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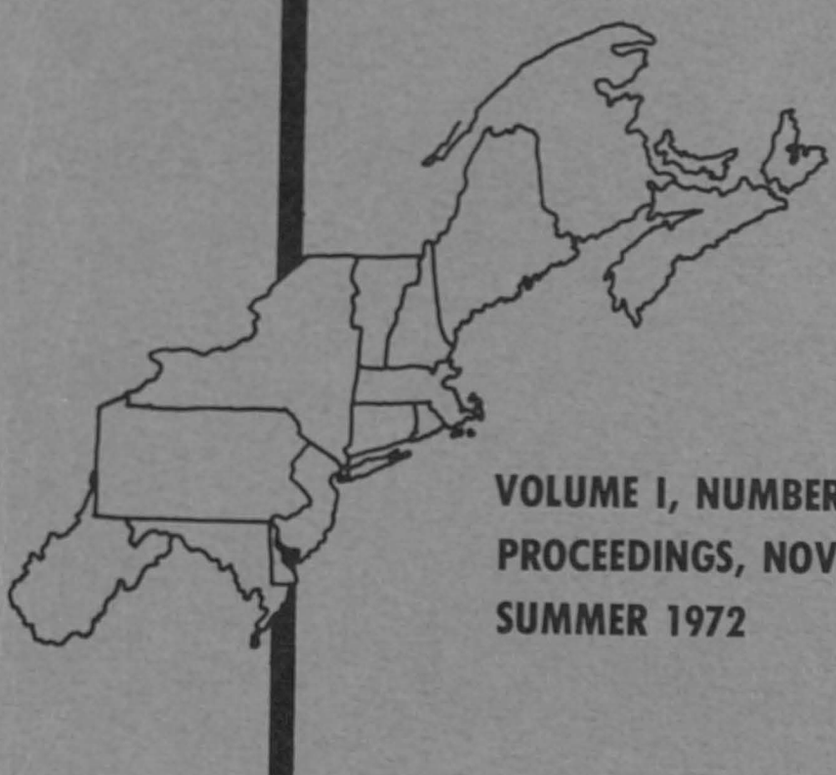

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THE PROBLEM OF RESOURCE USE AND QUALITY OF THE ENVIRONMENT, SOME POLICY ISSUES: THE POSSIBILITY OF THE APPLICATION OF EFFLUENT CHARGE IN MAINE

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Introduction

The beginning of the last third of the twentieth century can generally be characterized by a broad public awareness of the increasing deterioration of the natural environment, especially of the quality of air and water resources. The degradation of the quality of the natural resources has thus emerged as a public policy issue. The Federal and state governments responded to this public concern through the creation of various policy programs and administrative agencies. The environmental protection agency of the federal government is an example of a nationwide effort to establish policies related to the quality of the environmental resources. Many states established the legal framework within which administrative agencies could execute policies and ordinances related to the quality of environmental resources. Legislation recently passed by the Maine Legislature will be cited as examples. The site selection law specifies that the Environmental Improvement Commission must issue or deny a license for any commercial or industrial development which requires a land area of 20 or more acres; for structures in excess of a ground area of 60,000 square feet, for drilling or excavating natural resources (pits requiring an area of more than 5 acres). The recent denial of the application of Maine Clean Fuels, Inc., to construct a $200 million oil refinery on Sears Island, off the coast, attracted national attention. The vast majority of the project applications processed, however, are small in value and in size though their total impact on the environmental resource of the state are potential.[1/]

In the shore land zoning act the provision is made that a community must adopt subdivision and zoning ordinances related to the use of land adjacent to bodies of water (lakes and ocean shore line). The legislation

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[1/] Summary of application processed, March 1970 to August 1971. Acreage: 16,732 - mostly for housing: seasonal 41%, mobile homes 12%, lodging 8%, permanent housing 22%. The remaining 17% for other type development. Source: Maine Environmental Improvement Commission, Augusta, Maine, September, 1971.

gives the municipalities until June 30, 1973 to pass appropriate land use control measures. If the local government does enact an ordinance or if the land use control measure does not meet the standards set forth in the law, the State is empowered to draft the ordinance governing land use on shore land. In this case, nevertheless, the local government is responsible for the enforcement of the control measure.

The third environmental resource measure, recently enacted by the Maine Legislature, is the zoning ordinance applicable for the unorganized township.[2/] The State delegated the responsibility for administration of this law to the Land Use Regulation Commission, a newly created state agency.

The Penobscot River Study

The University of Maine Environmental Study Center and the Land and Water Resources Center recognized the multitude of environmental problems correlated by the use of the Penobscot River to transport and assimilate waste material. A research proposal was prepared and submitted to the Ford Foundation. It was consequently funded for a two-year period.

