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ECONOMIC CHARACTERIZATION OF THE ALBEMARLE-PAMLICO COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN

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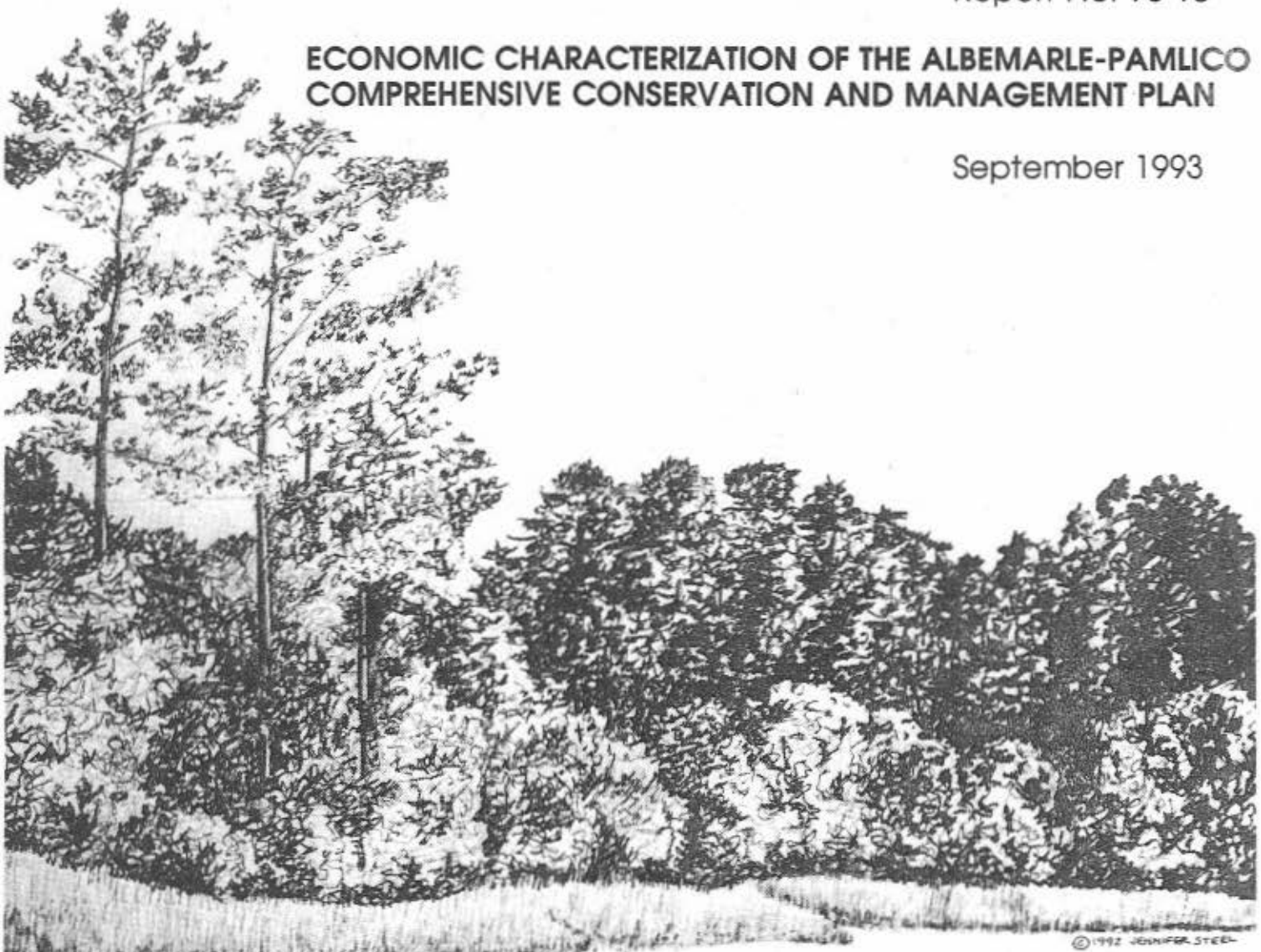

ALBEMARLE-PAMLICO ESTUARINE STUDY

NC Department of
Environment, Health,
and Natural Resources

Environmental
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National Estuary Program

ECONOMIC CHARACTERIZATION OF THE ALBEMARLE-PAMLICO COMPREHENSIVE CONSERVATION AND MANAGEMENT PLAN

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Chapter 1 INTRODUCTION

Concern over the quality of water, fisheries, wetlands and habitat in the Albemarle-Pamlico (APES) region has prompted public and private entities to collaborate on the management of the region's resources. To coordinate this effort, the Albemarle-Pamlico Estuarine Study Program was begun in 1987 under the joint sponsorship of the State of North Carolina's Department of Environment, Health and Natural Resources (DEHNR) and the United States Environmental Protection Agency (EPA). The Albemarle-Pamlico Estuarine Study (APES) has sponsored a large body of research looking specifically at the natural resources of the APES region, including fisheries resources, water quality, human environments (i.e., the use of land and water resources, including public trust areas), and vital habitats (including wetlands). The results of this research, as well as the input of researchers, experts from federal and state natural resource and environmental protection agencies, local government officials, private interest groups and individual citizens, have gone into the development of a Comprehensive Conservation and Management Plan (CCMP) for the APES region. The CCMP is divided into five broad areas of focus - water quality, fisheries, vital habitats, stewardship (planning, education, public awareness and public involvement), and implementation. These component plans address environmental problems related to that area of focus, the status of current laws and management efforts to deal with these problems, and the needs in each area for enhancing these efforts. The CCMP, therefore, is intended to encompass existing and on-going efforts as well as new proposed efforts, and includes action by corporations, individuals and non-profits, as well as state, federal and local governments.

The CCMP deals almost exclusively with the State of North Carolina. No attempt is made here to assess the applicability of the Management Actions to Virginia, part of which falls within the APES region. Note that the Implementation Plan of the CCMP recommends extending the plan to Virginia but make no specific recommendations as to the substance or timing of adapting the CCMP to Virginia.

Study objectives

Resource Analytics, Inc. (RAI), of Raleigh, North Carolina, was contracted to review the component plans of the CCMP as the document evolved. The primary objective of this study was to characterize the economic issues raised by the implementation of the CCMP. An economic characterization is a qualitative analysis of the costs and benefits that would occur

from the implementation of the CCMP's Management Actions. By characterizing the economic factors implicit in each of the CCMP Management Actions, a better understanding can be gained of the relative magnitude of costs and benefits accruing to different sectors of the regional economy as well as their relative distribution among sectors.

A qualitative analysis of the economic tradeoffs was selected chiefly because of the large number of Management Actions in the CCMP. A thorough economic analysis of each, although potentially yielding very useful results, would have been costly and time consuming. Moreover, citizens and public officials in the APES region have expressed rather urgent concerns and questions regarding the potential economic impacts of APES recommendations. It was felt that a characterization could be developed in a timely manner, and that the results would be sufficiently comprehensive to help frame the tradeoffs facing various stake holders and to aid in focusing debate on the selection and implementation of appropriate policy. Preliminary results of RAI's analysis were integrated into the second and third drafts of the CCMP, the final draft of which is being finalized at the time of this writing.

A second project objective was to locate and evaluate relevant economic studies, data, and methodologies that can be used to determine the economic consequences of the CCMP. A comprehensive literature search was performed in the course of the analysis and extensive contacts were made with government agencies, researchers and others involved in fields related to the Plan. Important sources of information are referenced throughout this document.

The third objective was to set priorities for further economic and policy studies based on the results of the characterization effort. The characterization has yielded a great deal of information about the potential distribution of costs and benefits generated by implementing CCMP Management Actions. However, quantitative estimates of the economic impacts of selected Management Actions, cost effective implementation strategies, and analyses of policy mechanisms would provide further direction for policy makers. A discussion of recommended future work in these areas is provided at the end of this report.

The remainder of this report is arranged as follows:

- A general discussion of the economic trade-offs involved in the conservation of ecological resources;
- The analysis of the individual Plans, including a description of each Management Action, a discussion of important economic issues raised and a characterization of the incidence of economic costs and benefits to user groups and the regional economy; and,
- Recommendations for improving the CCMP and for conducting more detailed economic studies that would best support on-going planning and implementation.

Chapter 2
GENERAL DISCUSSION OF ECONOMIC ISSUES

The main objective of this chapter is to convey some economic concepts to help citizens of the APES region make the best possible decisions about managing the APES system, given the present level of knowledge about the ecological and economic relationships that regulate it.

The trade-offs of managing environmental resources

The proposals of the CCMP present individuals, groups and society as a whole with certain trade-offs. Few people would doubt that, if implemented, the proposals in the Plan would generate certain benefits such as cleaner water or more healthy fisheries. And there is little doubt that these actions will create some costs to taxpayers (locally, statewide and nationwide), businesses, and individuals.

The question is whether or not the benefits are worth the costs. Unfortunately, it is difficult to judge the benefits of things like environmental quality relative to the costs of governmental programs for environmental protection. A large part of this problem is that benefits and costs vary from person to person and from group to group, depending in part on their own individual preferences and tastes. Those for whom the good aspects of a proposal outweigh the bad (the "winners") will consider themselves better-off, while those for whom the bad outweighs the good (the "losers") will be worse-off. How do we weigh the overall benefits to society of a program against the overall costs to society? How do we as a society balance the interests of the winners against those of the losers in a fair way?

Economics provides a consistent, logical framework for addressing these issues by developing models of how humans normally make trade-offs such as those faced in the APES region. When the underlying assumptions and models are appropriate to the application, economic analysis can clarify the nature and magnitude of the trade-offs facing individuals, groups and society as a whole.

Typically, there are several alternative projects or policies that a community or a society could turn to in order to address a perceived problem or goal. From among the various alternatives, a policy (or project) is said to be "best" from the economy's (i.e., society's) perspective when that policy's net benefits (benefits to society minus costs to society) are greater than all other alternatives. It should be pointed out, however, that measuring the benefits and costs to society mays not address many equity and distributional issues raised in the CCMP. Specifically, measuring net social benefits alone does not address trade-offs between different groups within a society - landowners versus non-landowners, fishermen versus farmers, coastal communities versus inland communities, the current population versus future generations.

These questions tend to remain part of the realm of politics, law and moral debate. Nevertheless, the economic trade-off framework can be useful for helping to clarify these issues and thereby enhance the decision making capability of all those affected.

Economic value

If it is reasonable to make decisions based on the benefits and costs that accrue to us, both individually and as a society, then we can judge the impact of changing environmental quality in terms of the effect it has on our well-being. With respect to a formal evaluation of benefits and costs, increases in the amount of habitat, natural community or wetland types are not benefits in and of themselves. Instead, we are interested in looking at how that increase makes us better-off than before. The quantity or quality of resources, while being important indicators of the benefits that we expect now and in the future, is one step away from that which we want to measure. The decision maker must look at the relationships between *inputs* (soil, species, number of staff in a program, etc.) and the economic *outputs* they help to produce (an enjoyable recreational experience, sustenance, livelihood, raw material for industry, or the knowledge that we are being good stewards of our world). It is this value that we are interested in assessing.

Economic value, then, measures the well-being of the individual, group, or of all society. We commonly think of money, our time, and things that can be bought and sold as having value. But there are other things that are not and perhaps cannot be traded on the market which increase our well-being (Fisher *et al.*, 1972; Freeman, 1979; Desvousges and Smith, 1983; Scodari, 1990). Natural resources do not necessarily have to be "commercially exploited", "consumed" or "depleted" in order to have value in the economic sense. On the contrary, we may place higher values on some resources (i.e., derive greater benefits from them) for their role as part of healthy ecosystems (e.g., many wetlands), for their aesthetic value (e.g., the Grand Canyon), or for purely ethical reasons (see Ehrenfeld, 1976).

What is being measured when we assess economic value?[1] The value of a good or service to someone is not what they paid or otherwise gave up for it. In most situations relevant to the CCMP, it is instead the most that they would be *willing* to pay or otherwise give up for that good or service. The sum of everyone's *willingness-to-pay* (or *WTP*) for a good or service is the appropriate measure of total value of that good or service to society. As suggested above, we may place value on (that is, we may be willing to pay for) many things that cannot be bought or sold. Also, we can "pay" for both market and non-market goods and services in ways that involve no direct transfer of money or other assets. For instance, we may give up a leisurely weekend for the satisfaction of performing some form of volunteer work. A community may give up some existing land development opportunities in order to maintain orderly growth patterns, protect or enhance the character of the community or preserve options for development for the future.

Intuitively, it makes sense to subtract out from this total value all that was given up for it (the costs). The appropriate measure of what is given up, whether it be monetary or otherwise, is what economists call the *opportunity cost*. The opportunity cost of a good or service is defined as the highest possible value that it could generate for society in the next most profitable use, or next best use. The "next best" concept is used because we have to assume that people use inputs available to them in the way that they believe will generate the most return or satisfaction for them. The definition of opportunity costs cannot be fully explained

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[1] At first glance, a seemingly reasonable estimate of the total value to society of the good in question would be the total expenditures (average price times the total quantity consumed). This is the wrong measure for two reasons. First of all, it measures what people spend on a good, not what they would be willing to spend on it. What they actually spend on a good is a function of the good's price, on which people generally have little effect. Their willingness to pay, on the other hand, is the measure of the good's value to them. The difference between willingness to pay and the cost of purchase is termed the *consumer surplus*.

The second problem with equating expenditures and economic value is that not all of the money spent on the good is a "benefit" to the seller. Their costs have to be considered, and the price times the quantity sold reflects the total of what all sellers received, not their production costs. Overall, producers receive a benefit which is the expenditures minus their total costs, including all labor, equipment, interest on borrowed funds, etc. This benefit is called the *economic rent*.

For the case of a good that is freely traded in a well-functioning market, the economic value of that good is the consumer surplus plus the economic rent. Accessible treatments of the measures of individual and social welfare in the context of environmental policy can be found in Batie and Shabman (1982), Desvousges and Smith (1983), Tietenberg (1988) and Scodari (1990). More thorough treatments are in Fisher (1981), Smith and Desvousges (1986), and Cropper and Oates (1992). The formal expression of these concepts will not be fully reviewed here nor will the appropriate adjustments necessary to evaluate changes in quality or price using compensated demand curves (Smith and Desvousges, 1986). The important point here is that this concept of economic value can be used in situations where the good or service in question cannot be freely bought or sold, like the visual quality of a shorefront view, recreational value of a sport fishing trip, the knowledge that Albemarle Sound is clean and healthy, etc. The basic concept of measuring value is still that of net benefits, that is, the benefits minus the costs, appropriately measured.

here, but one point should be emphasized - in policy evaluation, it is important to ask the question, "how could the inputs that we give up in order to implement this proposal be alternatively used, and what would their value be in that use?"

Often, it is claimed that government intervention on behalf of environmental protection will cause the loss of jobs, economic development opportunities, and personal assets. The underlying concerns here are often real enough, but such a statement can be misleading. In most cases, restrictions on the use of an individual's resource assets (like their land, their labor, their ideas or their capital) will restrict their *best* use, but they often may be used in some alternative way. These "next-best" uses may be nearly as remunerative or satisfying as the use that would have been chosen without the restriction (the "best" use), or in some cases they may be very poor alternatives from the perspective of the decision maker. The correct measure of value for a particular resource or set of resources in a particular use is the *difference* between their value in that use and their value in the next most productive use.

From the perspective of society, regulations may cause some losses but they will be offset to some extent by the gains created when resources are redeployed somewhere else. If environmental policies create restrictions to economic activities in an area, the demand for the products generated may be met with production somewhere else. Jobs "lost" in one place will be offset to some extent by jobs created where production can take place. Of course, this is small comfort to the "losers" in these situations. If the benefits of environmental protection do not, in their eyes, offset these losses, then they truly are left worse-off than before. This may be the case even if from the perspective of society as a whole the total benefits outweigh the total opportunity costs. Often, the strong feelings surrounding environmental policy are based on such issues of fairness, basic rights, or distribution of costs and benefits. These are legal, ethical and political questions about which assumptions must be made in the development of a quantitative economic impact assessment.

One final point should be made to clarify how the economic impacts of policy are judged. We are less interested in total net benefits *per se* of the system of production that policy affects than we are in the *change* - increase or decrease - in total net benefits that occurs as a result of a policy. Statements such as "wetlands are worth $X million to the economy" made in support or in opposition of an action can be misunderstood because they seem to refer to the total net benefits of the resources without reference to the change of value that action will cause.

In order to value the incremental effect of a policy or action it is necessary to know how well off we will be both "with" and "without" that policy or action. Most policy debate tends to focus on the "with" case, and we implicitly compare this case with our current state of welfare. But it may be that "without" the policy we will be better or worse off than we are now. Comparing the costs of fishing restrictions, for instance, against the current state of fishing activities ignores the possibility that without restrictions fish populations might

plummet or be wiped out entirely. Thus, sound scientific research is a critical component of evaluating the economic impacts of policies in both the "with" and "without" cases.

Issues in characterizing costs and benefits

Having introduced the basic idea of how we can evaluate the economic impact of a policy, we can now look at some considerations that must be made in characterizing benefits and costs. It is beyond the scope of this paper to present a full exposition of the economic theory behind the issues discussed here.[2] More thorough treatments can be found in the sources referenced.

Actions taken to protect or conserve environmental resources can affect economic values at many points in the chain leading from the natural resources themselves to producers and consumers. Changes in the final value of the goods and services produced can be caused by changes in the quality or quantity of the resource, the price and quality of goods that can substitute for or which complement the resource in their use, or in the nature of demand for the goods and services produced by users (their marginal value). Likewise, policies and programs can have an impact on any one or all of these factors in the value-generation process (Cropper and Oates, 1992).

Difficulty in identifying the impact of a policy on resources

In many cases the immediate effect of an environmental protection policy or project is a change in the quality or quantity of a resource - e.g., an increase in the number of acres of a particular type of habitat, or a decrease in the levels of pollutants in a body of water. As noted before, it may be quite difficult or costly to measure these effects. For instance, the water quality monitoring needs for a certain area may be scientifically straightforward, but it may be much harder to measure the impacts of water quality improvements on the productivity of fisheries.

Often, changes in quality and quantities of natural resources are affected by many different factors, and isolating the effect of a particular factor such as a policy may be difficult. In the case of protecting wetlands, for instance, a simple inventory of wetlands acquired by a public conservation agency does not by itself reveal the increase in benefits from the acquisitions.

A related problem is that it is difficult to define and separately characterize and measure the value of individual components of complex ecological systems. Again using the wetland

[2]Sources for general resource and environmental economics are Krutilla and Fisher (1975), Freeman (1979), Fisher (1981), Tietenberg (1988), and Cropper and Oates (1992). For shorter, less technical treatments of economic issues related to resource use see Batie and Shabman, 1981, and Scodari, 1990.

example, a public wetlands acquisition program could be said to protect individual plants, animals, lakes, stretches of river, seagrass beds, etc. However, in protecting individual organisms or landscape features, preservation would also be helping to protect species, habitat types, hydrological systems, and other ecological systems. Looked at in this way we have instead of a group of discrete resource units a more continuous fabric of interrelated functions and structures. Because of these interrelationships, the value of a wetland region is greater than the sum of the values of each plant, animal, gallon of water and of the other components of the system. These relationships make it difficult to assign a value to a single "component" of nature because part of that value is attached to the role that "component" plays in the larger scheme.

Substitute goods

For most resources there are potential substitutes which could be used to produce the same goods and services. The fisherman faced with declining catches can increase the inputs of labor and equipment in order to make up for the loss. Another example would be the construction of a water treatment plant to make up for the loss of water purification services provided by land that becomes eroded or by the loss of wetlands. Obviously, some substitutes provide far fewer of the benefits than the inputs they replace (or more would have to be used in order to fully replace the functional value of the original resource). The substitutability of other potential inputs, then, is an important consideration in an evaluation of the functional value of the resource in question. A resource that is easily substituted by another input has less relative value than a resource with few substitutes.

In most cases involving environmental resources, however, the users of goods and services from environmental resources do have alternatives. The question of what is being valued becomes more complicated. In this case, the value of the good or service in question is a function of both the change in the resource itself *and* the degree to which the valued good or service can be produced with substitute inputs.

Joint production and public goods

In addition to the complications that arise from the relative value and effectiveness of substitutes, many resources help produce more than one output simultaneously, some of which may be market goods and others which may be non-market goods. Some of the goods produced may be public goods, which are indivisible (consumption by one person does not diminish the amount available for others, like the beauty of an area seen from a scenic overlook) and which are freely accessible to all (Tietenberg, 1988). Because of jointness of production and the nature of public goods, economic studies are typically limited to a small number of goods and services.

