to satisfy these other needs is pressed into activity. Coordination of all these water resources and related land use programs will be required to insure protection of fish and wildlife habitat. While the most efficient and orderly development of water resources should be undertaken in the major river basins for the economic benefit of its inhabitants, proper allowance should also be made to provide both protection of the environment and a proper setting for outdoor recreation. While the direct economic value of open space for these purposes is not to be ignored, their value as a contribution to better quality of living is more important and is desired by most of our people.

Map No. 26

County	Totals
Androscoggin	486
Aroostook	3,672
Cumberland	1,315
Franklin	1,874
Hancock	2,121
Kennebec	1,126
Knox	725
Lincoln	1,126
Oxford	2,882
Penobscot	3,504
Piscataquis	2,640
Sagadahoc	365
Somerset	3,195
Waldo	1,881
Washington	2,533
York	2,283
Unknown	22
Total	31,750



1970 Registered Deer Harvest - 31,750

Existing and Potential Anadromous Fisheries Other Than Atlantic Salmon

Cumberland County	
Nonesuch River	Alewife, Shad
Piscataquis River	Shad
Royal River	Alewife, Shad, Smelt
Hancock County	
Union River	Alewife
Card Mill Stream	Alewife
Orland River	Alewife
Kennebec County	
Cobbosseecontee Stream	Alewife
Togus Stream	Alewife
Knox County	
Megunticook River	Alewife
Saint George River	Alewife, Smelt
Lincoln County	
Eastern River	Smelt
Damariscotta River	Alewife, Smelt
Medomak River	Alewife, Smelt
Pemaquid River	Alewife
Sheepscot River	Alewife
Penobscot County	
Penobscot River	Alewife, Shad, Smelt
Sagadahoc County	
Abagadassett River	Smelt
Kennebec River	Alewife, Shad, Smelt
Waldo County	
Ducktrap River	Alewife
Goose River	Alewife
Washington County	
Boyden Stream	Alewife
Dennys River	Alewife
East Machias River	Alewife
Machias River	Alewife
Narraguagus River	Alewife
Orange River	Alewife
Pleasant River	Alewife, Smelt
Saint Croix	Alewife, Shad, Smelt
Tunk Stream	Alewife

Rivers With Existing And Potential Atlantic Salmon Fisheries

Dennys River	Washington County
Ducktrap River	Waldo County
East Machias River	Washington County
Kennebec River	Kennebec, Somerset Counties
Machias River	Washington County
Narraguagus River	Washington County
Penobscot River	Penobscot County
Pleasant River	Washington County
Royal River	Cumberland County
Saco River	York, Oxford Counties
Sheepscot River	Lincoln County
St. Croix River	Washington County
Union River	Hancock County
Connecticut River	Connecticut, Massachusetts, New Hampshire and Vermont
Merrimack River	New Hampshire and Massachusetts

SIGNIFICANT COLD WATER FISHERIES

TABLE 28

Numbers of Lakes and Ponds

	Inland Fish & Game Lake Survey 1973					
County	Reclaimed Ponds	Primary Fishery With or Without Stocking	Mixed Fishery	Brown Trout	Landlocked Salmon	Lake Trout (Togue)
Androscoggin	4	0	6	3	3	3
Aroostook	18	76	54	0	31	14
Cumberland	4	4	12	12	6	4
Franklin	6	38	22	3	13	7
Hancock	14	33	30	7	28	11
Kennebec	11	4	9	15	10	5
Knox	1	2	2	6	3	0
Lincoln	1	5	1	10	1	0
Oxford	14	15	23	10	13	4
Penobscot	4	26	15	0	16	10
Piscataquis	23	128	61	0	38	43
Sagadahoc	1	0	1	1	1	0
Somerset	11	89	23	5	20	12
Waldo	0	5	0	5	3	1
Washington	12	30	14	0	20	4
York	11	7	1	12	2	1
Total	135	462	274	89	208	119

Department of Inland Fisheries & Game

and Craig Brook National Fish Hatchery

County	Brook Trout	Brown Trout	Rainbow Trout	Sunapee Trout	Lake Trout (Togue)	Atlantic Salmon	Landlocked Salmon	Large-mouth Bass
Androscoggin	9,500	5,650	— —	— —	12,660	— —	22,000	— —
Aroostook	115,525	— —	1,325	— —	32,100	32,057	36,904	— —
Cumberland	30,740	23,690	— —	5,000	84,865	— —	117,700	— —
Franklin	127,495	3,750	12,000	— —	9,400	— —	17,450	— —
Hancock	114,180	12,900	— —	8,995	25,200	19,552	55,850	— —
Kennebec	43,050	27,450	2,000	— —	8,500	— —	45,700	48
Knox	5,100	7,650	— —	— —	— —	— —	3,800	— —
Lincoln	7,000	6,900	— —	— —	10,000	— —	9,621	— —
Oxford	180,170	22,110	— —	— —	24,000	— —	76,400	— —
Penobscot	45,846	— —	— —	— —	11,800	48,948	42,800	— —
Piscataquis	195,600	— —	— —	10,000	98,550	27,846	157,600	— —
Sagadahoc	3,300	250	— —	— —	— —	— —	1,000	— —
Somerset	122,162	5,300	11,332	— —	41,600	— —	42,100	— —
Waldo	3,200	1,400	— —	— —	12,000	— —	11,900	45
Washington	86,860	— —	— —	— —	25,000	13,687	110,959	— —
York	42,600	29,260	— —	— —	10,400	— —	7,800	— —
Totals	1,132,328	146,310	26,657	23,995	406,075	142,090	759,584	93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