A brief description of the study area and the objectives of the study will follow. The discussion will emphasize the management alternatives in regard to the water quality of the Penobscot River and the use of an effluent charge to attain a desirable water quality. The Emscher-effluent charge model will be analyzed and suggestions will be made as to its applicability to the socio-political conditions in Maine.[3/]

The Study Area

The Penobscot River watershed included approximately 8,000 square miles. It is the largest river basin in Maine. The study area extends from Indian Island, above Old Town, to Islesboro Island in the Penobscot Bay. Twenty-five municipalities and towns are included in the study area (see Map 1). The City of Bangor with a population of 33,000 is the largest municipality. The population of several of the small villages averages below 1,000 according to the 1970 Census. The predominant industrial activity is centered around pulp and paper production. Four paper mills are located on the Penobscot River. These mills and many

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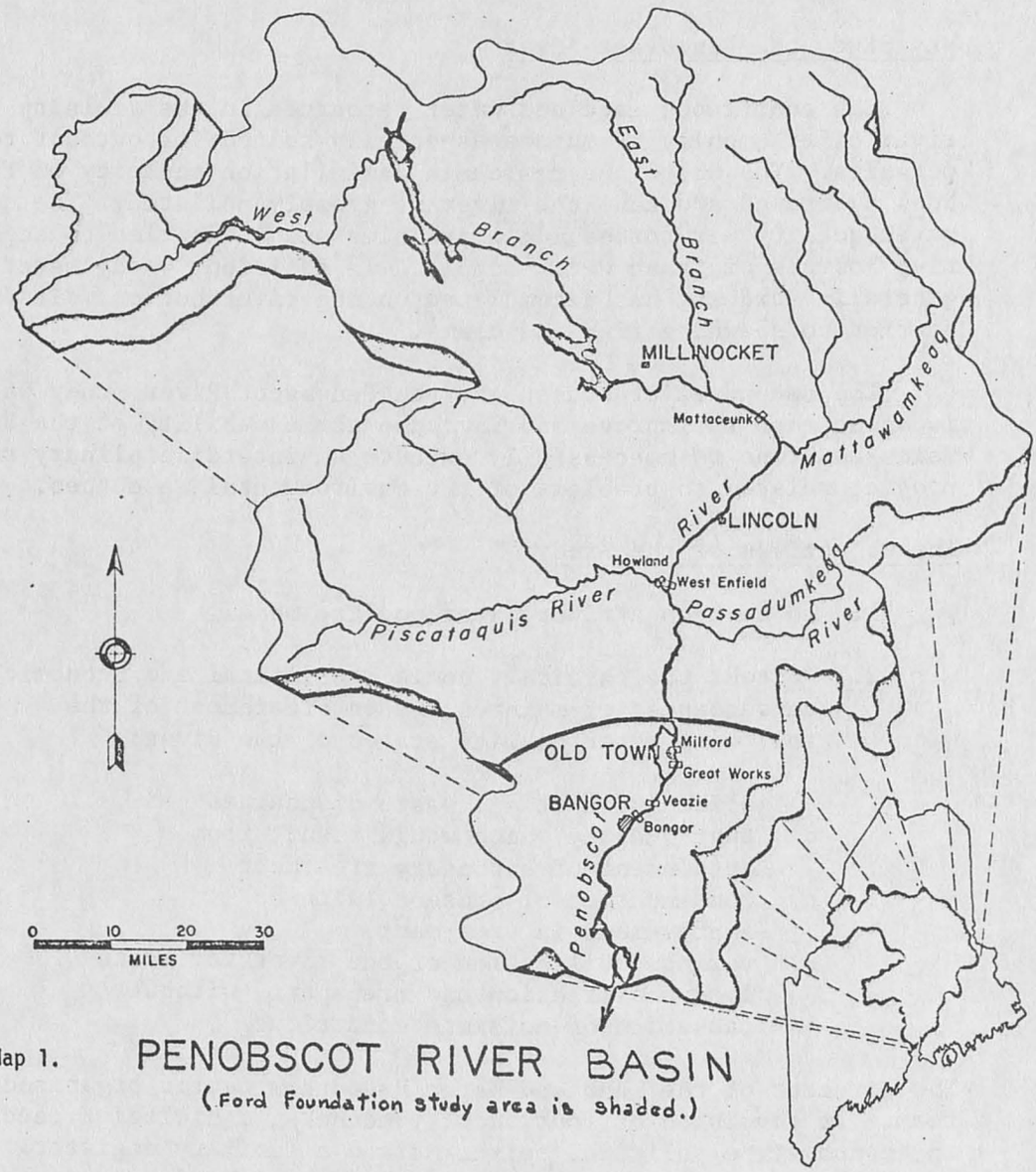
[2/] These are geographic areas laid out in townships, although not settled; thus without a municipal government. The land area is privately owned.