The effects of price changes

The preceding discussion has looked at the case of a policy or program that changes the quality of a resource. But policies can also affect prices in ways that have some ultimate

impact on the use of environmental goods and services. Consumers and firms faced with changing prices will change how they allocate their money, and these affects will alter the overall demand for the resource.

Time preference

Most costs and benefits considered in the CCMP accrue not on a single occasion but repeatedly over the long-term. It is often important to recognize that modest benefits realized over the long-term may be worth a one-time or short-term cost of larger magnitude, as in many investments where there are relatively high "up-front" costs. On the other hand, a large enough initial benefit may outweigh a small cost spread over the long-term, as in the case of a loan. The contentious technical issues of how to incorporate a time dimension into an assessment of costs and benefits, and the special problems associated with public expenditures in this regard, are not reviewed here. However, for any policy decision it should be considered whether or not it is worth it to society to bear a large "up-front" cost (like land acquisition) in order to assure a stream of comparatively small benefits over the long-term.

Uncertainty, risk and irreversibility

Uncertainty has already been discussed as an important factor in characterizing the outcomes both "with the proposal" and "without the proposal." Sometimes we are able to specify certain probabilities, or risks, that different possible outcomes will occur. We may be reasonably certain, for instance, that at a high enough level of harvest, a fish population will not be able to recover and will die off. However, at some given level of harvest we may only be able to specify a probability that a population will be overfished to the point of dying out.

Some important risks that we face in the management of natural resources is the potential for unintended consequences and outcomes that are irreversible. Once fossil fuels, for instance, are burned they are effectively gone forever. Once a unique natural community is altered by development, we risk the possibility of foregoing some important ecological or genetic information forever.

Practically speaking, it is often difficult to incorporate risk, especially of unintended consequences and irreversibilities, into an economic assessment. We normally must make do with the best information that we have regarding the likelihood of all potential outcomes, making sure, especially, that the potential for the worst-case scenarios are considered.

Primary and secondary effects

Economic assessments of the impact of environmental policies should concentrate, generally, on primary or direct impacts to the production of economic value. Often, there is evidence that public policies have what is called a "multiplier effect", or economic rippling effect, on nearby or related economic activity. The problem with including such effects in an analysis is that they involve more tenuous economic linkages that are often poorly understood in

specific cases. Often many costs included in this figure include the value of resources that would be redeployed, albeit less profitably, elsewhere in the economy. The inclusion of secondary, tertiary, etc. effects, in essence, can force the analyst to incorporate an exponentially increasing number of assumptions about these subsidiary linkages. This makes the double-counting or overestimation of costs more likely and the analysis more vulnerable to criticism (Desvousges and Smith, 1983). Nevertheless, such impacts can sometimes be highly significant in terms of the debate over policy. For our analysis of the CCMP, therefore, such effects are noted in cases where they are likely to be important to the discussion of distributional or equity issues, even though they may be too ill-defined for quantitative analysis.

The opportunity cost of public funds

This issue is normally discussed by economists in terms of the appropriate discount rate to use in the calculation of the economic value of benefits and costs over time. This issue is discussed in Desvousges and Smith (1983). In the context of the descriptive treatment given here, the important point to be made regarding the opportunity cost of public funds is that public officials should take into account how the money they spend could be spent alternatively. This concept emphasizes the importance of not only being concerned with developing programs with positive net benefits, but with developing programs with the *highest* net benefits as compared against all alternative uses of the funds.

The cost to society of new government programs is the opportunity cost of public funds, the foregone benefits of alternative uses of the money spent in the program in question. "Maximizing the effectiveness" of public investments is as important to sound policymaking as is the outcome of the policy itself. To judge this "effectiveness", we must compare the net benefits of the proposed program against all other possible programs. Immediately, we run into the problem of comparing the benefits of public expenditures in areas as diverse as child care, public health, education, and defense, not to mention other environmental initiatives. Even within environmental programs, it may be difficult to say how the value of an additional tax dollar spent on air pollution reduction can be compared to an additional dollar's worth of unique habitat preserved (keeping in mind the uncertainties and risks surrounding the true benefits of both programs). Comparisons made between programs in different areas of public concern (e.g., child care and military spending) are generally qualitative assessments that are made through the political process[3]. Comparisons made within a "single" area (e.g., natural

[3]In principle, a fair democratic political process which is representative of the will of a well-informed public should yield optimal public policy choices. It is interesting, however, to look at the results from a recent survey regarding the public's perception of public spending priorities (Hoban and Clifford, 1992). The survey performed for APES measured the relative support for an increment in public spending on "protecting the APES system" and other selected areas of public investment. Respondents reported that they preferred using the additional spending on protecting the APES system over the following choices given them: "highway construction", "economic development" and "welfare and public assistance." The other two choices, "crime

resource management) can be more quantitative, relying on such comparative figures as the percentage of elements of diversity protected in alternative habitat protection schemes, or dollars spent per ton of sediment load reduction in a comparison of different land management programs.

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control" and "public school education," took precedence over spending for environmental protection in the APES system (Hoban and Clifford, 1992). These results can be interpreted as meaning that the public perceives a greater net benefit from a unit of additional public expenditure on environmental protection or crime control than from spending that money on new roads, for instance.

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Chapter 3
FRAMEWORK FOR CHARACTERIZING THE ECONOMIC IMPACTS OF THE CCMP

Chapters 4 through 8 characterize the economic impacts of the component plan of the CCMP - the Water Quality Plan, the Fisheries Plan, the Vital Habitats Plan, the Stewardship Plan, and the Implementation Plan. Because of the great amount of detail involved with each Management Action, the critical steps and other explanatory material found in each Management Action are not repeated here. Each plan is briefly introduced and then each Management Action of the plan is analyzed within the following format:

- Review of the management action;
- Assumptions made in the characterization of economic impacts
- Characterization of economic impacts:
  - administrative costs to government;
  - practice costs to government;
  - government revenues generated (if any);
  - practice costs to affected private sector groups;
  - practice benefits to affected private sector groups;
  - overall social costs; and
  - overall social benefits.

Each of the above economic impact categories is discussed below:

Administrative Costs to Government

This category of costs consists of all direct and indirect incremental costs to all levels of government. In the detailed analyses of individual Management Actions, the level of government and the agency incurring each cost is identified where possible. In some cases, this was not clear from the proposals. Administrative costs include administrative overhead, planning, research, staff salaries, and other personnel, building, equipment and data type cost categories.

While conceptually easy to grasp, estimating the true costs of administering a program or project can be difficult, whether in the public sector or in the private sector. Changing economic forces can alter prices of inputs (prevailing wages, equipment, fuel, and other overhead charges, interest rates on borrowed funds, land, etc.). Often, programs for addressing public policy concerns are begun without knowing the full scale of operations necessary to achieve stated policy goals. New technology or new discoveries about the resource can ease some problems and aggravate others. Another factor is the substitution

effects of alternative forms of governmental administration on the productive value of public investment. Institutional changes (in statutes, in administrative operating procedures, changing priorities regarding the distributional impacts of policies) somewhat removed from the resource management problem can alter the effectiveness of government in general, and hence on the program in question. As noted above, uncertainty, risk, and assumptions regarding the allocation of resources and outputs are all important factors to be considered.

Practice costs to government
Practice costs include the costs of facilities or acquisitions of land specifically made in the implementation of the proposal.

Revenues generated
Any taxes, fines, user fees, or other sources of revenue directly attributable to the proposal were noted.

Practice costs and benefits to affected private sector groups
Costs in these sections include any increment in expenditures required in order to meet new standards set in the proposed Management Action. They are based on the concept of opportunity costs, or foregone benefits from the proposed allocation and use of resources. Costs of the CCMP include purchases made or the expense of changing routine practices which are borne by the affected party. Another significant cost item is transactions costs, which include the effort needed to learn about new regulations, to gather and store the information required, to report this information, and enforcement related costs (litigation, penalties, new restrictions, etc.).

Like costs, benefits are based on the concept of changes in value. For specific individuals or groups of people, benefits could include an increased availability of fish, clean water or other resources that they use directly or indirectly.

Social costs and social benefits
In these sections, costs and benefits of the proposals are discussed primarily from the perspective of society as a whole, which in this study is taken to be the point of view of both the region and the state. As noted before, this perspective overlooks many sources of policy conflicts in the proposals. Significant transfers of economic impacts to and from local communities and/or the regional economy may be especially contentious and for this reason these impacts have been discussed as well.

The general public cannot control every resource management decision made by government, even though the public is directly affected by these decisions. One of the tasks of government in this situation is to carefully weigh the legitimate interests of other citizens in a given community, in the region, in the state and in the nation. For instance, non-landowning farm or forestry workers could be affected in local economies where activity in certain sectors

is greatly reduced. County governments with low tax bases could be impacted disproportionately by actions that reduce the assessed value of land than counties with strong tax bases. The subsequent impact on the provision of vital public services must be considered in this case. The destruction of habitat which is critical to the survival of an endangered species could deprive the broader state and national communities of an important part of their natural heritage or some potential future benefit. These broader impacts are discussed under the "Social costs" and " Social benefits" section of the analysis of each management action.

Left out of the discussion of social costs in this study is a thorough consideration of the opportunity costs of public funds used for each action - i.e., the benefits from alternative uses of public funds which are foregone by using those funds for the use chosen (see the section on "opportunity costs of public funds" in the preceding chapter. For this study it was not feasible to fully consider alternatives to the actions chosen through the APES process and their net benefits relative to the actions chosen. In other words, asking the question "can this money be put to better use?" is central to economic impact assessment and to policy making, however, it was beyond the scope of this initial economic impact characterization to assess alternatives to each proposed action. Alternatives that promise to yield greater net benefits to the public should be considered on an on-going basis by the APES Management Conference. As the Conference assesses the CCMP and the programs of the agencies involved, more quantitative and thorough economic impact analyses should be performed.

As discussed above, it was not the intent of this study to estimate benefits. No quantitative measurements of benefits were undertaken in this analysis due to incomplete information and uncertainty. Costs are dealt with more concretely, because, as suggested before, the costs of managing and regulating environmental resources are the opportunity costs of mainly market-related goods and services. Aside from sharing many of the problems of uncertainty and risk, costs are more tangible or measurable in dollar terms in many ways than are the benefits of environmental protection.

Chapter 4
ECONOMIC CHARACTERIZATION OF THE WATER QUALITY PLAN

The Objectives and Management Actions of the Water Quality Plan are as follows:

OBJECTIVE A: ***"Implement a comprehensive basinwide approach to water quality management."***

Management Action 1:

"Develop basinwide plans to protect and restore water quality in each basin by 1999, according to the schedule established by the Division of Environmental Management's Water Quality Section. The plans would include planning for basinwide wetland protection and restoration. "

Management Action 2:

"Establish total maximum daily loads (TMDLs) and associated control strategies for all impaired streams in the Albemarle-Pamlico region by 1999."

Management Action 3:

"Renew all discharge permits in a river basin simultaneously by 1999."

Management Action 4:

"Consider the potential for long-term growth and its impacts when determining how a basin's assimilative capacity will be used."

Management Action 5:

"Improve the scientific models for understanding the estuarine system, the effects of human activities on the system, and the viability of alternative management strategies."

Management Action 6:

"Continue long-term, comprehensive monitoring of water quality in the APES system, collecting data to assess general system health and target regional problems."

OBJECTIVE B: ***"Reduce sediments, nutrients and toxins from nonpoint sources."***

Management Action 1:

"For each river basin, develop and implement a plan to control non-point source pollution by 1999, as part of the basinwide management plans."

Management Action 2:

"Expand funding to implement nonpoint source pollution controls, particularly agricultural best management practices (BMPs) through the North Carolina Agriculture Cost Share Program, and also to develop a broader Water Quality Cost Share Program by 1995. Expand the cost share programs to include wetlands restoration. Increase cost share funds to problem areas.

Management Action 3:

"Continue to develop and demonstrate alternative septic systems, as well as best management practices (BMPs) to reduce nonpoint source pollution."

Management Action 4:

"Strengthen current enforcement programs to detect and correct ground and surface water quality violations from non-point sources."

Management Action 5:

"Require all logging operators to submit a notice of intent to harvest by 1995. Notice would be filed with the state forester."

Management Action 6:

"Enhance stormwater runoff control by developing new regulations as needed and by strengthening existing ones to protect water quality in all state waters by 1995. Improve enforcement to ensure that stormwater management systems are properly installed and regularly maintained."

Management Action 7:

"Implement an inter-agency state policy that addresses marina siting and integrates best management practices through permitting and better public education by 1995."

OBJECTIVE C: ***"Reduce pollution from point sources, such as wastewater treatment facilities and industry."***

Management Action 1:

"Promote pollution prevention planning and alternatives to discharge, where feasible, for all point sources to reduce the volume and toxicity of discharges."

Management Action 2:

"Expand and strengthen enforcement of National Pollutant Discharge Elimination System permits. Increase site inspections and review of self-monitoring data to improve facility compliance by 1995."

OBJECTIVE D: ***"Reduce the risk of toxic contamination to aquatic life and human health."***

Management Action 1:

"Increase efforts to assess and monitor the extent of estuarine sediment contamination, fish and shellfish tissue contamination, and water quality violations, and to identify the causes and sources of these problems."

Management Action 2:

"Continue to issue fish advisories as necessary to protect public health. Improve communication and education about the risks associated with eating contaminated fish and shellfish."

Management Action 3:

"Remediate toxic contamination where necessary and feasible."

OBJECTIVE E: ***"Evaluate indicators of environmental stress in the estuary and develop new techniques to better assess water quality degradation."***

Management Action 1:

"Continue to track and evaluate indicators of environmental stress, including algal blooms, fish kills, and fish and shellfish diseases."

Management Action 2:

"Improve the techniques for evaluating the overall environmental health of estuarine waters."

Management Action 3 :

"Develop and adopt better indicators of shellfish contamination as soon as possible."

Objective A of the Water Quality Plan supports planning of water quality protection from unforeseen and more predictable degradation. Objective B addresses nonpoint pollution, while Objective C focuses on point source pollution control. Objective D would reduce the risk of toxic contamination to aquatic life and human health, and Objective E supports the evaluation of environmental stress indicators in the estuary as well as indicators to determine water quality degradation and contamination that pose environmental and human health risks.

Although some of the important rivers that feed the Albemarle-Pamlico estuary run through the populated Piedmont region, the Albemarle-Pamlico region is more rural in nature than many of the other estuarine systems in the United States. Thus, its major water quality problems are less associated with toxic wastes than with nonpoint source loading of nitrogen, phosphorus and sediment into the rivers and streams of the estuary. The population of the Albemarle-Pamlico region is increasing, and with that increase comes added pressure and demands on the natural resources of the area that depend on clean water. Pollution prevention through better water quality management is the focus of the Water Quality Action Plan.

The majority of the recommendations in the Water Quality Plan are aimed at reducing nonpoint source water pollution through the expanded use of best management practices that help to control the runoff of sediment and nutrients from agricultural and developed land. In addition to the provision of increased funding to North Carolina's agricultural nonpoint source pollution control cost share program, the plan uses this program as a model for a new cost share strategy to facilitate increased participation of the public in efforts to minimize nonpoint source pollution from developed urban and suburban areas as well as from marinas.

The recommendations in the water quality plan utilize existing infrastructures and regulations where possible, use cost share strategies, and in the case of marinas, tap available federal funding. In addition, expansion of outreach programs to provide training in best management practices and in wastewater management is recommended.

The benefits of the approach of these recommendations would be to reduce the costs of environmental regulations and protection, minimize the costs of future remediation measures and increase public participation in protecting the water quality of the region.
The costs of these recommendations will be largely governmental. These include funding of the cost share programs, provision of adequate staff to administer the programs, and provision of technical assistance and training. Private costs would also be incurred. They include possible foregone economic activity related to plan implementation, and possible increased costs of development. However, the costs of proper management and protection of the water quality of the region may be offset by the benefits that protected water quality can bring in terms of real estate values, and the viability of the fisheries and recreational industries.

OBJECTIVE A: "Implement a comprehensive basinwide approach to water quality management."

MANAGEMENT ACTION 1:
Develop basinwide plans to protect and restore water quality in each basin by 1999, according to the schedule established by the Division of Environmental Management's Water Quality Section. The plans would include planning for basinwide wetland protection and restoration.

REVIEW AND GENERAL COMMENTS

This Management Action recommends the development of water quality protection and restoration plans for each of the APES region's seven major river basins. The justification for this recommendation is that water quality is dependent on a number of interrelated variables which currently are managed under the authority of several state, federal and local government agencies. APES has suggested that optimal management strategies, therefore, would look at non-point source pollution, point-source pollution, wetlands, hydrological impacts, etc., in a comprehensive manner at the river basin level.

According to the CCMP, "Plans would address all nonpoint sources of pollution in each basin, targeting the most critical ares for controls. These plans would identify the nonpoint source pollution problems specific to each basin. Implementation would vary according to each basin's needs. Plans also would include strategies to control nonpoint source pollution in accordance with the total maximum daily loads (TMDLs) established for each basin. Possible measures include targeted funds for implementation for BMPs, buffer strips along waterways and BMPS for highway construction."

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The incremental level of effort required has been estimated by APES to be equivalent to one full-time employee per year. The costs of raw data gathering, map production and analysis, and wetlands analysis and planning are assumed to be included in the costs discussed in Management Actions 1 and 2 in Objective A of the Vital Habitats Plan and Management Action 5 in Objective B of the Vital Habitats Plan.

2. It is assumed for this review that the on-going review and assessment process established by both the interagency habitat planning committee and the APES Management Conference (see Implementation Plan of the CCMP) will assure that planning and implementation resources are spent in a cost-effective manner. No attempt to examine possible plan alternatives was made here. The economic impacts

of establishing a planning process are analyzed apart from the economic impacts of any regulations or other programs they may incorporate.

3. It is assumed that basinwide management planning will result in a reduction of water pollutants in the APES region.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Incremental program costs of this action are estimated at $50,000 per year to fund an environmental planner with modelling skills to work in the N.C. Division of Environmental Management.

Practice costs to government:
None.

Revenues generated by this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
No additional costs are expected for the major resource user groups most likely to be directly affected. Private groups and individuals that wish to contribute to the conservation of ecological resources would benefit from the planning.

Social costs:
No additional social costs as defined here (i.e., not including the foregone benefits of alternative uses of the public funds spent).

Social benefits:
This management action could result in an increase in water quality improvements achieved per dollar spent on the planning, administration, implementation and monitoring of water quality programs. Improved coordination of activities to protect and restore water quality within each basin would allow geographical targeting of resources spent on environmental protection, which in turn could result in increased benefits to the public and private sectors.

The development of a system for evaluating the impact of wetlands alterations on basinwide hydrology and water quality would allow those who administer wetlands permitting programs to consider the basinwide and cumulative impacts of permitting decisions. In addition, an evaluation system would help decision makers to focus

regulatory and mitigative efforts on those wetlands most important for water quality, and to channel and concentrate mitigation and protection efforts to areas where the need is greatest. (See Vital Habitat Plan, Objective B, Management Action 6, which refers to the exploration of a statewide wetlands mitigation program).

By incorporating wetlands impacts into basinwide water quality planning, government agencies, private firms and individual landowners can better tell where development will be most compatible with protecting water and wetland resources. This reduction in uncertainty should lower the overall costs of the permitting process over time for both the public and private sector. Other benefits of deliberate, coordinated and scientifically based wetlands management on a basinwide scale could include avoided, reduced or postponed expenditures on flood control structures and waste treatment facilities. (See also Vital Habitat Plan Objective B, Management Action 5).

Planning allows local governments to assess the physical capacity of land in their jurisdiction and to plan ahead for the highest quality growth possible within the constraints of the natural resource base. At a regional level, planning maximizes the effectiveness of efforts to identify and protect habitats vital to wildlife, rare species, rare natural communities, and fisheries (see the Vital Habitat Section). Finally, this approach would help local governments and landowners understand how land use decisions made elsewhere in their river basin affects the values of their land. For instance, a number of wetlands alterations which individually do not have a critical impact on water quality could cumulatively increase the intensity or periodicity of flooding for a downstream landowner or community. Understanding and measuring these effects is critical to sound basinwide management and to reducing future conflicts over land use.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

U.S. Department of Agriculture (USDA) Cooperative State Research Service - Special Research Grants Program/Water Quality
USDA National Research Initiative grants
U.S. Environmental Protection Agency (USEPA) - State Development Fund (provides grants for two year programs to develop and enhance wetlands monitoring and management programs)
USEPA Environmental Monitoring and Assessment Program (USEPA-led multiagency effort; for data collection and analysis assistance)
USEPA Water Quality Management Planning section 319 grants
USEPA Near Coastal Waters
USEPA Coastal America Program
State appropriations

OBJECTIVE A
MANAGEMENT ACTION 2:
Establish total maximum daily loads (TMDLs) and associated control strategies for all impaired streams in the Albemarle-Pamlico region by 1999.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Total maximum daily loads indicate the amount of pollution that can safely enter a body of water. To determine limits to these daily loads, current and projected levels of pollution must be considered in relation to what the system can absorb. Total maximum daily loads provide the foundation for basinwide plans and ensure that long-term growth does not harm the state's water resources."

Under the Clean Water Act, the state is required to establish TMDLs to determine the total pollutant loadings that a water body can assimilate while still maintaining its water quality classification and standards.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative Costs to government:
No additional state agency administrative costs are anticipated.

Practice Costs to government:
Local governments may incur costs. See private practice costs below.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
TMDLs are used as a tool in developing point source control strategies and targeting areas for nonpoint source management. If new permit levels are set as a result of this action, point source dischargers may have to pay increased costs of secondary treatment to comply with these new limits, and additional costs may be incurred by the private and public sector to reduce nonpoint source pollution.

Practice benefits to affected private sector groups:
See social benefits below.

Social costs:
None as defined here.

Social benefits:
While TMDLs may require increased investments in pollution control, they can also facilitate cost savings by allowing the DEM and the Division of Soil and Water Conservation to focus efforts and resources on geographically targeted areas of concern. This can help minimize governmental expenditures and better utilize taxpayers' dollars, while at the same time increasing environmental benefits per dollars spent on point and nonpoint source control.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Not applicable.

OBJECTIVE A
MANAGEMENT ACTION 3:
Renew all discharge permits in a river basin simultaneously by 1999.

REVIEW AND GENERAL COMMENTS

The CCMP reports, "Renewing permits simultaneously allows the Division of Environmental Management to consider the total impact from all dischargers when determining how much pollution each may release into the basin."

In the past, permits have been reissued randomly as they came up for renewal. In 1990, to allow for better water quality management, the Water Quality Section of the Division of Environmental Management (DEM) began implementing a basinwide National Pollutant Discharge Elimination System (NPDES) permitting schedule. In 1993, the Neuse River Basin became the first basin where all discharge permits expire and are renewed in the same year. The DEM's schedule will allow for synchronous renewal of discharge permits for the other river basins in the AP region and across the state. Permits will be reviewed and reissued at five year intervals.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
No additional state agency administrative costs are anticipated.

Practice Costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social costs:
None as defined here.

Social benefits:
Synchronous renewal will facilitate data gathering for water quality and wasteload modelling, TMDL development and basin plan development. It allows DEM's Water Quality Section to allocate staff and resources more efficiently. As with the previous Management Action, synchronous renewal and review of permits can help minimize governmental expenditures and better utilize taxpayers' dollars, while at the same time increasing environmental benefits per dollars spent on point and nonpoint source control.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Not applicable.

OBJECTIVE A
MANAGEMENT ACTION 4:
Consider the potential for long-term growth and its impacts when determining how a basin's assimilative capacity will be used.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "Assimilative capacity is the ability of a river basin to safely absorb pollutants. Basinwide planning should ensure that this capacity is used in a way that sustains long-term growth. However, planning for long-term growth also must consider how secondary impacts such as runoff from new roads will affect water quality."

The assimilative capacity of a water body is defined as the natural capability of the water body to receive a pollutant without violating water quality standards or impairing the functional use of the water body.

This Management Action calls for assessing the ability of river basins in the APES region to safely absorb or process pollutants. Under this action, this assessment would be used in basinwide planning for water quality (see Management Action 1, Objective A of the Water Quality Plan), in the permitting of point and nonpoint source pollution discharges, and in the local land and water use planning process (see Management Action 1, Objective A of the Stewardship Plan).

The main components of this Management Action are:

- for the Division of Environmental Management to establish caps (or "allocations") on total wasteloads from point and nonpoint sources.

- to review existing permits to determine how much of the allocations are already being used.

- to assure the non-degradation of existing uses of water and compliance with water quality standards.

The overall impact of this Management Action would be to help the Division of Environmental Management establish maximum assimilative capacities of the river basins of the region as limits on pollution dischargers - both point and nonpoint sources. The implementation of this plan would presumably entail denials of permits and/or restrictions on dischargers, which could in turn have a significant impact on the regional economy. See the analysis for Management Action 1, Objective A of the Stewardship Plan for a discussion of these potential impacts.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
No new state agency administrative costs are expected to be associated with this action.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups (adapted from Kniesel, 1979):

- landowners could bear a decrease in the value of their land due to greater restrictions or likelihood of permit denial based on assimilative capacities being exceeded.

- developers could bear an increase in costs of approving development plans because of need to assess impacts relative to basin assimilative capacity.

- developers could bear costs of secondary wastewater treatment or best management practices where these are made necessary to receive a permit for development or use.

- costs of delay in project development
  (most of these are not real losses to the economy, but transfers to landowners, subcontractors, financial institutions, etc.)
  - land holding costs;
  - building cost inflation;
  - overhead costs; and
  - foregone revenues.

Practice benefits to affected private sector groups:

- Some developers could benefit from better predictability of future development patterns or of the likelihood that specific tracts are developable.

- Owners of land outside of areas that would be restricted or are unlikely to receive permit approval would receive a greater value for their (developable) tracts. However, since the area that is not regulated is far greater than the area likely to be regulated or restricted, this benefit is spread very thinly over a large number of people and is likely

to be insignificant to any single landowner.

Social costs:
To the extent that planning leads to restrictions on development opportunities, the regional economy would forego the value of this development and related secondary economic activity. A review of land use control programs over the last fifteen years suggests that they have the effect of raising the value of existing improved/developed land relative to similar and adjacent sites outside of regulated areas, and of reducing the relative value of vacant and agricultural land in those zones (Fischel, 1990; Beaton and Pollock, 1992[1]). A potentially important negative impact of this manifestation of land use controls is increased housing costs and decreased availability of low-cost housing (Downs, 1992). Concerns over the decrease in the value of vacant land (its "developability") and the increase in low-income housing costs are legitimate. But the net effects of proposals in the CCMP must be measured in terms of their overall impact on development throughout the region, not just in areas or development types that may become more stringently regulated. The total level of development achievable in the region depends on the potential for development on non- or less-regulated areas and on the cost of changing development plans to meet standards (Kniesel, 1979; Batie and Shabman, 1982).[2] This will be determined entirely by the substance and implementation of any new regulations that are established in order to assure that assimilative capacities are not exceeded.

Social benefits:
Defining assimilative capacities for each river basin would also have the benefit of helping the citizens of that basin avoid the degradation of water use to which they are accustomed - drinking, fishing, swimming, etc.

Assuming that the assimilative capacity of a river basin for pollution is a true limit above which there would be a high probability of negative environmental and economic impacts, then its consideration in the planning/permitting process is very important to growth management, and ultimately the quality of life, in the region. This is because in light of a recognized limit to pollution, a county's or municipality's

[1]Beaton and Pollock actually found that vacant land in designated critical areas in Maryland were not affected relative to nearby vacant lands, but this was due to provisions in the law that gave local governments "growth allocation permits", extensive floating growth zones. This provision has allowed Maryland to postpone (not avoid) the market's internalization of restriction on development, along with accompanying equity issues.

[2]Note that this ignores important questions about equity - specifically, individual landowners who own undeveloped parcels on which land use controls are imposed will see a decline in that parcels value, reflecting its lower "developability." Such landowners may feel that they are bearing an unreasonable cost for the provision of a public good, but this is more of a legal issue and is not typically included in an assessment of impact to the regional economy.

citizens may choose to allocate the assimilative capacity of their watershed to a different mix of uses than they would without any recognized limits on total discharges. For instance, if the state were forced to start denying permits for development once some critical pollution level was reached, a community might lose opportunities beyond that point in time to develop new industries, allow new highly desirable developments, or otherwise diversify its economy and tax base. On the other hand, if that same community had known well in advance that they were reaching their limit in terms of allowable dischargers, that community might have chosen to restrict some types of development in order to reserve their total discharge capacity for future uses or for more desirable types of development.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Not applicable.

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OBJECTIVE A
MANAGEMENT ACTION 5:
Improve the scientific models for understanding the estuarine system, the effects of human activities on the system and the viability of alternative management strategies.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "Scientists use models to understand how systems work. Models for the Albemarle-Pamlico's river basins need to be further developed to determine how much pollution can be safely released into the estuary, (ie., total maximum daily loads). This would allow regulators to focus on the most critical sources of pollution, thereby reducing the cost of regulations, monitoring and enforcement. Increased knowledge gained from models will help planners manage water resources to allow for future growth."

This action calls for estuarine water quality modeling, which would focus on the description of terrestrial and airborne nutrient loadings into estuarine waters; surface and ground water cycling, toxicant loadings, fate, and transport, and cumulative effects of loadings on water quality and biotic health to more accurately characterize the estuarine system as a basis for planning and management.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Average one year cost: $400,000 per year for five years to refine and develop hydrodynamic and water quality models for the A-P region. A model that has already been developed for the Tar Pamlico Basin will be refined and adapted as needed for use in the other river basins of the A-P region. The additional cost for each basin is expected to be considerably less than the cost of developing the original model.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social costs:
None as defined here.

Social benefits:
Improved information on the effect of specific loadings, cumulative impacts, surface and ground water cycling, wetland functions, and the impacts of drainage and other hydromodifications would allow policy makers to set appropriate discharge limits and to target policy and implementation efforts at the most damaging discharges and loadings. This could reduce the cost of regulation, monitoring, enforcement and compliance while at the same time reducing the most harmful loadings.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA Clean Water Act, sections 106 and 319
State appropriations
Members of nutrient trading associations such as the Tar-Pamlico Basin Association

OBJECTIVE A
MANAGEMENT ACTION 6:
Continue long-term, comprehensive monitoring of water quality in the APES system, collecting data to assess general system health and target regional problems.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "On a system-wide basis, water quality monitoring allows managers to assess the effectiveness of management strategies. In addition, monitoring data may be used to develop scientific models or other methods of evaluating water quality on a smaller scale. Continued monitoring also would assess long term trends."

Water quality monitoring is a principal means by which most of the actions of the CCMP are to be evaluated. Furthermore, if water quality priorities and budgets are based only on the status of water quality at a single point in time, these priorities will become less efficient as water quality variables change such that they would be best approached with a different set of management strategies. The CCMP argues that monitoring would help agencies adapt to changes in water quality problems and assess the effectiveness of their management efforts.

The EPA's Environmental Monitoring and Assessment Program (EMAP) is designed to yield statistical estimates of a range of ecological variables at a multi-state geographic scale. The EMAP program is divided into several ecological types; the EMAP near coastal waters program is the one of greatest interest with respect to this Management Action. Because EMAP is designed with stratified random sampling in order to yield data that are statistically significant at the multi-state and national levels, the data generated need to be used with more intensively collected data at the local (i.e., APES region) scale. The EMAP process can be enhanced in this way or used in tandem with state or regional data collection efforts to yield data that is more useful at the local level, while still being used to develop national/multi-state statistics (EPA, 1993). The CCMP supports EMAP and efforts to coordinate EMAP data collection with APES-specific data.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. This Management Action supports existing monitoring efforts and calls for their expansion.

2. Fixed water quality monitoring stations would continue to be used by the Division of Environmental Management for grab samples; and by the U.S. Geological Survey (USGS) for continuous monitoring. The data from these stations would be supplemented by samples taken by the EPA's Environmental Monitoring and

Assessment Program (EMAP) and by the APES Citizens Water Quality Monitoring Network (CWQMN).

3. DEM and USGS would intensively survey water quality on individual areas of the APES region on a rotating basis. These surveys would help in the development of basin management strategies (see Management Action 1, Objective A of the Water Quality Plan).

4. Additional sampling and analysis would be performed in response to specific concerns on water quality or problem areas.

5. The fixed station sampling would be expanded to include biological monitoring in estuarine waters and pesticide monitoring. Area intensive surveys would target the impacts of runoff.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
In addition to currently funded monitoring programs, annual costs to the N.C. Division of Environmental Management would be $100,000 for grab samples and water quality analysis.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None as defined here.

Social costs:
None (not including the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues; see also the preceding paragraph on the costs and benefits to private sector groups).

Social benefits:
Water quality monitoring is the means by which many environmental management efforts are to be primarily evaluated, including many of the Management Actions of the CCMP. This Management Action is therefore central to the long-term success of the CCMP and of many of its individual component actions. Changes in the status of water quality could require that a different level of spending or rearranged set of management priorities be adopted in order to achieve the greatest level of water quality benefits per unit of costs. Without a continuous or periodic assessment of the impact of management on water quality, these adjustments cannot be made. Thus, this Management Action's benefit would be to assure that the benefits of the other water quality-related Management Actions of the CCMP are maximized. This benefit is contingent on the results of monitoring being duly considered and acted upon by the APES Management Conference and its constituent agencies (see the Implementation Plan).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations
U.S. Geological Survey (USGS) for technical assistance

OBJECTIVE B: "Reduce sediments, nutrients and toxins from nonpoint sources."

MANAGEMENT ACTION 1:
For each river basin, develop and implement a plan to control non-point source pollution by 1999, as part of the basinwide management plans.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Plans would address all nonpoint sources of pollution in each basin, targeting the most critical areas for controls. These plans would identify the nonpoint source pollution problems specific to each basin. Implementation would vary according to each basin's needs. Plans also would include strategies to control nonpoint source pollution in accordance with the total maximum daily loads (TMDLs) established for each basin. Possible measures include targeted funds for implementation of BMPs, buffer strips along waterways and BMPs for highway construction."

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. A basinwide nonpoint source control plan would function as part of an integrated point and nonpoint source control and management plan for each basin. For further discussion, see analysis of Water Quality Plan Objective A, Management Action 1.

2. It is assumed that basinwide management planning will result in a reduction of water pollutants in the APES region.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Program costs are estimated at $50,000 per year for a field technician/planner to work for the N.C. Division of Environmental Management to identify the actions to be taken to reduce nonpoint source pollution in each basin.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social costs:
None as defined here.

Social benefits:
A comprehensive plan for each basin utilizing incentive and regulatory based programs should help to lower the costs and increase the effectiveness of resources spent on reducing non-point source pollution in the following ways:
(1) Planning would allow incentives for implementation of BMPs to be targeted in geographically specific areas important for the protection of water quality in each basin; and (2) it would target resources to areas of each river basin where water quality is at greatest risk.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

National Oceanic and Atmospheric Administration (NOAA) Coastal Zone Management Act section 6217
U.S. Fish and Wildlife Service (USFWS) Sport Fish Restoration Fund
USEPA Clean Water Act s205
State appropriations

OBJECTIVE B
MANAGEMENT ACTION 2:
Expand funding to implement nonpoint source pollution controls, particularly agricultural best management practices through the N. C. Agriculture Cost Share Program, and also to develop a broader Water Quality Cost Share Program by 1995. Expand the cost share programs to include wetlands restoration. Increase cost share funds to problem areas.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Economic incentives and technical assistance have been effective in promoting nonpoint source pollution controls in agriculture. Under this initiative, the N.C. Agriculture Cost Share program would expand and a new Water Quality Cost Share Program, modeled after the one for agriculture, would be created. Cost-sharing would give farmers, marina owners, forestry operations and individual land owners greater incentive to reduce nonpoint source pollution."

See Vital Habitat Plan Objective B, Action 5 for costs and benefits of wetlands restoration for nonpoint source pollution control.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
A total of $5,000,000 per year would be needed by state agencies to implement this action. The N.C. Agriculture Cost Share Program for the APES region requires an additional estimated $2.5 million in fiscal year 1994-95 to hire additional technical outreach personnel and provide ample support for BMPs. Funding needs for the broader Water Quality Cost Share Program are estimated at $2.5 million per year. For each of the programs, $500,000 would be used to fund administration and technical assistance, $2 million would be used to fund on-the-ground practices.

Practice benefits to affected private sector groups:
The N.C. Agriculture Cost Share Program offers farmers not only strong economic incentives to implement BMPs (the program will pay up to 75 percent of implementation costs), but technical assistance to help them determine the most appropriate BMPs for each farming operation. In addition, technical assistance personnel who are familiar with local conditions are located in each district office. These factors help control the cost of reducing nonpoint source pollution from agricultural operations.

As is the case in the Agricultural BMP program, BMP implementation through the broader Water Quality Cost Share Program is intended to improve water quality on the landowner's property as well as in adjacent areas and downstream. Just as the agricultural program aims to improve the efficiency of farm operations, the New Water Quality Cost Share program would aim to increase the efficiency of marinas, forestry and individual homeowners' operations. For example, upgrading dysfunctional and non-compliant septic systems would also involve improvement in the efficiency of the homeowner's septic system. Reduction of soil erosion can save topsoil and increase the productivity of forester's soil. If pesticide use is reduced, urban and suburban homeowner's as well as forester's pesticide costs may be reduced.

In addition to the above benefits, urban and suburban homeowners could benefit from an increase in land value due to upgrading of dysfunctional and non-compliant septic systems. Private foresters may benefit from an increase in land value due to decreases in erosion resulting from BMPs.

See Vital Habitat Plan Objective B, Management Action 5 for costs and benefits of wetlands restoration for nonpoint source pollution control.

Social benefits:
Reduction of urban nonpoint source pollution such as storm drainage could improve water quality in the APES region by reducing the amounts of pesticides from urban and suburban lawns, and heavy metals (such as lead) and oil that run into the estuarine system from stormwater runoff. Reduction of the water pollution from these suburban and urban nonpoint sources can reduce the risk of harm to shellfish and finfish as well as human health risks.

Reduction of urban and suburban stormwater runoff pollution and malfunctioning septic system pollution would include a reduction in bacteria and pathogens which can cause fish diseases and fish kills, and can also pose human health risks. Reductions in bacterial pollution from malfunctioning septic systems would not only improve the potential for shellfish harvesting, but also would lessen the threat of groundwater and drinking water contamination.

A reduction of nutrients from urban and suburban lawn runoff would also improve water quality in the APES region by reducing algal blooms, resulting in fewer fish diseases and fish kills.

BMPs that reduce erosion of construction site areas and of forestry logging and replanting sites could reduce turbidity caused by sediment loadings, and thus benefit fish and other aquatic life who are harmed by it.

See Vital Habitat Plan Objective B, Management Action 5, for costs and benefits of wetlands restoration for nonpoint source pollution control.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations
USDA Agricultural Conservation Program,
Water Quality Initiative Project, and
Conservation Reserve Program.
NOAA Coastal Zone Management Act s6217.
USEPA Clean Water Act s319 and Near Coastal Waters.
USFWS Sport Fish Restoration Fund for marina BMPs
and pump-outs.
Private industries through participation in nutrient trading associations.

"Expand funding to implement nonpoint source pollution controls, particularly agricultural best management practices (BMPs) through the North Carolina Agriculture Cost Share Program, and also to develop a broader Water Quality Cost Share Program by 1995. Expand the cost share programs to include wetlands restoration. Increase cost share funds to problem areas."

The following discussion and analysis will be focused specifically on component of this action that deals with the North Carolina Agriculture Cost Share Program.

REVIEW AND GENERAL COMMENTS

The plan recommends that the N.C. General Assembly increase funding to the NC Agriculture Cost Share Program for the APES region in 1994 by $2,500,000 to fund additional personnel and to provide ample support for BMPs. Although this is an increase of more than 50% of the estimated $4,000,000 that the state spent on BMPs and technical assistance in the APES region in Project Year 1992, this increase has been recommended to meet current needs, which appear to be greater than the state has allocated. For example, in Project Year 1992 for BMPs alone, the APES districts requested approximately $1,800,000 more than the NC Soil and Water Conservation Commission had available to allocate to the area.

For Project Year 92 (July 91- June 92), the state spent 40% of its total BMP funds and 33% of its technical assistance funds in the 36 counties of the APES region. For BMPs, the total contract amount that the state paid was $9,425,337.00. The contract amount the state paid in the 36 APES counties for BMPs was $3,801,521.00. The contract amount is the amount the state has paid to applicants for BMPs. The state reimburses applicants up to 75% of the predetermined average cost for each BMP. For technical assistance, the state made available to the local governments a total of $1,106,363.00 for 50:50 cost sharing to hire technical personnel, $362,144.00 of which was made available to the local governments in the APES region.