[3/] The author spent several weeks during the summer months of 1971 in the Ruhr-Emscher area to familarize himself with the operation of effluent charges, and their relation to management objectives.



Map 1. PENOBSCOT RIVER BASIN

(Ford Foundation study area is shaded.)

towns and municipalities in the study area utilize the Penobscot River to transport waste products and sewage. Most of these residuals (industrial waste and sewage), are currently not treated. The law, however, provides for mandatory treatment in the year 1976.

Why Study the Penobscot River

The contiguous land and water resources in the vicinity of the river offer amenity resources especially suited for outdoor recreational pursuits. The waste and residuals assimilation capacity of the river has been overtaxed and thus the river is grossly polluted. The deteriorated water quality has forced municipalities and industries to seek alternative sources of fresh water supply. In addition, woody materials, generally sawdust, has accumulated on the river bottom. It formed a barrier to spawning fish and clams.

The second major reason why the Penobscot River study was undertaken is an attempt to improve and increase the capability of the University of Maine at Orono to successfully execute an interdisciplinary research project related to problems of the environmental resources.

The Objectives of the Study

1. To develop a river water quality model.

2. To test the physical, social, political and economic consequences of maintenance or attainment of the following water quality states of the River:

   a) elimination of all waste discharges
   b) that quality which would result from attainment of secondary treatment
   c) continuation of present, with no improvement in treatment
   d) maximum utilization of the river for waste load assimilation and transport, without causation of nuisance conditions

The Director of the Land and Water Resources Center organized the study team. It consisted of four faculty members, a biologist (ecologist), an economist, a political scientist and a sanitary engineer. In addition six graduate students worked on various contributing research projects in conjunction with the project outline. Details about the mathematical river model developed by the sanitary engineer and the various contributing projects are beyond the framework of this paper.[4/] It should be

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[4/] The report of the Penobscot River Study will be available about August 1, 1972.

stressed that effective management of the water quality of the Penobscot River must be based on a method to predict the river condition under various river flow and waste load situations.

The Current Situation

Existing institutional arrangements, which range from riparian ownership rights to the tacit public permission given to a hydro-electric company to manipulate the river flow through lowering or raising the two dams, are not correlated to the waste load and assimilation capacity of the river. Thus, currently no comprehensive river management does exist. Industrial users, municipalities and other private riparian landowners release residuals and sewage (generally untreated) into the river. As suggested, the waste load and assimilation capacity is already overtaxed. The river is, therefore, heavily polluted and neither available as a recreational resource nor as a source of water supply.

The analysis of the waste load and assimilation model suggests that secondary treatment of the residuals released by the industries located on the river and primary treatment of municipalities would make it possible that the river, due to its flow conditions, would restore itself in a very short period of time. Under this alternative, a water quality suited for recreational purposes could be obtained. This water quality standard, however, could only be attained under the assumption of maintaining current conditions. These are that no further expansion in industrial activity would occur, as well as, the population concentration along the river would be static.

The State of Maine has classified its rivers based on water quality standards which are to be attained in 1976. Two bond issues were passed totaling $75 million. These funds will be used to pay the share of the State for the construction of waste water treatment plants. The construction of treatment plants is one alternative to manage residuals. The fee or user cost structure charged by waste water treatment plants is generally based on the volume of sewage (e.g. price per 1000 cubic feet) and the total cost of sewage treatment. Under this system, therefore, each household and firm is paying a sewer fee which is not related to the waste load generated by the unit. Benefits accrue to the water user who generates a substantial waste load (e.g. toxic substances) but only utilizes a small quantity of water to transport it. Firms and households which discharge a light load are indirectly penalized and thus are paying a higher user fee than would be required to treat their waste load.

Effluent Charge

The 1976 standard "the construction of municipal treatment plants" is one public management policy approach. From an economic viewpoint costs are shifted to someone else (frequently the public) although the benefits accrue to the "heavy" waste load generating unit. The concept of effluent charge is another management alternative to obtain a desired

water quality standard. It is an equitable method of allocating costs to those units generating the waste load as well as charging a fee related to the benefits received.

The concept of effluent charges was successfully applied in the Ruhr Region of West Germany almost 70 years ago as a means to attain water quality and to pay for transportation of residuals. The effluent charge system employed by the Emschergenossenschaft (= water management association in the Ruhr Region) will be briefly described.