BMP contract expenditures for Project Year 92 in the APES region can be broken down as follows:

Erosion/Nutrient Control:

Item	Cost	Units
Conservation Tillage	$204,233	20,354.14 acres
Terraces	$ 63,903	207,095 lin. ft.
Diversions	$308,399	341,903 lin. ft.
Critical Area Planting	$ 51,179	75.60 acres
Sod-based rotation	$117,953	2,263.70 acres
Strip cropping	$ 29,969	419.55 acres
Conversion to Grass	$138,715	1,306.11 acres
Conversion to Trees	$ 61,602	572.70 acres
Conversion to Wildlife	$ 729	6 acres
Conversion to Christmas Trees	$ 0	0
Grade stabilization structures	$ 17,690	18

Sediment/Nutrient Control:

Item	Cost	Units
Filter Strips:	$ 39,513	40.40 acres
Field Borders:	$610,812	664.42 acres
Grassed Waterways:	$789,349	565.79 acres
Water Control Structures	$290,951	326
Stream Crossings:	$ 1,525	1
Livestock Exclusion:	$ 1,920	4,550 sq. ft.
Portable Water Facilities	$ 10,677	1

Animal Waste Management:

Item	Number of Animals Managed
Cows	1,676
Fish	0
Hogs	238,799
Horses	0
Poultry	2,829,200
Sheep	0

Animal Waste Systems:

Item	Cost	Units
Lagoons	$1,446,183	120
Ponds	$ 30,077	3
Dry stacks	$ 32,973	3
Pads	$ 2,438	3
Litter storage structures	$ 26,936	4
Composter	$ 109,886	26

Land Application:

Item	Number of Animals Managed
Cows	130
Fish	0
Hogs	44,948
Horses	0
Poultry	3,880,000
Sheep	0

Item		Units
Acres		5,728
Gallons		62,703,111
Tons		29,435.75
Total Cost	**$236,755**	
Solid Set	$182,476	20
Wetlands	0	0
Hydrants	$ 9,982	1

Grand Total Summary Data

Acres Affected:	75,984
Tons of Soil Saved:	185,638
ASCS Payment	($1,016,133)
Total Contract Amount	**$3,801,521**
Total Technical Assistance	**$ 362,144**

Current funding of the N.C. Agricultural Cost Share Program:
According to the NC Division of Soil and Water Conservation (NCDSWC), its current annual budget for the fiscal year July 1992-June 1993 for the N.C. Agriculture Cost Share Program is approximately $8,225,000. Of that money, the total state cost share budget for all BMPs is $6,900,000, and the total state budget for technical assistance to the cost share program is $1,325,000.

Because the state matches the amount that is spent by the local districts on technical assistance, we assume that the 94 local districts together could spend $1,325,000 this year on technical assistance. The total state and local districts' budget for technical assistance for this year can thus be estimated at $2,650,000.

NOTE: Expenditures may be funded by money allocated in previous years. This would explain differences between Project Year allocation figures and expenditure figures.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. This action recommends increased funding to the technical assistance component as well as the "contract" component of the program.

2. The technical assistance funds would be used to match local districts expenditures (50%-50%) on salaries of technicians and engineers.

3. The state would pay up to 75% of the total physical practice costs of new BMP expenditures.

4. Private landowner's costs of BMP expenditures would be approximately 25% of total costs.

5. This action recommends increased funding to cover cost share for the purchase and

installation of any equipment or other costs of establishing BMPs associated with the requirements of the NC Environmental Management Commission's recently adopted regulations for animal operations.

6. This action recommends increased funding to cover cost share for the purchase and installation costs of BMPs to reduce passage of nutrients and soluble pollutants to groundwater as well as surface water.

7. This action recommends increased funding to cover cost share for the implementation of integrated pest management and practices that reduce inputs of nutrients and toxicants.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
It is estimated that the existing NC Agricultural Cost-Share program for the APES region requires an additional $2,500,000 in the fiscal year 1994-95 to fund the hiring of additional technical outreach personnel and to provide ample support for BMPs.

The salaries of additional staff, including technicians and engineers, are administrative costs included in the technical assistance component of the program. Under the current system, 50% of staff's salaries would be paid by the state, and 50% would be paid by the local districts.

Practice costs to government:
The state's cost share "contract" costs are assumed to be 75% of total costs of agricultural BMPs that reduce nonpoint source pollution.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Individual landowner's costs are assumed to be approximately 25% of total costs of agricultural BMPs that reduce nonpoint source pollution. In cases where the state cannot pay 75% of the total costs of the agricultural BMP being implemented, the landowner's costs would be higher. Other costs to landowner's, specifically farmers, include any land which may be taken out of production through the implementation of BMPs. Other costs may include those for new equipment to utilize new BMPs, and the costs of changing the management practices of the agricultural operation.

Practice benefits to affected private sector groups:
BMP implementation is intended to improve water quality on landowners' property as well as in adjacent areas and downstream. At the same time, BMPs are also intended to meet the operational needs of the landowner and improve the efficiency of the operation. For example, if pesticide or fertilizer use is reduced and if yield remains the same, farmers' net income may increase. The current cost share program is voluntary, which implies that landowners perceive a net benefit from the cost share contributions, implementation of BMPs and the technical assistance provided by the state to help them install and maintain BMPs.

Social costs:
None as defined here.

Social benefits:
Agricultural BMPs for nonpoint source pollution control are intended to reduce the input of agricultural nonpoint source pollution such as sediment, nutrients, animal waste and pesticides into surface water. Agricultural BMPs reduce nonpoint source pollution by reducing nutrients available in runoff, reducing sediments that flow into streams, rivers, lakes and estuaries, reducing pesticide use in farming operations, and by reducing freshwater loading of primary nursery areas. Social benefits from these reductions include the protection of public health, the economy, and the environment. These reductions can also benefit wildlife and recreational activities such as boating, fishing, and swimming.

Decreased inputs of pesticides into surface water can protect the ecology of the estuarine waters and reduce the risk to human health posed by long term impact of toxic compounds, which can become concentrated in shellfish and finfish.

Decreasing freshwater loading to primary nursery areas provides important benefits to the APES region through the protection of estuarine waters from decreased salinity, which would otherwise threaten the health of marine animals, including fish and shellfish and their habitats.

BMPs that reduce animal waste in runoff from livestock operations can reduce the risk to the health of fish and humans by reducing the amount of bacteria and other pathogens in the runoff. Fecal coliform tests are used as indicators of the presence of wastes from warm blooded animals, and shellfish harvesting is prohibited when these tests show the shellfish to be contaminated by human or animal wastes. A reduction in livestock waste in runoff can also reduce the amount of organic matter in the waters of the APES region. A reduction of organic matter can help to reduce fish kills and diseases that result from reduced oxygen levels in the water.

Successful coordination efforts recommended by this action between the DEM and the DSWC to ensure the appropriate targeting of the most pressing nonpoint source water pollution concerns would yield social benefits. These could include reduced redundancy of effort, as well as more cost effective expenditures on pollution control. Both would reduce regulatory and compliance costs.

Expand funding to implement nonpoint source pollution controls, particularly agricultural best management practices (BMPs) through the North Carolina Agriculture Cost Share Program, and also to develop a broader Water Quality Cost Share Program by 1995. Expand the cost share programs to include wetlands restoration. Increase cost share funds to problem areas.

The following discussion and analysis will be focused specifically on the New Water Quality Cost Share Program recommended in this action.

REVIEW AND GENERAL COMMENTS

Using the existing North Carolina Agriculture Cost Share Program as a model, it is recommended that land or operation owners share in the cost of nonpoint source controls at a rate of 25% of the total cost of the controls on their property. The program would supply the other 75% plus the technical assistance necessary for planning and developing the controls.

Funding needs are currently estimated at $2.5 million dollars per year ($500,000 for administration and $2 million for on the ground practices).

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. This program would provide cost share monies to farmers, private foresters, urban and suburban developments, homeowners, and others for implementation of BMPs for water quality protection from nonpoint source pollution including implementation of forestry and marina BMPs.

2. Cost share monies will be provided to homeowners to upgrade dysfunctional and non-compliant septic systems. This includes the provision of money to residents with failing septic systems to install proven alternative systems on present lots, or, for those who live in areas of high density development, to hook up to existing central sewer systems.

3. Cost share monies will be provided to communities or individuals for the construction of stormwater detention ponds and other BMPS that reduce nonpoint source pollution from stormwater runoff.

4. State practice costs would be 75% of the total practice costs of implementing BMPs on privately owned land.

5. Each individual landowner's practice costs would be 25% of the total practice costs of establishing BMPs on his or her land.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Costs would include new program development, administration, and implementation. Modeled after the N.C. Agriculture Cost Share Program, the administrative costs, primarily the salaries of technicians, would be considered Technical Assistance costs. Fifty percent of these costs would be paid by the state, and 50% would be paid by the local districts.

Practice costs to government:
Modeled after the N.C. Agriculture Cost Share Program, the state would pay up to 75% of total costs of non-agricultural BMPs that reduce nonpoint source pollution.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups: Those landowners with costs associated with implementing non-agricultural BMPs would pay 25% of total costs.

Practice benefits to affected private sector groups:
As is the case in the N.C. Agriculture Cost Share Program, BMP implementation is intended to improve water quality on landowner's property as well as in adjacent areas and downstream. In the same way the agricultural program aims to improve the efficiency of farm operations, the same would be true for homeowners and foresters. For example, upgrading dysfunctional and non-compliant septic systems would also involve improvement in the efficiency of the homeowner's septic system. Reduction of soil erosion can save topsoil and increase the productivity of forester's soil. If pesticide use is reduced, urban and suburban homeowner's as well as forester's pesticide costs may be reduced.

In addition to the above benefits, urban and suburban homeowners could benefit from an increase in land value due to upgrading of dysfunctional and non-compliant septic systems. Private foresters may benefit from an increase in land value due to decreases in erosion resulting from BMPs.

Social costs:
None as defined here.

Social benefits:
Reduction of urban nonpoint source pollution such as storm drainage could improve

water quality in the APES region by reducing the amounts of pesticides from urban and suburban lawns, and heavy metals (such as lead) and oil that run into the estuarine system from storm runoff. Reduction of the water pollution from these suburban and urban nonpoint sources can reduce the risk of harm to shellfish and finfish as well as human health risks.

Reduction of urban and suburban storm water runoff pollution and malfunctioning septic system pollution would include a reduction in bacteria and pathogens which can cause fish diseases and fish kills, and can also pose human health risks. Reductions in bacterial pollution from malfunctioning septic systems, would not only improve the potential for shellfish harvesting, but also would lessen the threat of groundwater and drinking water contamination.

Reduction of the amounts of nutrients from urban and suburban lawns would also improve water quality in the APES region by reducing algal blooms, resulting in fewer fish diseases and fish kills.

BMPs that reduce erosion of construction site areas and of forestry logging and replanting sites could reduce turbidity caused by sediment loadings, and thus benefit fish and other aquatic life who are harmed by it.

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OBJECTIVE B
MANAGEMENT ACTION 3:
Continue to develop and demonstrate alternative septic systems, as well as best management practices (BMPs) to reduce nonpoint source pollution.

REVIEW AND GENERAL COMMENTS

The CCMP states, "Alternative septic systems will help protect the environment and support long-term growth by providing effective waste treatment for eastern North Carolina. BMPs improve the performance of septic systems, and reduce costly repairs. Developing and demonstrating additional BMPs for other sources of pollution, such as runoff from agriculture, urban lands and highways, would provide proactive, cost-effective means to reduce nonpoint source pollution."

The action recommends additional research and development to demonstrate new systems and make them affordable. Research, development and demonstration of alternative wastewater treatment systems should make new septic systems more effective than currently used systems at a lower cost.

Agricultural and non-agricultural BMPs would be developed to reduce nonpoint source pollution caused by the leaching of nitrates, salts, and pesticides into the groundwater of the APES region. Agricultural BMPs that can help to reduce this pollution include: controlling the rate, method, and timing of manure, fertilizer, and pesticide applications; irrigation scheduling to minimize water use and excessive leaching, which also may reduce runoff if infiltration capacity is not exceeded; and conservation tillage for runoff and erosion control.

Non-agricultural BMPs that can help to reduce groundwater pollution include improved siting, installation and maintenance of septic systems. In addition, minimum lot size requirements reduce the risk of drinking water contamination by preventing the concentration of wastewater and sewage treatment near water supplies. Non-agricultural BMPS to protect surface water and groundwater resources also include the adequate management and maintenance of stormwater structures.

Streamside buffer strips are an example of a BMP that can be used on agricultural and developing land to help minimize groundwater and surface water pollution. Liddle (1993) notes that nitrate inputs may be mitigated by transport of discharging waters through riparian wetlands that border stream channels, marshlands and woodland buffer strips surrounding cropland, or through other microbially active zones.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The research and demonstration could be conducted by individuals at state agricultural stations, colleges and universities, research institutions, federal or state agencies, or private organizations.

2. Educational materials with major findings from the research would be organized and disseminated by relevant agencies.

3. The Federal Agricultural Research Service, the NCSU Agricultural Research Service, the N.C. Division of Soil and Water Conservation, the N.C. Department of Agriculture, the Cooperative Extension Service and Farm organizations would provide information on and help to develop the agricultural BMPs.

4. The Groundwater Section and the Wellhead Protection Program of the DEM would work with other relevant agencies and local governments to develop the non-agricultural BMPS.

5. Research and demonstration sites such as the Greenville Stormwater Detention Pond Demonstration Project would be developed throughout the APES region to demonstrate the benefits of best stormwater management practices.

6. Demonstration sites would include urban BMPs such as stormwater detention ponds, infiltration trenches, infiltration basins, porous pavement, water quality inlets and vegetative practices, proper pesticide and fertilizer application, proper disposal of oil, gasoline, antifreeze and other commonly used products which can contribute to nonpoint source pollution.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
It is anticipated that $350,000 per year for five years will be needed to fund research and demonstration projects.

Practice costs to government:
We have included the cost of demonstration projects under administrative costs.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social costs:
None as defined here.

Social benefits:
Research, development and demonstration of alternative wastewater treatment systems should make new septic systems more effective than currently used systems at a lower cost.

Benefits from improved siting, installation and maintenance of septic systems include the protection of surface water and groundwater reserves near sewage disposal sites from nitrogen, phosphorous, and bacterial contamination and pollution which can result in increased eutrophication and in pollution and subsequent closing of shellfish waters.
BMPs such as improved siting, installation and maintenance of septic systems, and proper construction, operation and maintenance of stormwater structures offer ground and surface water protection as well as cost savings. These preventative BMPs not only improve the performance of septic systems and stormwater structures, they also are less costly than repairing or replacing systems and structures.

Demonstration of the effectiveness of best management practices that offer ease of integration into existing practices and that provide economic or labor saving benefits can help to increase the understanding, acceptance, and use of these practices by local citizens.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Agricultural Conservation Program
USDA Water Quality Initiative Project
USDA Conservation Reserve Program
USDA Cooperative State Research Service
USDA National Research Initiative
USDA Cooperative Extension Service
NOAA Coastal Zone Management Act s309, s6217
NOAA Coastal Zone Management Estuarine Research Reserves

USEPA Clean Water Act s319 and Near Coastal Waters
State/EPA Data Management Financial Assistance Program
EPA National Environmental Education Grants
EPA Coastal America Program
State appropriations
Freshwater Foundation
Soil and Water Conservation Society

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OBJECTIVE B
MANAGEMENT ACTION 4:
Strengthen current enforcement programs to detect and correct ground and surface water quality violations from non-point sources.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Although current enforcement authority exists, nonpoint sources of water quality violations are difficult to identify because they are varied and, often, widespread. The Division of Environmental Management's Water Quality and Groundwater Sections would strengthen enforcement to ensure that these violations are identified and corrected."

There are a series of statutes already on the books regarding noncompliance with Water Quality Standards. Civil penalties can be assessed by the Environmental Management Commission for persons or entities that violate water quality standards. Currently, enforcement is complaint driven. A more proactive approach would be to dedicate a certain number of staff members to ensuring compliance with nonpoint source regulations by identifying sources and working with them to remediate the problem.

This Management Action calls on the state legislature to fund additional staff for the Division of Environmental Management for enhanced nonpoint source pollution controls enforcement. Among the duties of this staff are:

- inspection and enforcement activities, including the issuance of notices of violation;
- prioritization of violations according to severity;
- outreach and technical assistance; and
- recommendations on appropriate remedial action.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The 3 additional staff members would be stationed at the Division of Environmental Management's regional office in Washington, N.C., and would be equipped with continuous monitoring capabilities.

2. The staff would identify possible water quality violations and ensure compliance with water quality standards.

3. The enforcement staff would make recommendations to landowners who are not in compliance on how to comply, and work with landowners to remedy the situation and to locate sources of financial assistance, such as cost share programs, to the

landowners to help them pay for the costs of compliance.

4. It is assumed that non-compliance is partially due to a lack of adequate enforcement. Moreover, it is assumed that a marginal increase in enforcement and inspection effort will lead to an increase in compliance rate (i.e., that the marginal benefit of increased compliance exceeds the cost of enforcement).

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Funding needs are estimated at $200,000 per year for program staffing, administration and implementation. This would include 3 additional staff members to be hired by the DEM as well as equipment and supplies. The staff would be stationed in the regional office in Washington N.C. and provided with continuous monitoring equipment.

Practice costs to government:
None as defined here.

Revenues generated under this action:
Revenues from fines collected from water quality standard violators.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
No increased costs will be borne by those parties who are in compliance with ground and surface water quality standards.

Practice benefits to affected private sector groups:
Farmers, developers, and others who currently are regulated and who are in compliance with the law or the terms of their permits would benefit by decreasing or eliminating the competitive advantage (if any) that wetlands resource users who do not currently comply have. See also the Social benefits section below.

Social costs:
None as defined here.

Social benefits:
Improved enforcement of and compliance with regulations would protect the public's drinking water and water resources from nonpoint source violations that otherwise could threaten human and environmental health, with associated health, environmental and economic costs. Enforcement that begins by identifying nonpoint source pollution violations and is solution-oriented can help reduce future violations, and by doing so

reduce the future costs of enforcement and pollution. In addition, improved compliance with regulations and laws leads to better environmental quality (see General Discussion of Economic Issues). Users of water resources would benefit from the added protection of wetlands and regional water quality. These users include, among others, municipal water users, fishing interests and nature-related tourism/travel industry and consumers.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

NOAA CZMA s6217
State appropriations

OBJECTIVE B
MANAGEMENT ACTION 5:
Require all logging operators to submit a notice of intent to harvest by 1995. Notice would be filed with the state forester.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Notification prior to harvest allows state agencies to provide outreach and technical assistance to promote best management practices, which protect water quality and wetlands. Notification also improves agencies' ability to monitor forestry BMPs according to existing regulations."

This Management Action is intended to give state and county foresters a better opportunity to provide forestland owners and loggers with technical advice and assistance regarding best management practices and compliance with forestry regulations. The main components of this proposal are:

- the General Assembly would legislate the requirement to notify the state forester before any timber harvest and give the Division of Forest Resources the authority to enforce the requirement. The Division would develop rules for notification and enforce the law.
- The Division would notify county foresters about harvest plans in their area.
- State and county officials would use the notification data to provide technical assistance on best management practices for protecting wetlands and water quality, and to assess regional logging trends and cumulative impacts on a regional scale. An annual report would be produced by the Division of Forest Resources.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The CCMP has not specified the substance of proposed notification requirements. When the General Assembly drafts the new statute required for this Management Action, notification requirements may or may not include a waiting period, or a maximum time from the date of notification within which harvest could occur. Other specifics of the requirement that will be of interest include whether operators will need to certify that existing regulations or BMPs have been followed, or to provide maps of the area to be harvested. These details will need to be specified before the costs of the notification requirement can be fully determined. In addition, the nature of the penalties for failure to notify would play an important role in the cost and effectiveness of this proposal.

2. Apart from the added staff in the Division of Forest Resources, all costs to government agencies of this plan would come from existing budgets.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Administrative costs to government of this action include clerical costs and the cost of coordination between the state forestry division and county foresters. It is estimated that the N.C. Division of Forest Resources would require $50,000 per year to cover the costs of hiring an information manager.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Forestry operators will incur added costs from this proposal mainly in the form of the time it takes them to fill out the notification form. As long as they are not required to wait for approval to harvest, they would not incur opportunity costs related to missed opportunities to harvest.

Practice benefits to affected private sector groups:
Operators would receive some benefit from better access to technical assistance to the extent that the Division of Forest Resource and/or county foresters are better able to provide this assistance because of the notification data.
Benefits may include more profitable logging operations if operators learn techniques that make their operations more economically efficient. As a result of best management practices being implemented, landowners may benefit from a decrease of soil loss and erosion on their property.

Social costs:
None as defined here.

Social benefits:
The primary environmental benefit of this proposal would be any enhancement of water quality, wildlife habitat, soil conservation and other environmental variables due to more and better applications of forestry best management practices. Some of these benefits would accrue directly to the landowner (e.g., reduced soil or stream bank

erosion). APES feels that the positive impacts on water quality for the region as a whole could also be significant. The main benefit to water quality from increased use of forestry BMPs would be decreased sediment pollution of estuarine waters, with a resulting decrease in damage to aquatic life, including ecologically, commercially and recreationally valuable fish. To the extent that the enhanced use of best management practices leads to better water quality, this proposal could benefit a wide range of water resource users including those who benefit from downstream drinking water supplies, recreational fishing, and downstream commercial fisheries. (see the General Discussion of Economic Issues chapter). The nature and magnitude of this benefit cannot be estimated before the exact nature of the notification requirements are determined.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations

OBJECTIVE B
MANAGEMENT ACTION 6:
Enhance stormwater runoff control by developing new regulations as needed and by strengthening existing ones to protect water quality in all state waters by 1995. Improve enforcement to ensure that stormwater management systems are properly installed and regularly maintained.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "At present, there is no integrated program to manage stormwater runoff in North Carolina, and therefore, not all waters are protected. Under this initiative, various regulating agencies would coordinate their efforts to protect all state waters. The Division of Environmental Management would dedicate more staff time to monitoring the installation, operation and maintenance of stormwater systems. A critical part of enforcement would be providing education and technical assistance to private land owners, industries, municipalities, and others required to comply with these regulations."

Improvement of stormwater management through education, technical assistance, monitoring and certification could reduce loadings of sediment and toxicants from stormwater runoff from inland, as well as coastal sources. This could provide more comprehensive water quality protection for estuarine and coastal waters, and would also benefit inland waters. Proper maintenance of stormwater systems such as wet detention ponds provides for continued flood control and retention of sediment and other pollutants associated with particulates that settle in the ponds.

This Management Action calls for DEM to dedicate more staff time to monitoring the construction, operation and maintenance of stormwater control facilities throughout the state. In addition, it recommends that the state stormwater control program dedicate more staff to education and technical assistance of private land owners, industries, municipalities, and regions required to comply with the state or federal stormwater control regulations, so that these parties understand the reasons for the regulations and how to improve maintenance.

Current State Coastal Stormwater Program and Regulations
The coastal stormwater certification program applies to the 20 coastal counties, and is administered by the DEM. The program was designed to protect coastal waters from stormwater runoff contaminated with fecal coliform, sediments, and associated pollutants. Projects that require Coastal Area Management Act (CAMA) development permits or sedimentation erosion control permits must also apply to DEM for stormwater certification. Developers are required to submit plans to the local regional DEM office specifying operation and maintenance needs associated with stormwater facilities proposed for their projects, criteria for triggering maintenance actions, and responsibility for undertaking maintenance.

(N.C. Administrative Code, Title 15A, Subchapter 2H, 1989). Development projects that disturb less than 1 acre of land, and all on-going agricultural and forestry projects are exempt.

In addition to wet and extended detention basins or ponds, the coastal stormwater regulations also permit other kinds of stormwater control systems, including infiltration trenches, infiltration basins, porous pavements, water quality inlets and vegetative systems.

Current Staffing and Funding
The Water Quality Section of DEM now employs one half time and 3 full time staff persons to administer the state coastal stormwater control program from the Raleigh office. DEM provides technical assistance from offices in Washington and Wilmington.

Related legislation:
Legislation related to this action's recommendation has already been passed. North Carolina's Water Supply Watershed Protection Act, also known as HB 156, was adopted in February 1992. The Act addresses stormwater pollution statewide by limiting the amount of impervious surface area allowable in defined low density and high density areas in critical and protected areas of water supply watersheds, and by requiring wet detention ponds in areas of high density in the critical and protected watershed areas. In addition, it requires that local governments assume responsibility for operation and maintenance of the detention ponds, including annual inspection, and standardized reporting. The local government is granted authority to impose civil penalties on pond owners whose ponds do not meet performance standards. The act requires those undertaking projects to submit a plan to their local government for certification.

Maintenance of Stormwater Management Systems
Roenigk et al. (1992) emphasize that "Adequate maintenance of stormwater structures is essential if both water quality (pollution control) and quantity (flood control) benefits are to be realized over time. Additionally, stormwater maintenance is important for public health and safety, community aesthetics, and groundwater recharge."

In the 20 county coastal region, "...developers are required to submit plans specifying operation and maintenance needs associated with stormwater facilities proposed for their projects, criteria for triggering maintenance actions, and responsibility for undertaking maintenance. (N.C. Admin Code, Title 15A, Subchapter 2H, 1989).

Roenigk et al. found that "...local governments' ability to actually maintain stormwater systems or require private landowners to do so may be impeded by gaps in information on the most appropriate institutional, financial, and operational procedures for maintaining stormwater systems." (Roenigk et al. 1992)

Roenigk et. al undertook research to help local governments improve their management of stormwater systems. The results of their research include assessments of expected frequency and costs of maintenance for stormwater control structures and the most cost-effective methods of providing stable long-term financing of stormwater management. (Roenigk et al. 1992)

Although the costs of constructing stormwater facilities vary depending on design, type of control, and site factors, Roenigk et al. (1992) found that wet detention ponds "appear to be the most expensive but may also be the most cost-effective for water quality improvements." Although maintenance needs vary significantly, "A survey of six local and national agencies having stormwater management programs suggests that routine annual costs can be roughly approximated for detention ponds as 2 to 3% of construction costs." Additionally,"... non-routine annual costs for detention ponds are estimated at between 1 and 2% of construction costs." (Wiegand et al., 1986, in Roenigk et al. 1992)

Although few cost estimates for stormwater control structures other than detention ponds are available, Schueler, 1987 found that "well planned design can reduce maintenance costs as well as construction costs." (Roenigk et al., 1992).

Planned runoff controls for new development are more easily implemented than retrofitting runoff controls for development that has taken place without these controls; thus, planned runoff controls may be less costly.

Inadequate Stormwater Regulation Enforcement, Financial and Access Guarantees:
Roenigk et al. (1992) found that stormwater regulations may be inadequate in the following respects:

1.Insufficient enforcement: In N.C., 45% of the cities across the state with regulations do not monitor private sector compliance with regulations in any way.

2.Insufficient guarantees that the developers have the money to build and maintain the facilities: 42% of cities with regulations do not require performance bonds or other financial guarantees for the construction operation of private facilities.

3.Insufficient access provisions: 42% do not require that developers or landowners provide access to the stormwater facility.

Urban Stormwater Quality Management:
According to Moreau et al. (1979) "evaluations of alternative strategies for managing urban stormwater quality should be carried out with a multiple-objective accounting framework which recognizes both the multiple purpose nature of those technologies and their

simultaneous impacts on several social objectives, including both beneficial and adverse effects." Site to site variations affect costs, and thus, deciding on the appropriate practice should be done on a case by case basis. Bearing this in mind, Moreau et al. have compared the cost effectiveness of certain technologies. A summary of these comparisons follows:

• Erosion Control at Construction Sites

Intensity of sediment loadings from construction sites may often be several orders of magnitude larger than loads from other urban activities. Erosion control costs are incurred at the time of active construction and soil exposure. Erosion control costs vary by site, however, Bell (1977) estimated a range of from 1 to 5% of total construction costs. (Moreau 1979)

• On-Site Retention

Costs of porous pavement over those of conventional asphalt or concrete are reported to be significantly higher (Thelin, 1972, 75-95); but other on-site controls can be less costly than conventional drainage practices (Poertner, 1974). (In Moreau et al. 1979)

• Street Sweeping

Although capital, operation, and maintenance costs for vacuum sweepers are higher than those for broom sweepers, from a water quality control perspective, Moreau et al. (1979) conclude that vacuum sweepers are much more cost-effective than broom sweepers, because vacuum sweepers are much more effective at removing street surface solids and related pollutants.

• Settling and Storage Basins

Excluding land costs, Moreau et al. (1979) found that for the single purpose of water quality management, settling basins designed for 2-month storms are much more cost-effective than those designed for a 2-year storm; and significant savings in costs of constructing and operating those basins are possible through the use of on-site basin controls.

Moreau et al. (1979) analyzed four different comprehensive strategies utilizing a mix of the above technologies. They found that the most cost-effective strategies were those which used grassed swales in lieu of curb and gutters in low density residential areas, effective erosion control at construction sites, and in high density areas, vacuum sweeping and settling basins where possible. Moreau et al. (1979) found that effective strategies should apply a range of small scale technologies to different land use types, and that uniform requirements applied over all of the land uses were inferior approaches.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
$150,000 per year for 3 staff persons to be hired by the NCDEM to evaluate current stormwater management rules; monitor coastal and inland stormwater control facilities to ensure proper construction, operation, and maintenance; and to provide outreach, education and technical assistance to private landowners, industries, municipalities and counties to ensure proper maintenance of stormwater management facilities.

Practice costs to government:
Implementation of the regulations called for in this action may require municipalities and counties to incur practice costs of construction of the required facilities or costs of construction of the required additions or modifications. There may also be additional operation and maintenance costs of expanded stormwater management facilities.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Implementation of the regulations called for in this action will probably require private landowners, developers and other industries to incur practice costs of constructing, operating and maintaining stormwater management facilities.

Stormwater systems for which costs may be incurred include wet detention ponds and basins, infiltration trenches, infiltration basins, porous pavement, water quality inlets and vegetative practices.

Practice benefits to affected private sector groups:
Possible aesthetic and erosion control benefits to landowners, industries and homeowners associations from stormwater systems such as wet detention ponds sited on their properties.

Social costs:
Social costs could include increased costs to industries passed on to consumers, and possible higher city and county taxes to pay for municipal and county stormwater management facilities.

Social Benefits:
Improvement of stormwater management through education, technical assistance, monitoring and certification and expansion of the program watershed wide could reduce loadings of sediment and toxicants from stormwater runoff from inland, as well

as coastal sources. This could provide more comprehensive water quality protection for estuarine and coastal waters, and would also benefit inland waters.

The APE Study has funded an urban stormwater detention pond demonstration project in Greenville, N.C.. The pond has been built and has already begun providing benefits that are visible to Greenville residents. Stormwater detention ponds remove nutrients and heavy metals from runoff. They are an example of a best stormwater management practice in urban areas experiencing new development. This pond is a 1.5 acre, 500,000 cubic foot detention pond which removes pollutants from the runoff within a 200 acre watershed. The pond will serve as a model for regional stormwater management in the Pamlico-Tar River basin.(Belk et al., 1992)

Beside flood control and retention of sediment and other pollutants associated with particulates that settle in the ponds, wet detention ponds can provide aesthetic amenities. Demonstration sites such as the wet detention pond in Greenville remove litter and other debris from stormwater runoff before they enter the estuarine system. According to Belk et al. (1992),"...aesthetic benefits [from the pond at Greenville] were immediately apparent to the local population, especially to adjacent property owners." In addition, the authors noted that "...project construction rectified a dangerous, ongoing erosion problem and increased useable land area..."(Belk et al. 1992).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

EPA Clean Water Act s319
EPA State Revolving Fund
EPA Near Coastal Waters
State/EPA Data Management Assistance Program
State appropriations
Local governments and coalitions
Private industries

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OBJECTIVE B
MANAGEMENT ACTION 7:
Implement an inter-agency state policy that addresses marina siting and integrates best management practices through permitting and better public education by 1995.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "There is no consensus on the cumulative impacts of marinas.on the estuary or on how to manage marina development. A state marinas policy would coordinate agencies concerned with regulating and planning for marinas. It would address such issues as public trust rights and marina siting and would integrate new best management practices. New BMPs include designing marinas to contain oil spills and pollution; minimizing the impact of turbulence from boating outside marinas, and controlling pollution from fish wastes and boat cleansers. A marinas policy, along with the appropriate regulations, would be a guide for local government planning. Public education, particularly boater education, plays an integral role in encouraging the use of best management practices."

The North Carolina Division of Coastal Management (NCDCM) recently completed a study of pump-out facilities in N.C., and has developed a guide to marine sewage pump-out stations in N.C. that are open to the public. The guide will be distributed to boaters as part of a boater information and public education effort.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
No additional state agency administrative costs for this coordinating action are anticipated.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Although marinas would incur some additional short term costs to implement additional best management practices, most of these measures are preventative, and can actually reduce costs in the long term. For example, design criteria for marina

fueling stations protect the public and the environment from serious health risks and costs when they require that design allow for containment of spills in a limited area.

Practice benefits to affected private sector groups:
If water quality is improved, marinas as well as other businesses in the region could benefit from a possible increase in tourist's and recreational fishermen's expenditures. Boaters could benefit from the increased convenience and accessibility of pump-out facilities. If water quality is improved, boaters may benefit from a possible increase in satisfaction from boating and related activities. If water quality is improved and results in healthier fish and shellfish stocks, commercial fishermen may benefit from an increase in income. Recreational fishermen would also benefit from improved water quality and healthier fish stocks.

Social costs: None as defined here.

Social benefits: A comprehensive, interagency, statewide approach to marina siting and management can help reduce user conflicts, increase total economic benefits, and preserve and enhance the natural resources of the area for future production of goods and services. In addition, implementation of the marinas policy could serve to enhance the economic vitality of coastal, estuarine, river and lakeside areas of the state by contributing to the quality of the region's amenities, providing an attractive inducement for continued growth of tourism and water related recreation.

Although the effect of boat sewage pollution in N.C. has not been quantified, it is a type of water pollution that is preventable. Boater education could increase boaters' awareness of the possible health risks posed to them of water pollution resulting from dumping boating sewage into the water. In addition, boaters who fish could be made aware of the dangers that nutrient loading pose to fish and shellfish. This increased awareness may increase boater's demand for and use of pump-out facilities.

At the same time, if marinas provide more convenient public access pump-out facilities to boaters free of charge or for a minimal fee, this may also provide an incentive to boaters to use the pump-outs rather than dump their sewage in the water. Currently, only 9 of the 25 marinas reporting public access pump-out facilities indicate that they offer their use free of charge. Another 5 report a $5.00 charge for pump-out use. The remaining 11 report use fees from $10 to $50. In a recent study, NCDCM (1992) found that those marinas reporting fees of $10 or less reported the most use.

A decrease in boater sewage dumping would reduce nutrient loading, which is a significant water quality concern. It would reduce pollution from sewage treatment chemicals used by some boaters, which are highly concentrated and can cause immediate deleterious effects on water quality and on aquatic life. Furthermore, a

decrease in boat sewage dumping would decrease the amount of fecal coliform present in the water, which is an indicator of a possible public health danger, and is used to determine when to close shellfish beds. Although pollution reduction would probably be most noted in marina areas, a decrease in dumping at and away from marina areas would result in improved water quality in general.

Social benefits of coastal water pollution prevention will probably increase with time. According to the US Census Bureau, almost 75% of the US population will live at or near the coast by the year 2000 (Ross et al., 1992). According to the NCDCM (1992), total North Carolina inland and marine boat registrations increased by 56% from 1970 to 1990. Decreases in preventable pollution will help to lessen the degradation of water quality that often occurs when areas experience an increase in human population. This prevention can not only help to protect water quality and public health, it can also deter the depletion of natural resources and preserve commercial and recreational opportunities which are important to the economy and the quality of life of both coastal and lakeside communities.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Not applicable.

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OBJECTIVE C: ***Reduce pollution from point sources, such as wastewater treatment facilities and industry.***

MANAGEMENT ACTION 1:
Promote pollution prevention planning and alternatives to discharge, where feasible, for all point sources to reduce the volume and toxicity of discharges.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "Environmental problems [occur] when inadequately controlled or treated wastewater is discharged into the system. Pollution prevention programs are a proactive measure aimed at reducing waste at its source. These programs make treatment more efficient, reduce pollutants in the waste stream, and lower clean-up costs for industry and government. When appropriate, alternatives to discharge should be encouraged."

This action would result in increased cooperation among dischargers, state regulatory agencies, the N.C. Office of Waste Reduction's Pollution Prevention Program, and the DEM Facility Assessment Unit's Pre-Treatment Program. Expert engineering analysis and operator training could increase the operating efficiency as well as reduce the waste discharges of industrial plants.

One of the ways that end of pipe pollution reduction can be achieved is through more efficient plant operations. An example of this exists already in the APES region. In the Tar Pamlico Nutrient Trading Program, participating dischargers "perform engineering evaluations of their existing plants to identify cost-effective operational or minor capital improvements to reduce their nutrient loading."(Levitas and Rader, 1992). Results of engineering evaluations done at participating Publicly Owned Treatment Works (POTWs) showed that "substantial nutrient [loading] reduction could be achieved by the POTWs at less expense than anticipated..." (Levitas and Rader, 1992).

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Due to recent increases in appropriations for staffing by the legislature, this action is not anticipated to require an additional increase in staff or funding in the Office of Waste Reduction or in DEM's Facility Assessment Unit.

However, other governmental administrative costs include any costs to POTWs of performing engineering evaluations of their processes to determine cost-effective methods that could be employed to reduce waste discharge.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Private practice costs would include those incurred by private firms to prepare plans, which may include the performance of engineering evaluations to determine ways to improve plant operating efficiency and reduce waste discharge.

Practice benefits to affected private sector groups:
Although costs may be incurred to establish pollution prevention programs in industrial plants, many firms have found that waste reduction often results in savings in operating costs that more than offset the costs of implementing the plans.

Further expenditures for expansion of public and private wastewater treatment facilities may be decreased if their efficiency is improved, resulting in cost savings to taxpayers, industries, and consumers if industries do not have to factor those further expenditures into the cost of goods and services.

Social costs:
None as defined here.

Social benefits:
Reduction of pollution at its source could have positive effects on consumer prices of goods as well as on the environment. Source reduction would minimize the contribution of wastes, toxicants and other pollutants from point sources into the waters of the estuary. Cooperation of state and private organizations may result in reduced costs of regulation and compliance.

Better inter-governmental coordination and cooperation can help reduce the costs of ensuring compliance with environmental regulations. In addition, coordinating DEM's Compliance Group and the Office of Waste Reduction is a cost-effective method that uses existing government programs to target firms that may need technical assistance and training to establish pollution prevention methods and technology in their plants. These coordination efforts translate into lower governmental spending, resulting in higher environmental benefits per taxpayer's dollar spent on governmental programs.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA Clean Water Act s106
State appropriations
Revenue from permit fees
Private industry and industry associations

REFERENCES AND RELATED RESEARCH

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OBJECTIVE C
MANAGEMENT ACTION 2:
Expand and strengthen enforcement of National Pollutant Discharge Elimination System permits. Increase site inspections and review of self-monitoring data to improve facility compliance by 1995.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Increasing the staff of the Division of Environmental Management's Compliance Group would allow for more frequent site inspections and would enhance enforcement. More frequent inspections would improve communication between the Division and dischargers and would help prevent some violations before they occur. Stronger enforcement would dampen incentives for dischargers to violate their permits."

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

It is assumed that non-compliance with NPDES permits is partially due to a lack of adequate enforcement. Moreover, it is assumed that a marginal increase in enforcement and inspection effort will lead to an increase in compliance rate (i.e., that the marginal benefit of increased compliance exceeds the cost of enforcement).

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
DEM would require $300,000 per year to hire six additional personnel and to purchase additional monitoring equipment if necessary.

Practice costs to government:
None.

Revenues generated under this action:
Revenues from fines collected from those not in compliance.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
No costs will be incurred by firms and facilities in compliance. Those not in compliance may incur the costs of fines as well as expenditures necessary to bring them into compliance.

Practice benefits to affected private sector groups:
See Social benefits.

Social costs:
None as defined here.

Social benefits:
More frequent and comprehensive inspections of permitted dischargers will bring about higher rates of permit compliance. The direct results will be a decrease in water pollution from these sources and lower governmental expenditures on water treatment and pollution clean-up, which translate into increased environmental benefits and more efficient use of taxpayer dollars.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA Clean Water Act s106
State appropriations
Revenues from permit fees

OBJECTIVE D: Reduce the risk of toxic contamination to aquatic life and human health.

MANAGEMENT ACTION 1:
Increase efforts to assess and monitor the extent of estuarine sediment contamination, fish and shellfish tissue contamination, and water quality violations, and to identify the causes and sources of these problems.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "Several areas within the Albemarle-Pamlico region have been identified as exceeding levels of concern for toxicity in water, sediment and fish tissue. Any additional contaminated sites should be identified. Existing contaminated sites would be evaluated to determine the extent of the problem and its impact on aquatic life, wildlife and human health. Management actions should focus on reducing or eliminating further contamination in areas of concern."

The implementation of this Management Action would entail three distinct activities: on-going ambient water quality monitoring, sediment toxicity testing, and fish and shellfish testing. The following discussion focuses primarily on sediment toxicity testing.