This system has become a world-wide model for an operative, functional system using effluent charges. No effort is made here to describe in detail the laboratory tests nor the assessment system by which the users of the Emscher report the wasteload they release in the Emscher.[5/]

The Physical Setting

The Emscher, a tributary of the Rhine River, is used exclusively for waste carriage, dilution and degradation. Its riverbed has been fully lined with concrete. High dikes were built as a safeguard against flooding. The Emscher is thus a single purpose stream; a waste load carrier. The second water quality objective is the avoidance of undesirable odor. The geographic area however depends upon adjoining watersheds for its fresh water supply.

The Effluent Charge

The principle is actually quite simple: "He who causes the waste load pays the actual costs of transporting and treating it in order to achieve a desired water quality standard."

In Table 1, the 1971 distribution of the assessment for current expenses and the operation of the dephenolating plants are summarized. Coal mines, for example, pay 44 percent of current operation but 72 percent of the operating costs of the dephenolating plants because these mines produce the phenol as an undesirable product.

The formula below gives the amount of clean water required to dilute the effluent to such an extent as to avoid harm to fish. Although no acquatic life exists in the Emscher, the formula, therefore, serves as indicator of a desired water quality standard. A single number can be computed taking into account differing types of waste. The monetary

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[5/] For details see Allen V. Kneese and Blain T. Bower: Managing Water Quality: Economics, Technology, Institution. Johns Hopkins Press 1968, pp. 237-53.

Effluent Charge Assessment Formula
of the Lippengenossenschaft
Essen, W. Germany

$$D = -1 + \frac{S}{S_p} + \frac{1}{2}\frac{B}{B_p} + \frac{1}{2}\frac{P-30}{P_p} + F$$

D = dilution factor

S = materials subject to sedimentation in cm^3/l,

S_p = permitted S in cm^3/l,

B = BOD_5 in mg/l after sedimentation,

B_p = permitted BOD_5 in mg/l,

P = potassium permanganate oxygen used in mg/l after sedimentation,

P_p = permitted potassium permanganate use in mg/l,

F = toxicity to fish as determined by dilution method.

cost of attaining the specified water quality is then computed and an assessment is levied on the unit discharging the waste.

Table 1.
Distribution of 1971 Assessment
Emschergenossenschaft

Major categories of users	Current expenses* (in percent)	Operation of dephenolating plants* (in percent)
Coal mines	44.0	72.0
Iron and steel mills	9.0	4.0
Other industries	15.0	8.0
Railroads	0.5	0.25
Highway administration	0.8	0.4
Navigable canals	0.01	0.04
Water pumping stations	0.8	0.4
Municipalities	30.0	15.0
* rounded off	100.0%	100.0%

Source: Obtained by J. Delphendahl: personal communication from Emschergenossenschaft.

Another facet of the assessment procedure should be mentioned. Suppose a new industrial firm will locate in the Emscher area. The Emscher Association[6/] might have to construct a new treatment plant to handle the anticipated waste load of the firm, or would have to build transportation facilities to transport the residuals to existing treatment facilities. The total costs generated by this new facility are assessed against the firm and must be paid by the firm and not by the other users of the Emscher. The effluent charge which all users of the Emscher, municipalities, firms, highway administration, etc., must pay can be considered a price which the users pay for the use of a scarce resource: the waste assimilation and transportation capacity of the Emscher. The price "buys" in addition to these functions a combined collective water management system.

Waste loads delivered to the Emscher by the users are adjusted because the price incentive of lower effluent charges rewards the firm in terms of a lower effluent charge. Firms are therefore economically

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6/ "Genossenschaft" has power to tax; police power to manage entire water supply of the area; has also the power eminent domain.

encouraged to use various forms of residuals recovery, pre-treatment, or changes in the resource input mix in order to reduce effluent charges. The phenol recovery plants operated by the Association recover 65-70 percent of the waste phenol. In this case, economies in recovery were achieved through a collective system which the single firms probably could not have accomplished.

The Emscher system is indeed a model for incorporating costs for transporting and treating waste loads based on detrimental effects on water quality. It also proved beneficial to industries and municipalities to make use of economies of regional waste disposal transportation and assimilation.

Concluding Comments

In the brief description of the Emscher effluent charge model the principle of payments for the cost of transporting and disposition of the residuals and the benefits received, was stressed. The basic principle of allocating costs and benefits to the users of a resource can generally be applied if two basic conditions exist. First, institutional arrangements have to be made to establish a management association which is empowered to use taxation, police power, and eminent domain to achieve the desired management goal. Secondly, the waste load should be such that large scale treatment plants are economically justified.

The effluent charge could legally be applied to the use of the Penobscot River but at the present time, it probably is economically more feasible to use municipal or firm treatment plants rather than construct a river treatment system.

The effluent charge is not a license to pollute but a fair and equitable fee to be charged for the use of a scarce resource.