There has been no on-going program to systematically sample and assess levels of metals and other potentially toxic contaminants in the sediments of North Carolina's waters, nor are there any state standards or EPA criteria for freshwater or estuarine sediment contaminations. Cunningham et al. (1992) developed interim values for the purposes of evaluating previous sampling work and analyses in sediments of the APES region, based largely on the work of National Oceanic and Atmospheric Administration's National Status and Trends Report on estuarine sediment quality around the country (Long and Morgan, 1990). This study allows for an interim assessment of sediment quality in the APES region relative to other estuarine areas in the country.

For estuarine sites, Cunningham et al. (1992) based their assessment on work done by Riggs et al. (1989, 1991, 1992). Riggs et al. (1989, 1991, 1992) intensively sampled estuarine sites throughout the APES region for metal contamination (freshwater riverine sites were not sampled). For estuarine sites, elevated levels of metal concentrations were found at several locations in the region. Problems with metal contamination appear to be localized at this time, though several sites warranted further study and evaluation for possible remediation.

For freshwater sites, Cunningham et al. (1992) found that no metal contamination had been detected in previous analyses. However, they found that only minimal sampling (three sample locations) was being done, and no routine, systematic sampling program was done by federal or state agencies. Of special concern in freshwater areas are possible contamination

problems near point source dischargers. Upon national approval, DEM will utilize EPA protocols for sediment and toxicity testing.

Once EPA protocols are approved, sediment monitoring and analysis program would involve a review of candidate sites based on systematic sampling techniques as well as other criteria such as point source pollution discharge records, Superfund site records, stormwater discharge records and hazardous waste discharge records (Tony D'Angelo, pers. comm., 1993). Areas that are most conducive to sediment accumulation and potential threats to accumulation in biota would also have to be identified in order to design the sampling regime. Efforts for monitoring and analysis could then be focused in areas determined to be most likely in exceedance of state or federal standards. Monitoring should commence once testing criteria are adopted by the EPA.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The costs of the monitoring in this action are not included in the estimated program costs for other water quality related monitoring initiatives.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
This action would require an additional $150,000 to fund 3 new positions in the NC Division of Environmental Management, as well as analytical and biological support.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
See social benefits.

Social costs:
None as defined here.

Social benefits:

Monitoring and GIS mapping of sediment toxicity, along with point source dischargers, marinas, TSDFs, Superfund Sites and landfills, may be a cost-effective method to assist DEM in identifying possible sources of pollutants near contaminated sites, and in beginning actions to reduce or eliminate pollutant emissions from those sites.

Enhanced inter-governmental coordination and cooperation can help reduce the costs of monitoring fish contamination and issuing public health advisories. In addition, coordination among the Division of Environmental Management (DEM), Center for Geographic Information and Analysis (CGIA), Shellfish Sanitation Branch, the Division of Marine Fisheries, the Division of Water Resources, the EPA and the Research Triangle Institute is a cost-effective method that uses existing government programs and research institutions to target areas and populations of concern.

Using existing GIS data layers as well as enhanced coordination, cooperation and information-sharing between DEM and CGIA could help reduce the costs of identifying potential sources and causes of pollution at sites where water quality standard exceedances have been identified.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations
USEPA Superfund, Clean Water Act s106 and s319,
USEPA Near Coastal Waters 104b
State/EPA Data Management Financial Assistance Program
USEPA Environmental Monitoring and Assessment Program
USEPA Clean Lakes Program
United States Geological Survey
USDA Cooperative State Research Service, National Research Initiative
NOAA Sea Grant, Saltonstall-Kennedy Grant Program,
USFWS Sport Fish Restoration Fund
Possible revenues from fishing licenses

REFERENCES AND RELATED RESEARCH

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OBJECTIVE D
MANAGEMENT ACTION 2:
Continue to issue fish advisories as necessary to protect public health. Improve communication and education about the risks associated with eating contaminated fish and shellfish.

REVIEW AND GENERAL COMMENTS

The CCMP explains, "Regional fish advisories alert the public to the potential health hazards of eating contaminated fish. The Environmental Epidemiology Section would continue to review fish tissue analyses and issue advisories as necessary. Public outreach and education should stress the risks associated with eating contaminated seafood to the general population and sensitive populations (e.g., women of child-bearing age and children)."

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
No additional program costs are anticipated for this action.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social benefits:
Protecting public health through the activities mentioned in this recommendation could result in preventing or lowering the incidence of illness due to ingestion of chemically contaminated fish and shellfish, and consequently lowering the costs of health care for those individuals who might otherwise require treatment for chemical poisoning.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE
Not applicable.

OBJECTIVE D
MANAGEMENT ACTION 3:
Remediate toxic contamination where necessary and feasible.

REVIEW AND GENERAL COMMENTS

The CCMP states, "Considerable efforts should be made to remedy contamination that is an immediate threat to human health and aquatic life. The Division of Environmental Management would proceed with sediment cleanup only where necessary and where remediation activities would not cause further damage to ecological communities."

This action recommends efforts to remove the source of the pollutants causing contamination as well as sediment clean-up where feasible. For a discussion of source reduction and its costs and benefits, see action , see Objective C, Management Action 1. The following discussion focuses on toxic site remediation.

Results of monitoring and analysis would be used to perform more comprehensive site assessments and feasibility studies in areas determined to be potentially toxic. Such assessments typically include evaluations of surrounding human habitation or activity, nearby sites of historical, environmental or other importance to society, and an assessment of possible risks to humans and other importance resources (Jack Butler, Division of Solid Waste, pers. comm., 1993).

Under the Superfund program, the government is required to pursue recovery of remediation costs from the parties responsible for deposition. In the case of sediments, this could be very difficult, since contaminants can travel some distance before being deposited, and can be derived from nonpoint source discharges.

Estimates of potential remediation costs are problematic. Remediation costs are dependent on the nature and volume of material to be moved (Tony D'Angelo, EPA Region IV, Office of Integrated Environmental Analysis, pers. comm., 1993), and no surveys of these volumes are available. As noted above, some potential sites for further monitoring and risk assessment have thus far been identified (Cunningham et al., 1992). Furthermore, in many cases it may be determined that removal of the sediment would not significantly improve environmental quality. For instance, it may be the case that the process of removal would present a higher threat (by stirring up sediments) to the environment than leaving the sediment in place.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The government may recuperate clean-up costs of Superfund sites, however, no blanket assumptions can be made. Although the Superfund program requires the government to pursue recovery of remediation costs from the parties responsible for deposition, this is often a lengthy and expensive process, because in many cases, more than one party shares responsibility for the remediation costs. Finding all of the responsible parties, as well as litigation, often takes many years. Thus, the government often must wait several years before recuperating remediation costs. In addition, the government must also cover costs of litigation, which it may not be able to recuperate.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Based on the available data, it is not possible to determine the costs of remediation feasibility studies and remediation activities.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Under the Superfund Amendments of 1986, there is joint and several liability for the cleanup of toxic sites. This means that all past and present owners of land on which the site is located, as well as those who have operated facilities on that land are liable for payment of the costs of cleanup and other damages.

Those found to be liable for the deposition of toxic pollutants in sediments could be sued for the costs of the remediation. It may be difficult to prove the origin of contaminants, however, and it is likely that at least in some cases it will be determined that the removal of toxic sediments is not recommended.

Some sites determined to have contaminated sediments could be subject to closure for fishing or shellfish harvest. This could, in some cases, reduce opportunities for recreational fishing or reduce commercial harvests. While this may be an important

impact in a few locales, the total area that is likely to be affected is small, based on the observation that known problems are localized.

Practice benefits to affected private sector groups:
This Management Action would lead to reduced health risks associated with contact with sediments, contact with overlying waters, or consumption of fish or shellfish taken in and near contaminated sediments. Another benefit may be increased productivity in certain fisheries and shellfish beds if remediation is successful. See Social costs and benefits below.

Social costs:
Where sediments are contaminated with toxic pollutants, one method of remediation is the removal of the contaminated sediment. This can be extremely costly, both in terms of the environment and the economy. The overall cost of remediation could be reduced by using feasibility studies to determine whether sediment cleanup is necessary and whether the cleanup will cause further damage.

The costs of any resulting remediation could be the most significant cost to society. Site remediation which involved the removal and treatment of contaminated material can be enormously expensive, especially under the special conditions of submerged sites. While it is possible that few such remediation projects would ultimately be required, their cost could still be high enough to affect the regional economy.

Site closures to fishing, swimming and other activities could be important locally.

Social benefits:
The benefits of cleanup to residents on land nearby toxic sites that are remediated depend on the success of the decontamination of the site. Due to the slow process of remediation, any benefits that would be gained would be realized over the long term.

Successful remediation could reduce health risks (both known and potential risks) associated with contaminated sediments. The magnitude of these benefits are contingent on the nature of individual sites and the form of their remediation. Similarly, the benefits of successful remediation would include the reopening of sites closed to recreational and commercial activity.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA Superfund, Clean Lakes Program
USEPA DATA & EMAP
USGS for technical assistance
Source liability under Superfund

OBJECTIVE E: Evaluate indicators of environmental stress in the estuary and develop new techniques to better assess water quality degradation.

MANAGEMENT ACTION 1:
Continue to track and evaluate indicators of environmental stress, including algal blooms, fish kills, and fish and shellfish diseases.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "Biological assessments are useful tools in evaluating the integrity of the estuarine system. Traditional biological indicators such as algal blooms and fish kills can signify water quality problems that chemical and toxilogical monitoring may have missed or underestimated."

The kills response network and research on fish diseases would be closely tied to management objectives.

According to this action, individuals in state agencies would form a region-wide response network with researchers to investigate kills. Biologists from DEM and DMF would be assigned to staff the network. Expert researchers skilled in diagnostic techniques would be incorporated into the network.

The response network would include the establishment of a continuous database of information on fish and shellfish kills. Thus, the network would not only respond to and record kills, it would collect information for the purpose of determining the causes of kills and diseases. This information would be shared with those charged with developing fisheries management schemes, so that they can plan for the minimization of human impacts which lead to kills and diseases.

The following agencies would be involved in the network and research: Division of Environmental Management, the Pamlico Environmental Response Team (PERT), Division of Marine Fisheries, the National Marine Fisheries Service, and universities.

Using PERT as a model, the DMF and DEM would work closely to collect data and establish the region-wide response network. Biologists from these divisions would be assigned to staff the network. In addition, the network would incorporate experts skilled in diagnostic techniques.

Researchers would establish standardized collection and diagnostic techniques to ensure consistent, reliable data collection and documentation. Water quality would be sampled during and after fish kills. Fish would be collected and autopsies performed and documented

to record physiological and biological data on the species. Researchers would test for known pathogens such as the recently discovered toxic dinoflagellate (*Pfiesteria piscimorte*). Researchers would investigate factors that affect fish health, natural environment variations that affect susceptibly to disease, and natural levels of incidence of diseases and kills.

Some of DMF's shellfish disease research is conducted with contracts with research institutions. For example, the DMF has a contract with North Carolina State University (NCSU) to do microscopic sectioning of oysters for oyster disease research. In this way, the research benefits from NCSU's equipment and expertise. The estimated yearly cost of monitoring and contracting research on oyster disease is $40,000 per year, which includes the salary of one full time medical lab technician under the auspices of the DMF. To test for diseases in oysters, the DMF already takes oyster samples regularly from the North Carolina waters between from Manteo and South Carolina (Michael Marshall, pers. comm., 1993).

An environmental technician at the DEM's Washington office continues to maintain the data base which was established with data that PERT collected. The DEM, which is in charge of water quality, and has the statutory authority and responsibility for responding to fish kills, has developed a standardized protocol for sample collecting and data documentation. The network that was set up under PERT still operates on an informal basis, and could benefit from some minimal additional funding. Although the DEM has statutory responsibility to respond to fish kills, it has only two coastal offices, one in Washington and one in Wilmington, which would make it difficult for DEM alone to respond to fish kills throughout the region. A multiagency effort includes marine fisheries enforcement officers as well as wildlife game wardens, who help to report and investigate fish kills. Because the DMF has offices in Manteo, Elizabeth City, and Morehead City, and because enforcement officers as well as game wardens patrol the entire region, they are able to respond more quickly to fish kills than the DEM in many instances (Kelvin Miller, pers. comm., 1993).

The DEM continues to respond to fish kills through an emergency management system and its seven regions throughout the state. DEM is currently working to graphically display the locations of events such as fish kills and algae blooms on GIS maps. According to DEM staff, fish kill reporting and documentation could benefit from refined reporting criteria, and an automatic follow up mechanism to determine: (1) whether samples were taken when the fish kill occurred; and (2) if a cause was determined, and what it was. More compliance staff could help to cut down on the incidences of fish kills and algal blooms by ensuring compliance with discharge rules (Steve Tedder, pers. comm., 1993).

Recently, the Neuse River Foundation (NRF) in New Bern received funding from the Z. Smith Reynolds Foundation for a program to monitor the water quality of the lower segment of the Neuse River where fish kills have been reported. The NRF has hired a river keeper who is responding to events such as fish kills and algal blooms. The NRF has limited analytical capabilities, but it will follow the DEM protocols for sampling and data collection,

and provide samples and data to the DEM in Washington, N.C. for analysis. In addition to the river keeper's efforts, the NRF hopes to use volunteer pilots to spot and report fish kills and other potential problems (R.J. Fritz, pers. comm. 1993).

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. Two technicians will be hired to work in the Washington, N.C. regional office of the DEHNR

2. The team will not incur the start-up costs of a vehicle capable of pulling a boat, field instruments, an answering machine, or data base software, because the DEM and DMF are already equipped with them.

3. Although the former PERT boat is still operated by the DEM in Washington, it is not specifically designated for fish kills response.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The CCMP calls for $125,000 per year to the DEM and the DMF for two additional staff people for regional offices in the APES region, equipment, and data base establishment. Costs would include sampling costs and contracts to research institutions.

According to staff at the Washington N.C. regional office of the DMF, a rough estimate for a two person response team for the Neuse/Pamlico River and Albemarle Sound area would entail start-up costs of $30,000, with yearly costs of $64,000 (Katy West, pers. comm. 1993). These costs can be broken down as follows:

One Time Start-up costs:	
Boat, motor, trailer	21,000
Sampling equipment	3,000
Computer	6,000
Annual costs:	
Salary and fringe for 2 technicians	55,000
Mileage	3,000
Boat operations	6,000

Practice costs to government:
All costs of the network are included under administrative costs.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
Fishermen and the local population would benefit from quick response and sampling of fish and water during and following fish kills as well as from the education and outreach efforts of the response team. One of the main benefits to these groups is the identification and reduction of the sources of pollution that may cause fish diseases and kills, algal blooms, hypoxic conditions, or the loss and degradation of aquatic vegetation and quality.

Social costs:
None as defined here.

Social benefits: Using a response network that includes and promotes the sharing of information, skills and management tools can help reduce the cost of monitoring, evaluation and source identification, as well as reduce response time.

Fish kill events often signal a severe environmental stress on a water body. The network and database document the magnitude and probable cause of the kill in case an attempt is made to recover costs for the resource injury. Major data elements for each event can include location, associated land use cause, source, incident, direct cause and specific pollutant. The data can provide useful insights to analysts and decision makers regarding problem areas and sources. For example, fish kill data can be used to identify and correct discharge problems from single sources, or lead to more in-depth investigations of water quality problems. PERT is an example of how fish-kill data can be used to target an area experiencing ongoing water quality problems.

The information from fish kills response data bases is being used by researchers in the Strategic Environmental Assessments Division of NOAA. Pait et al. (1991) are studying the effects of agricultural pesticide use in coastal areas, and Hinga et al. (1991) are evaluating nutrient enrichment problems in estuaries (Lowe et. al 1991).

In addition to research at the national level, kills response networks like PERT can also support local research on water quality and the health of local estuarine fisheries. Examples from PERT include support of work on the toxic dinoflagellate, and research on ulcerative mycosis in Atlantic menhaden. Collaborative efforts between the network and researchers is beneficial because the researchers can then share important information with the network and with water quality and fisheries managers so that they can make better informed decisions.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Cooperative State Research Service, National Research Initiative
NOAA Sea Grant, Saltonstall-Kennedy Grant Program
USFWS Sport Fish Restoration Fund
State appropriations
Support from private foundations in the form of data collection from "river keepers" and others hired by such organizations as the Neuse River Foundation with funding from the Z. Smith Reynolds and other Foundation donors.

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Tedder, Steve, Chief, Water Quality Section, DEM, Raleigh, N.C.. Personal communication, 2/4/93.

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OBJECTIVE E
MANAGEMENT ACTION 2:
Improve the techniques for evaluating the overall environmental health in estuarine waters.

REVIEW AND GENERAL COMMENTS

According to the CCMP, "The sensitivity and diversity of organisms inhabiting an area can be an indication of the system's overall environmental health. Further research is needed to target these "indicator species" in the estuary. Once found, these organisms could be used to monitor the general state of the system and indicate areas that warrant further attention."

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Program costs for this action are estimated at $100,000 per year to improve DEM's techniques for evaluating cumulative environmental impacts in estuarine waters.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social costs:
None as defined here.

Social benefits:
This action would help researchers, planners and regulators understand and monitor health indicators and water quality in the APES region for better protection, and would provide better protection for special ecological communities from chronic and acute toxicity and general cumulative degradation. These efforts may help focus efforts to protect water quality, which could reduce the costs of regulation and compliance.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Cooperative State Research Service, National Research Initiative
USEPA EMAP and Near Coastal Waters
State/EPA Data Management Financial Assistance Program
State appropriations

OBJECTIVE E
MANAGEMENT ACTION 3:
Develop and adopt better indicators of shellfish contamination as soon as possible.

REVIEW AND GENERAL COMMENTS

The CCMP explains: "The presence of fecal coliform bacteria currently is used to detect sewage contamination in shellfish beds. This practice has been criticized, however, and the National Oceanic and Atmospheric Administration's National Indicator Study is investigating better indicator tests. These tests, which assess both bacterial and viral contamination, better indicate the health risk from eating contaminated shellfish. They also would establish more reliable criteria for closing shellfish areas or re-opening previously closed areas."

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Program costs are estimated at $50,000 per year to fund a full time field technician to be shared by the DEM and the Shellfish Sanitation Branch.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
None.

Practice benefits to affected private sector groups:
None.

Social costs:
None as defined here.

Social benefits:
Economic as well as public health benefits would be provided by the establishment of more reliable criteria for the closure of additional shellfish areas and/or the re-opening of previously closed areas. Development of more precise indicators to test for sewage

contamination in shellfish beds and assess the risk to human health from the consumption of shellfish from these beds would help researchers, planners and regulators understand and monitor health indicators and water quality for better protection. Economic benefits would result if tests using the improved indicator found the shellfish from formerly closed beds safe for public consumption. In addition, better indicators may help focus efforts to protect water quality, which could reduce the costs of regulation and compliance. If indicators demonstrate that formerly opened beds should be closed, public health benefits would result that can be translated into economic benefits.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Cooperative State Research Service, National Research Initiative
NOAA Sea Grant and Saltonstall-Kennedy
USFWS Sport Fish Restoration Fund
USGS
USEPA Near Coastal Waters, State/EPA Data Management Financial Assistance Program, and EMAP
State appropriations.

Chapter 5
ECONOMIC CHARACTERIZATION OF THE VITAL HABITATS PLAN

The Objectives and Management Actions of the Vital Habitats Plan are as follows:

OBJECTIVE A: ***"Promote regional planning to protect and restore vital habitats in the APES region."***

Management Action 1:

"Develop ecosystem protection and restoration plans for each river basin in the region by 1999. Such plans should set coordinated priorities for habitats and critical areas in each basin, and should target areas most vital to the survival of wildlife, fisheries and natural heritage."

Management Action 2:

"Develop and maintain accurate maps and records of wetlands, fisheries habitats, natural areas, and natural communities, as well as the existence of federal and state endangered species and their habitats."

Management Action 3:

"Expand programs for the advanced identification and evaluation of wetlands on a regional basis."

OBJECTIVE B: ***"Maintain, restore and enhance vital habitat functions to ensure the survival of wildlife, fisheries and the region's natural heritage."***

Management Action 1:

"Bring areas with the highest priority for protection into public ownership and/or management. Expand funding for the public acquisition of parklands, gamelands, coastal reserves, and other natural areas."

Management Action 2:

"Promote private stewardship of vital habitats through incentives and technical assistance to landowners, local governments and other interested parties."

Management Action 3:

"Enhance the ability of state and federal agencies to enforce existing wetland regulations by 1995."

Management Action 4:

"Strengthen regulatory programs to protect vital fisheries habitats, which include submerged aquatic vegetation, shellfish beds and spawning areas by 1995."

Management Action 5:

"Enhance existing efforts to restore wetlands and vital fisheries habitats. Develop and implement a program to restore wetlands by 1995."

Management Action 6:

"Establish a consistent and effective wetlands mitigation program to compensate for unavoidable, permitted wetlands losses by 1995."

The Objectives and Management Actions listed above are intended to help achieve the plan's stated goal to "conserve and protect vital fish and wildlife habitats and maintain the natural heritage of the Albemarle-Pamlico region." The strategy of the first Objective, to promote regional ecological planning, is to create a mechanism for prioritizing and coordinating the activities of all state and federal agencies involved in habitat protection. It was felt by APES that there is a degree of fragmentation among resource agencies which hinders communication among them and reduces the opportunities for cooperation, sharing resources, etc. The second major facet of this strategy is that such a comprehensive coordination mechanism would be more conducive to assessing habitat protection problems at the landscape scale. This refers to selecting and managing natural areas not as isolated units but as parts of a regional system of natural areas. The theoretical justification for this approach is that ecosystems are affected by the areas that surround them, pollution, changes in river flows or water quality, and other factors beyond their borders, and therefore must be managed in consideration of these factors. It also means that priorities for new acquisitions should be made based on regional strategies for protecting the overall environmental quality of entire river basins. For instance, one wetland area could be selected over another if it is believed that the first area would contribute significantly to protecting water supplies, provide wastewater treatment services or serve as vital fisheries habitats downstream in addition to the other benefits of protecting wetlands.

In general, the benefits of this Plan may be conceptually divided into two major groups, 1) those which stem from the actual protection of certain ecological resources, and 2) cost savings associated with enhanced effectiveness in the regulation and management of these resources.

The first group of benefits accrue from the protection of wetlands ecosystems, rare natural communities, and rare species habitat. (A given tract of land could be all of these.) The Vital Habitats Plan reviews the environmental values associated with the areas in detail. Of these three classes of ecological land resources (rare natural communities, wetlands ecosystems, and rare species habitat), wetlands are the most extensive in terms of area. The benefits they

provide to the public are also more generally acknowledged, though often not easily quantifiable. The following outline of the many economic goods and services provided to society by wetlands is adapted from Scodari (1990):

- water supply for residential, industrial and farm use;
- flood control;
- storm protection ;
- municipal/industrial waste treatment;
- erosion prevention;
- consumptive recreational uses;
  (e.g., hunting and fishing, where allowed)
- nonconsumptive recreational uses (e.g., camping, boating);
- consumptive commercial uses;
  (e.g., commercial fishing, forestry, agriculture, mining, urban-type development, other uses of the land)
- scenic value;
- spiritual/ethical value;
- educational value;
  (e.g., research, school field trips, etc.)
- undiscovered uses; and
- option for future high-value use.

These are discussed at length in Scodari (1990). The provision of these values depends on the individual wetland in question as well as on the needs and values of surrounding human communities. Also, some uses may be incompatible with one another to some degree depending on the nature of the activity and the absorptive or renewal capacity of the wetland in question.

The benefits of protecting rare natural communities and rare species habitat are more difficult to assess and weigh. Assessment of benefits are difficult because of uncertainty regarding the

type and magnitude of the benefits provided by a given rare community or species, and because of the risks of irreversibly eliminating those benefits. Because of uncertainties and risks, it may not be possible to say for certain whether the value of protection relative to it costs is low or high.

Specifically, the benefits of preserving these resources may include:

- genetic resources for medicine, agriculture and bioengineering;
- research value - insight into unique natural processes; and
- values associated with the act of preserving something rare for the benefit of future generations (existence/bequest value).

Society's aversion to the risk of irreversibly degrading or destroying complex ecological systems and genetic information they embody is increasingly leading to pressure to preserve rare communities and species.

The other type of benefits that would arise from the implementation of this Plan would be better coordination among existing programs for protecting regional land and water resources. One of the primary objectives of the CCMP is to provide an effective means of bridging, among other things, the following:

- on-going management efforts specific to protecting endangered species, rare natural communities and other important ecological resources (vital fisheries habitats, endangered species habitat, rare natural communities, etc.);
- human uses of these resources, including conflicting demands made on these resources; and
- general land and water use plans that may be prepared by various government agencies at the federal, state and local levels and which cover jurisdictions in which these resources are located.

Currently, complying with several complicated layers of environmental regulations, local ordinances, zoning, etc. often incurs very high transactions costs for businesses, individuals and governmental agencies themselves. Better coordination would significantly increase the capacity of planners, resource managers, and citizens to access and use information regarding local and regional resources at a lower cost (to them and to government). To the extent that most of the environmental protection measures in this plan are already in place and could be poised to be more vigorously applied, the Management Actions of this plan that achieve more efficient public administration would generate high net benefits.

Note that for the purposes of this analysis no assessment of the viability of the alternatives proposed relative to other options could be made. Because this could not be done for each of the many actions proposed, the alternatives selected and put into this plan are assumed to be the "best" options available. This assumption must be questioned for each Management Action as the CCMP is implemented in detail and as the Management Conference (if reconvened - the Implementation Plan) reviews and revises the strategies within the CCMP.

OBJECTIVE A: "Promote regional planning to protect and restore vital habitats in the APES region."

MANAGEMENT ACTION 1:
Develop ecosystem protection and restoration plans for each river basin in the region by 1999. Such plans should set coordinated priorities for habitats and critical areas in each basin, and should target areas most vital to the survival of wildlife, fisheries and natural heritage.

REVIEW AND GENERAL COMMENTS

In economic terms, the goal of this Management Action is to focus vital habitat management efforts in ways that generate the greatest benefit in terms of regional ecosystem health for any given level of effort. Ecosystem protection and restoration plans would lay out a strategy to meet this goal through better planning and coordination among the various public agencies involved with ecological resource management in the region.

Plans would be developed for each of the APES region's eight major river basins. Some planning has already begun for one basin, the Roanoke River, and once completed and assessed this plan could serve as a model for the remaining seven plans. The CCMP calls for these plans to be developed by an interagency committee composed of all agencies (state and federal) with resource management mandates in the region. Because of the involvement of The Nature Conservancy in the Roanoke planning process, the participation on some basis of non-profits and perhaps local governments is presumably not precluded in this arrangement.

Under this Management Action, all plans would have to be completed by 1996, formally endorsed by participating agencies, and fully implemented by 1999. The Management Action sets out considerations that should be made in the development of the plans, such as the desirability of coordinating ecosystem plans with the N.C. Division of Environmental Management's basin water quality plans, Division of Environmental Management wetlands restoration plans (see the analysis of Objective B, Management Action 5 in this Plan, below), and with endangered species recovery plans developed by the U.S. Fish and Wildlife Service. Other considerations include the need to develop clear criteria and strategies for protecting and restoring specific ecological resources, and for managing land at the landscape scale, for instance, through the use of buffers and corridors. Results or assessments undertaken in several other Management Actions of the CCMP would be used in the development of the protection and restoration plans.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. The incremental level of effort required has been estimated by APES to be equivalent to two full-time person-years per plan. Other expenditures by participating agencies would come from existing spending authorizations. This level-of-effort is likely to be split among several agencies. Note that planning and prioritization for wetlands is considered a separate activity under Objective B, Management Action 5, of this Plan.

2. It is assumed for this review that the on-going review and assessment process established by both the interagency habitat planning committee and the APES Management Conference (see Implementation section of the CCMP) will assure that planning and implementation resources are spent in a cost-effective manner. No attempt to examine possible plan alternatives was made here.

3. In assessing the merits of this Management Action, the planning process to be established should be considered separately from any policies implemented via the resulting plans. The plans are considered as mechanisms of better managing public-sector resources rather than simply packages of particular policies, regulations, etc.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:

Ecosystem protection and restoration plan development and implementation would require a level of effort equivalent of two full-time staff person-years per plan. Two staff at $50,000 each per year would cost $100,000 per plan. In-kind contributions from participating agencies consisting of staff time spent in meetings and conferences is assumed to be paid for through existing budget authorizations. Note that significant funds would be requested for GIS data and technical assistance through Management Action 2 of this Objective, and that planning and prioritization for wetlands is considered as a separate activity, the costs of which are included in Objective B, Management Action 5, of this Plan. Each plan can be expected to require the extensive use of GIS facilities, materials, map production, communications, publications and travel, a liberal estimate of which would be $50,000/plan. The average plan, therefore, would entail an incremental cost to the several agencies involved of $150,000. This average cost multiplied by eight basins is $1,200,000. Assuming that it is feasible to implement plans by the 1999 deadline established by the CCMP, the average annual incremental cost would be $240,000. See "Social costs and benefits" below for a further discussion of economic impacts.

Practice costs to government:
None

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
No significant additional costs are expected for the major resource user groups most likely to be directly affected. Private groups and individuals that wish to contribute to the conservation of ecological resources would benefit from the planning. See "Social costs and benefits" for a further discussion of expected economic impacts.

Social costs and benefits:
No significant additional social costs as defined here (i.e., not including the foregone benefits of alternative uses of the public funds spent) are expected from this Management Action. This conclusion is based on the argument that the purpose of the planning process is to seek increases in benefits per unit of public spending, and on the assumption that the APES Management Conference would assure that the planning process established under this Management Action achieves this goal.

This conclusion also assumes that policies implemented through the plans should be considered as separate from the planning process itself. The question is likely to be raised whether or not this Management Action would lead to increased regulation and/or government spending on habitat protection (other than the incremental spending on the plans themselves). Planning *per se* is a means of assuring that fiscal and human resources (mainly of government, in this case) are deployed in the most efficient manner possible. This Management Action makes no specific proposals regarding the level of public expenditure necessary to protect vital habitats in the region, the goals of such protection, or which (if any) regulatory actions are necessary to achieve these goals. These, of course, would be considered in the development of basin plans, but the policies on which they would be based would be determined through existing channels of decision making.

Based on the APES finding that coordination and joint planning among resource agencies is critical to effective habitat management, this Management Action can be assumed to have positive net benefits. Furthermore, the mandate of the APES Management Conference, and by extension, of the interagency habitat protection committee, calls for them to assure that money spent on implementing habitat protection and restoration plans yield greater benefits per dollar than would be the case without the plans.

Giving habitat protection goals and priorities a better focus in the public eye could yield benefits in the form of greater public awareness of the issues surrounding ecological resource management. Ecosystem plans, for instance, could serve as guides to landowners, communities, local governments and others wishing to protect these resources in their areas. Ecosystem plans could also help in the development of more detailed environmental impact analyses, species protection plans, etc., which need to be developed by government agencies, developers, and others. A better planning process and clear plans for the future could reduce uncertainties regarding major habitat protection projects, allowing communities to avoid unexpected negative impacts and to capitalize as much as possible on the opportunities these projects present, such as nature-based tourism, recreation, and sustainable forestry and agriculture.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

NOAA Coastal Zone Management Administration Awards (Section 309 of the Coastal Zone Management Act, administered by the N.C. Division of Coastal Management)
USFWS North American Wetland grant and the National Coastal Wetland grant
USDA National Research Initiative grants
National Park Service (NPS) - Rivers, Trails and Conservation Programs (technical assistance for greenway development and similar projects)
In-kind services from participating agencies and many non-profit groups

REFERENCES AND RELATED RESEARCH

USEPA, Office of Water. 1992. The National Estuary Program After Four Years: A Report to Congress. EPA 503/9-92/007. Washington, DC: U.S. Environmental Protection Agency.

USEPA, Office of Water. 1993. National Estuary Program Guidance, Base Program Analysis. EPA 842-B-93-001. Washington, DC: U.S. Environmental Protection Agency.

OBJECTIVE A
MANAGEMENT ACTION 2:
Develop and maintain accurate maps and records of wetlands, fisheries habitats, natural areas, and natural communities, as well as the existence of federal and state endangered species and their habitats.

REVIEW AND GENERAL COMMENTS

This Management Action supports on-going mapping and geographic information system (GIS) data development efforts, and calls for the expansion of these efforts including the periodic updating of many data sets on a ten-year cycle (or less if feasible). The final product of this Management Action would be a data set which is complete, up-to-date, geographically/cartographically accurate within consistent standards, and easily accessed and analyzed by resource managers.

The information and data processing capability generated by this strategy will improve staff productivity by automating time-intensive tasks involving the analysis of spatial patterns that are complex or that change over time. Many environmental, social and economic variables measured at hundreds or thousands of geographic points over time can be stored and selectively analyzed and mapped. The ability to visualize and analyze such dynamic maps has boosted productivity in many fields in both the public and private sectors. In the field of habitat management, GIS can allow for the rapid assessment of changes in habitat areas and potential disturbances to those areas. It might facilitate wetlands permitting, but it should be noted that on-the-ground surveys would probably still be required for permitting purposes. It could ease enforcement and monitoring by habitat related agencies and regulatory programs. In addition to the potential for more effective management and enforcement, mapping integrated with GIS can improve planning by allowing better analyses of trends, better problem identification, and more flexibility to deal with unique circumstances. The economic question is whether or not the cost of a GIS system is worth these benefits.

The largest part of the public expenditures treated in this plan have to do with remote sensing and the development and use of Geographic Information Systems (GIS) for the analysis, distribution and presentation of geographically referenced data. However, it appears that federal and state funding for most of the activities listed above is already in place and secure over the near term (Zsolt Nagy, N.C. Center for Geographic Information and Analysis, pers. comm., 1993; Wayne Wright, U.S. Army Corp of Engineers, Wilmington, pers. comm., 1993; Curtis Hinton, City of Wilson Planning Department, pers. comm. 1993). U.S. Fish and Wildlife's National Wetlands Inventory maps for the region are currently being checked for accuracy. N.C. Center for Geographic Information and Analysis has also developed a master plan for developing and coordinating a state-wide GIS data network, which would provide the infrastructure that this Management Action calls for. Therefore, the increment in funding that

would actually result from the implementation of this Management Action is limited to the inventories of natural communities and rare species habitat (or the Natural Heritage Inventories).

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. Implementation of GIS is assumed to result in significant improvements in management and planning; the magnitude of net benefits generated cannot be estimated here without further data. This assumption rests on the judgement of the APES Management Conference.

2. All 36 counties in the APES region will need such inventories over the course of the 10 year cycle.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
County natural heritage surveys are estimated to cost an average of $23,500 per survey. All counties would be surveyed over the course of the 10-year cycle (those which already have surveys would be redone towards the end of the first ten year cycle); this would suggest a cost of $846,000 over the course of the ten year cycle, or an average of about $85,000 per year (these figures are based on estimates from the N.C. Division of Parks and Recreation).

Other critical steps in this Management Action are given as guidance to existing efforts, are efforts that are recommended elsewhere in the CCMP, or are expected to be funded through existing budget authorizations. For fisheries mapping and protected area delineation, see Objective B, Management Action 4 of the Vital Habitat Plan (below).

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
Direct costs or benefits to specific private sector groups (e.g., landowners, developers, farmers) are not expected to be significant.

Social costs:
No significant additional social costs as defined here (i.e., not including the foregone benefits of alternative uses of the public funds spent).

Social benefits:
The main benefits would be improved efficiency in governmental activities making use of or developing geographic information. Specifically, more and better GIS data could:

- allow agencies to share up-to-date information;
- ease and improve efforts to monitor changes in the extent and quality of ecological resources;
- help agencies monitor and assess the nature and degree of threatening sources of disturbance or pollution;
- aid in the spatial analysis of ecosystem processes, disturbances, pollution and resource use patterns on a regional scale (e.g., for the study of cumulative effects of pollution); and
- to some extent, facilitate extension work, permitting, enforcement and monitoring activities of cooperating agencies in the field due to the availability of high-quality, reliable maps and other geographically-referenced information (e.g., the locations of erodible soils, rare communities/species, permitted activities, etc. could be readily mapped, analyzed together, and used in the field).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

NOAA Coastal Zone Management Administration Awards (Section 309 of the Coastal Zone Management Act, administered by the N.C. Division of Coastal Management)
USEPA - State Development Fund for wetlands protection
USEPA - Near Coastal Waters and Section 104b of the Clean Water Act grants
USEPA Data Management Financial Assistance Program
State appropriations
Technical assistance with mapping work may be available through the U.S. Army Corps of Engineers and the U.S. Geological Survey (USGS), among others

REFERENCES AND RELATED RESEARCH

Council of State Governments. 1991. "North Carolina" State Geographic Information Activities Compendium. [no publisher information].

North Carolina Center for Geographic Information and Analysis. 1990. Albemarle-Pamlico Estuarine Study Data Management and Analysis System; Functional Description. APES Project No. 90-21. Raleigh, NC: Albemarle-Pamlico Estuarine Study.

OBJECTIVE A
MANAGEMENT ACTION 3:
Expand programs for the advance identification and evaluation of wetlands on a regional basis.

REVIEW AND GENERAL COMMENTS

An Advance Identification (ADID) for wetlands is a program in which aerial photography, satellite imagery, and/or ground surveying and sampling are used to produce a generalized map of all wetlands in a particular area such as a county or watershed. These maps are produced at a scale that does not allow for official determinations of status for the purposes of wetlands-related permits. However, they can significantly reduce the uncertainty of many landowners and public officials as to the extent of wetlands in their area and of the general likelihood that their parcel would be considered a wetland for permitting purposes. Wetlands identification and mapping at the county and regional scale could also allow local governments more latitude in planning for growth that does not degrade important ecological resources. This would be especially true if the scope of the mapping is not too narrowly focused on jurisdictionally-defined wetlands and instead includes information regarding ecological information such as natural community types, hydrological regime, soils, etc.

ADID procedures are still being developed and their overall costs and benefits are still being determined. Because of this uncertainty, this Management Action is limited to performing a study on the feasibility of widespread application of ADID in the APES region. This study would use as a point of departure an assessment of a pilot ADID project sponsored by APES in Carteret County, as well as other ADIDs from other parts of the country.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

This analysis can only appropriately consider the costs of the evaluation of ADID for broader application. Because it could be found that the widespread use of ADID is not feasible, and because of the many variables that would affect the incidence of costs and benefits, the economic impacts of ADID itself are not analyzed here.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The estimated total cost of a formal assessment of ADID including a report of the potential for application in APES region is $50,000.

Practice costs to government:

None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None, as defined here (see Assumptions above).

Social costs:
None, as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues). The overall economic cost of this action is negligible (see Social benefits section following).

Social benefits:
The benefit of performing the feasibility study is to lower the uncertainty of whether the future benefits of using a ADID system would be high or low compared to its costs.

The impact of an ADID program on the efficiency of government administration, on landowners, on local planners, etc. depends on the outcome of the feasibility study and the form that the program would take, if recommended. However, some general observations can be made. The intended benefit of ADID is to make the wetlands permitting process more predictable and efficient. The question of whether or not ADID would in fact have this impact is separate from the debate over the fairness and efficiency of wetlands regulations themselves. Because the scale of the maps does not allow for precise determinations it has been questioned in APES focus group meetings whether or not ADID would make the wetlands permitting process more efficient from the perspective of private landowners, since they would still, under current rules, be required to pay for a on-the-ground survey of their land for a permit determination. However, the savings to landowners as a group accrues mainly where owners consult ADID maps and decide not to apply for permits or seek a determination because it appears unlikely that they would be approved. Because of the scale of the maps, there is a good possibility that a parcel on or near a mapped wetland boundary could be successfully permitted for development. The decision to seek approval and an on-the-ground determination is entirely up to the owner.

Part of the overall benefit of ADID is that the data gathered can be used to create or update a regional GIS database of wetlands resources. This should help ease certain permitting activities, wetlands management and planning efforts, etc. As mentioned

above, local governments may be able to use ADID maps in their land use planning and resource protection efforts. For example, these maps could help in the development of ordinances, septic systems permitting, or flood hazard zones.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA State Development Fund
USEPA Water Quality Management Planning section 319 grants
U.S. Army Corp of Engineers for technical assistance
USGS for technical assistance
USDA National Research Initiatives grant

OBJECTIVE B: "Maintain, restore and enhance vital habitat functions to ensure the survival of wildlife, fisheries and the region's natural heritage."

MANAGEMENT ACTION 1:
Bring areas with the highest priority for protection into public ownership and/or management. Expand funding for the public acquisition of parklands, gamelands, coastal reserves, and other natural areas.

REVIEW AND GENERAL COMMENTS

This Management Action sets out the means of permanent protection of natural areas of very high ecological value. This protection would be provided through voluntary sales or donations of land or partial interests in land. The areas that would be sought for such protection would be selected and prioritized through the basinwide habitat planning process discussed in Objective A, Management Action 1, of the Vital Habitat Plan.

This Management Action also recommends that more resources be directed towards the management of these areas. Under this plan, state and local government lands that contain high-value rare natural communities or rare species habitat identified in the basinwide habitat planning process would be dedicated under the North Carolina Nature Preserves Act. Similarly, federal lands which contain rare natural communities or rare species habitat would be protected through protective management agreements with the relevant agencies. These actions would formalize their status and provide the legal grounds for permanent protection. Management plans for areas protected by state and federal agencies and for the resources they contain (e.g., endangered species habitat, vital fisheries habitat buffers) are also recommended.

This Management Action describes some of the types of land that are likely to be given the highest-priority in the basinwide plans. However, no specific tracts are targeted nor are there acreage goals. These will presumably be contingent both on the outcome of the basinwide planning process, on the level of public funds made available, and on the willingness of current owners to sell or donate land and easements.

The principal economic issues are the high overall level of public spending involved in the acquisition of land, and the impacts on certain localities of restricting resource-based commercial activity over large areas of land within, for instance, a given county.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. Land values remain constant (in 1991-92 dollars) throughout planning horizon. The price per acre of future land acquisitions can be estimated by prices of current land acquisitions for similar land use/land cover types. For the purposes of this analysis, it is assumed that 25,000 acres of land of the types described in critical step 2 would be acquired through purchases of full title at market value by public agencies (i.e., no donations, no easements).

2. The overlap between wetlands targeted for acquisition under critical step 3 and those areas listed in critical step 2 is assumed to be minor. Step 2 is given as guidance to existing and already-planned efforts and are therefore assumed to be funded through existing/expected budget authorizations.

3. Programs are voluntary for private landowners, therefore it is assumed that landowners are compensated for any costs they incur.

4. Tracts of land that would be targeted in the basinwide plans, except those found on the Outer Banks, are in remote or rural areas not undergoing rapid development at this time.

5. All of the areas to be targeted for acquisition are currently not being used for agriculture, tree plantations, or other commercial uses, though much of the land has value for commercial hardwood timber harvesting and possible conversion to pine plantation (i.e., these areas are "raw" land).

6. Payments in lieu of property taxes are made in the amount of 50% of what counties would otherwise expect to collect. The policy of the U.S. Fish and Wildlife Service is to pay in lieu of taxes approximately 85% of what would have been assessed for private landowners. The figure of 50% is used in order to yield a conservative estimate, and to account for lands not acquired by agencies that make payments-in-lieu of property taxes to local governments.

7. A reasonable estimate of expected administrative costs of the acquisition activities, including appraisers, realtors, surveyors and general administration would be $100,000 per year throughout the planning horizon.

8. The dedication of land (critical steps 5 and 6) and the management of these areas as special natural areas (step 7) involves no additional net costs for the public agency owning the land. For the purposes of this assessment we assume that existing planning and management could shift resources as required to adapt to this task. The

dedication of land could entail both increases and decreases in administration and management, but these changes have been assumed to offset each other.

9. The value of foregone resource production from land dedicated as natural area (or some equivalent status on federal land) would be relatively minor from the perspective of the region as a whole and can be ignored in a regional impact analysis (note: important localized impacts such as logging jobs in a few communities would still be issues to be addressed before implementation of these proposals).

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:

The increment in administrative costs to government for this action is estimated to be $100,000 annually. This would include appraiser reports, legal fees, realtor fees, surveying, management plan development and general administration. The estimated cost of acquiring 25,000 acres mentioned in the plan is $45 million. These estimates are based on information from appraisers, officials in federal and state agencies involved in land purchases in the region, Nature Conservancy officials, unpublished U.S. Fish and Wildlife data, realty firms and unpublished data provided by the N.C. Department of Revenue, Tax Research Division. The following describes the development of these cost-estimates (assume all areas acquired through purchases of full title at market value by public agencies (i.e., no donations, no easements)):

a) For the purposes of this estimate, the breakdown of priority areas developed in previous drafts of the CCMP is used. This includes 12,000 acres of high-priority (as defined by the S1, S2, G1 or G2 designations of the Natural Heritage Program) non-riverine swamp forests, 1,000 acres of high-priority barrier island natural communities, and 12,000 acres of other high-priority areas;

b) High-priority non-riverine swamp forests: Estimated costs are $2.4 to $9.6 million over 10 years (12,000 acres at an estimated price range of $200 to $800 per acre). Total value calculated with estimated average price (current dollars) of $600/acre is $7.2 million;

c) High-priority barrier island natural communities: Estimated costs are $15 to $30 million over 5 years (1,000 acres at an estimated price range of $15,500 to $30,000 per acre). Value calculated with estimated average price of $26,000/acre is $26 million; and

d) High-priority areas not including non-riverine swamp forests and barrier island communities: Estimated costs are $1.2 to $18 million (12000 acres at an

estimate price of $100 to $1500 per acre). A large price range is possible here since some areas may occur in rapid growth areas with high land values. Average is likely to be low, however, since largest areas targeted are wetlands in low growth areas. Total value calculated with a price (current dollars) of $1000/acre is $12 million.

Total annual costs for b) through d): $45 million

It is assumed the discussion of acquiring areas of priority wetlands identified in the National Wetlands Priority Conservation Plan is given as guidance to existing and already-planned efforts and are therefore assumed to be funded through existing/expected budget allocations. The purchase of this amount of land (164,000 acres), assuming an average value per acre of $500, would cost $82 million. The true value is more likely to be less than this amount. **This value is not included in the final total cost estimate for this plan.**

[**Note:** Wetlands can range greatly in value per acre, from under $100 per acre for completely undevelopable marshlands (which are often restricted from most uses) to $1,500 or more per acre for wetlands which have been converted to quality cropland. Based on information about recent purchases of forested wetlands in eastern North Carolina, a reasonable range of values of land for forestry is $200 to $400 per acre, not including the value of the standing timber. Standing timber (stumpage) values can range from negligible to $400 above the value of the land for quality stands of timber from forested wetlands. Again, these values are highly variable. (Fred Annan, Nature Conservancy, pers. comm., 12/92; Jim Johnson, USFWS, pers. comm. 12/92; several forestland appraisers, realtors, and US Forest Service data for the region were consulted as well.) Public agencies acquiring such lands for the purpose of habitat protection would have to pay for both the value of the land and the standing timber, if any.]

No other incremental costs would be expected from any of the other critical steps of this Management Action. The dedication of state and federal lands as officially protected natural areas and the development of management plans for these areas would involve only minor administrative costs. The dedication of land could entail both increases and decreases in administration and management, but these changes have been assumed to offset each other.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:

1. Owners of lands targeted for acquisition:

   None as defined here. Because transfers of land and easements are voluntary, it is assumed that the landowners are sufficiently compensated. Compensation may be in the form of direct payment, tax incentives, satisfaction gained from contributing to conservation, or other benefit (market or non-market).

2. Owners of lands adjacent to areas acquired:

   Natural areas can in some cases present a nuisance to adjacent farmland, resulting in a real decrease in land values. Such decreases could result from pest problems that develop, fire hazards, nuisances caused by extensive public use of the adjacent land or the loss of customary uses of the adjacent land (e.g., hunting or fishing access) (Anne Coan, pers. comm. 6/2/93).

3. Current users of public lands to be dedicated and managed as natural areas:

   The dedication and subsequent management of certain public lands as natural areas could directly lead to the restriction of some uses, and therefore could impact some current users of public lands. Costs would depend on restrictions placed on the activity or group affected (e.g., loggers, hunters, hikers, boaters, etc.). There could be benefits from increases in activities that are incompatible with current uses but that would be allowed in a protected area, mainly be recreational opportunities. There is no way to determine if these benefits would make the net impact positive. The issue of transfer of benefits from restricted to unrestricted user groups would still have to be addressed. Nevertheless, the careful selection of areas to be protected (Objective A, Management Action 1 of this plan; also, the Implementation Plan) would help assure that net benefits of dedication and acquisition were positive and that impacts on any specific user groups are justifiable.

Practice benefits to affected private sector groups:
Owners of lands adjacent to areas acquired, dedicated, and managed as protected natural areas:

Value of land adjacent to that which is acquired/protected as a natural area may increase since the amenity of a neighboring natural area is guaranteed into the future. This effect is more likely to be significant in the case of a high density recreation-oriented area such as the Outer Banks than in a more remote, rural area. While this effect may be substantial for some landowners (probably on the Outer Banks), the total effect for all acquisitions in the region is likely to be negligible, since most tracts that would be targeted for acquisition are in rural areas with low demand for high value development.

Social costs:
This Management Action raises two main economic issues: a) the general issue of public spending of the magnitude recommended, and b) localized impacts of certain acquisitions on local government tax bases and on jobs in agriculture and forestry. The latter issue is not discussed in detail here (for a generalized discussion see the "Opportunity Cost of Public Expenditure" section in the General Discussion of Economic Issues of this report).

The planning and coordination recommended in Objective A, Management Action 1 and in the Implementation Plan are intended to help insure that the benefits to society of each dollar spent are as great as possible; the coordination of management activities on publicly owned natural areas is likewise intended to assure maximum cost-effectiveness. Note that this analysis has not addressed the critical issue in this regard - whether or not the money spent could be better spent elsewhere. This is the implicit decision made in the creation of the National Estuarine Program and other related environmental protection programs, legislative decisions to fund natural area acquisitions (as will be necessary for the implementation of this proposal) as well as in the development of the CCMP itself.

The more volatile economic issue is the potential for impact on local tax bases and on jobs in sectors excluded in acquired/dedicated areas. Local property tax revenues could decrease since the value of the land acquired is reduced. This revenue is lost where governmental agencies acquire the land, but in the case of federally owned lands, the revenue loss is partly or fully offset by payments in lieu of taxes made to local governments. These issues are treated in turn.

The impact of state and federal acquisition to local tax bases is estimated to be minimal when considered from a regional perspective, since the overall acreage being acquired is not large relative to other available tracts of land in each county and since,

in most cases, expected levels of development could be accommodated on acreage not acquired. In some localities, however, large-scale acquisitions could cause a negative economic impact if important employment opportunities, such as forestry or agriculture are broadly affected. Within the CCMP's Implementation Plan are recommendations to assess the potential for these impacts in the course of the decision to acquire land.

In some cases, the value of (and tax revenues from) some properties adjacent to protected areas is likely to rise (see "Social Benefits" section which follows). On the other hand, there could potentially be some decreases in the value of farmland adjacent to protected areas as well (see "Costs to owners of lands adjacent to areas acquired" section above). The net impact of these effects could not be determined due to time constraints and lack of data.

Losses of property tax revenue would be offset to some degree by payments in lieu of property taxes for federally-owned lands. A conservative estimate would assume that a large proportion of acreage is relatively high-value bottomland hardwood forest, and that payments in lieu of property taxes would offset 50% of this loss. 200,000 acres multiplied by $1000/acre (a high-end estimate of land value) equals $200,000,000 of total value, and applying a property tax rate of $0.76 per $100 of value (the approximate average rate for the region) there would be $1.52 million in property taxes per year foregone by local governments. Assuming the federal payments make up for 50% of this loss, the potential net loss is $760,000 per year for the region.

The real average value per acre is more likely between $500 and $800, based on conversations with appraisers and conservation agencies in the region. Under the same conditions as the high-end estimate just given, these average land values would suggest a potential loss of tax revenue of $380,000 and $608,000 per year (after payments in lieu of taxes are made).

In 1991-92, the total ad valorem tax revenues for all counties in the North Carolina portion of the APES region was about $559 million according to the State Treasurer's office. While the estimates of lost tax revenues above are not directly comparable with this figure, the difference in order of magnitude (around $1 million versus $560 million) suggest that the loss of revenue from the preservation of important natural areas is relatively small from a region-wide perspective. Note that these figures can only be considered estimates since real property includes structures and other improvements besides the land itself, the value reflects assessments made in various years, and because only county-wide tax property tax levies were used.

Any reduction in commercial activity, if any, (farming, forestry, mining, etc.) could impact the regional economy, even though landowners are fully compensated.

Specifically, any resulting declines in available wage or contract labor, plus any declines in subsequent purchases of goods and services in local markets, are costs to the regional economy.

To a large degree, the severity of these impacts depends on the availability of opportunities for alternative employment and the availability of the training and education needed in those new jobs. Because the North Carolina portion of the APES region contains some of the most economically weak counties in the state, this could be an important consideration in some locales. Governments may wish to consider certain economic development and job training measures in some areas if a disproportionately large burden on local tax base and employment is found to have been caused by acquisitions.

While many of the natural areas and wetlands identified for conservation acquisition are threatened by encroaching development, most tracts are currently in their natural state and are not commercially used except for forestry. Therefore, their acquisition can be assumed to have a small impact on regional employment, with the possible exception of the forestry sector. If all acquisitions are assumed to be restricted from timber harvesting then the acquisitions outlined above would imply a decrease on the order of 200,000 acres (including the lands targeted through the National Wetlands Priority Conservation Plan). Much, though not all, of this area could theoretically be used for commercial timber production. Given the nearly 7.7 million acres of potentially exploitable timberland in the APES region (4.6 of which is in hardwood forest types), the loss of 200,000 acres would yield a decrease in timberland of about 2.6% (or about 4% of hardwood timberland).

This decrease is probably made less significant by the fact that acquisitions are voluntary, and it can be assumed that land with the highest potential returns to forestry or other uses will not be sold or donated (see assumptions above). While no timber surveys of the tracts in question have been published, and while there are pockets of high quality timber in the areas being targeted for acquisition according to appraisers familiar with the tracts, many areas are poorly stocked, inaccessible due to poorly drained (wetland) conditions, and on the whole of low value for extensive commercial forestry given forecasted levels of forest product prices in the short and medium terms (Fred Annan, The Nature Conservancy, pers. comm., 1992).

The official designation of important state and federal natural areas could cost the economy the foregone value of resource/recreational opportunities that are subsequently restricted on these lands. The costs and benefits of the dedications depend on what activities are allowed or foregone (hunting, timber harvests, fishing, water supply wellfield), and the value of the environmental goods and services provided by the land.

Again, it is important to point out that while overall regional impacts could be small, certain localities and sectors of the labor pool, especially communities and families that are heavily dependent on timber harvesting, could bear a disproportionately high burden from the proposed acquisitions. However, the most extensive tracts targeted in the CCMP for acquisition are already being acquired through the National Wetlands Conservation Plan, and remaining acquisitions are unlikely to have a major additional impact on any localities. Nevertheless, it will be important to further demonstrate that major land acquisition do not disproportionately impact some local communities or counties.

Social benefits:
The benefits of this Management Action fall into 4 categories: a) ecological/environmental benefits; b) some increases in local property taxes from some lands adjacent to protected natural areas; c) improvements in the cost-effectiveness of governmental programs; and d) increases in economic activity related to tourism and outdoor recreation. The first category was treated in the introduction to this analysis of the Vital Habitats Plan and in the General Discussion of Economic Issues.

Local property tax revenues from land adjacent to the natural area may increase in cases where the permanent protection of the amenity provided by the neighboring natural area increases the value of the land. For all acquisitions in the region, this effect is likely to be negligible in most cases, except on the Outer Banks and some other limited areas (see "Benefits to selected groups . . . private landowners" above).

While the dedication and management of public land as natural areas is not expected to result in net increases in public spending, there could be real economic benefits from these actions. A redirection of priorities within the existing programs involved implies that there is some rational decision making process through which opportunities to increase net social benefits without increasing total real costs (including non-market costs).

It was not possible given the scale of this study to determine the net impact of major land acquisitions, official dedication of certain public lands and of management on the regional economy. The acquisitions currently being undertaken by the U.S. Fish and Wildlife Service are not likely to have major impacts on the regional economy, mainly because these large acquisitions are focused on waterfowl habitat protection and are in many cases very inaccessible. Other acquisitions by the state are more likely to be developed as state parks, with visitor facilities, interpretive centers, etc. These installations could certainly generate some revenues for local economies as well as improving the quality of life for nearby residents.

Increases in recreational activity are likely to be minimal in terms of impact to the regional economy, but could be locally important sources of job creation and income. While the acreage of public lands that would be affected is relatively small, the presence of some rare species can generate tourist interest. In the APES region, the threatened or endangered species which probably hold the most potential for generating tourism would be birds like the bald eagle, the red-cockaded woodpecker and several migrating birds near the coast. In some cases, tourist facilities will already be developed or could be developed at a minimal expense (such as a bird observation platform on an estuarine shoreline). In some cases, on the other hand, facilities might be restricted in order to adequately protect the rare species in question. In other words, rare species habitats may have considerable value for tourism and recreation, but it is impossible given available data to estimate the net effect that the management of land currently owned by the state or federal governments for rare species protection would have on public on-site use.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Private conservation land trusts
USDA Agricultural Conservation Program, Conservation Reserve Program, Wetlands Reserve Program, Small Watersheds and Flood Protection Program
NOAA Coastal Reserve Program, National Estuarine Research Reserve program (NOAA has provided matching funds for both the Coastal Reserve System and the National Estuarine Research Reserve. Matching funds have come from state appropriations, the N.C. Recreation and Natural Area Trust Fund, and donations)
USFWS Federal Aid to Wildlife Restoration (Pittman-Robinson), Cooperative Endangered Species Conservation Fund, North American Wetland Grant, Land and Water Conservation Fund
N.C. Nongame and Endangered Wildlife Fund
N.C. Recreation and Natural Heritage Trust Fund
N.C. Wildlife Resources Commission gamelands acquisitions
Special state appropriations/bond issues for natural areas and parks

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OBJECTIVE B
MANAGEMENT ACTION 2:
Promote private stewardship of vital habitats through incentives and technical assistance to landowners, local governments and other interested parties.

REVIEW AND GENERAL COMMENTS

Under this action public agencies would provide technical assistance, and private non-profit organizations such as the Nature Conservancy, the Audubon Society, the N.C. Conservation Trust and the N.C. Coastal Land Trust, other groups, and private landowners would contribute to the stewardship of important natural areas. This could be done through a combination of the following tools: official dedication through the N.C. Natural Heritage Program; the management of natural areas in their control; and through the development and distribution of guides to environmentally sound land use and site development and other informational resources.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. Forestry stewardship programs would need an additional 5 staff members as well as money for subsidizing management plan development and implementation (Stewardship Incentive Plan funds; subsidy per landowner capped at $800 per plan, according to Division of Forestry rules).

2. Agricultural extension-based programs are assumed to be funded through existing authorizations or through funding being recommended in the Water Quality plan. Agricultural cost share funding is recommended in Objective A, Management Action 2, of the Water Quality Plan.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:

1. Expanding existing stewardship programs, cost-share programs for agriculture and forestry, and other conservation incentive programs within the region would incur incremental costs to state and federal agencies. Recent experiences with the Wetlands Reserve Program (WRP) suggest that there is a strong demand for opportunities to participate in conservation management programs if the incentives are adequate. Permanent conservation easements over 15,000 acres were offered by North Carolina farmers in a pilot round of the WRP in North Carolina in late 1992. The bid values summed $14.5 million. Because of funding cuts, the program failed to enroll any land. The costs of such programs is dependent in large measure on the cost-share

arrangements made, the types of management practices required, the objectives of management, and the acreage involved.

a) Forestry Stewardship Program - assuming either on-staff work or contract work would cost the equivalent of 5 full-time staff per year (at $50,000 per person per year), including administration, travel and materials. Cost-share money is assumed to be $120,000 per year ($800/plan X 150 plans per year; based on cost data provided by the N.C. Division of Forestry). Total: $370,000 per year.

b) Agricultural conservation incentive programs - it is assumed here that costs are covered in the Water Quality section of the CCMP. See Management Action 1, Objective A of the Water Quality Plan.

c) The equivalent of one full-time staff for the U.S. Fish and Wildlife Service to assist with private land stewardship plan development in the APES region at $50,000 per year for five years.

This breakdown of figures used only to provide estimate of total figure. Actual proportions of total in breakdown could be changed if a fuller needs assessment finds that one area needs more money and another less.

2. Two staff persons needed in Natural Heritage Program to coordinate private outreach and incentive programs (two full-time staff and associated overhead assumed to cost $50,000 per person per year).

3. Develop design and land use guides for private owners of environmentally sensitive land (N.C. Division of Coastal Management and/or the Division of Community Assistance). One guide per year is assumed. A guide with a publication run of 10,000 at an average cost per unit of $2.00 for printing, promotion and distribution and $15,000 for research and writing implies a total annual cost estimate of $35,000 per year.

Total incremental cost to government per year: $555,000 per year.

Practice costs to government:
None as defined here.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:

Landowners:

Because the programs are voluntary, it can be assumed for the purposes of this assessment that there are no net costs to landowners. They freely accept the terms of arrangements made and presumably receive benefits that equal or exceed costs incurred.

Specifically, any loss in production and income from land sold or donated, and any other tangible or intangible losses, are offset by proceeds from the transaction (if any), tax benefits (as applicable), possible increases in value of neighboring land owned by the same person, satisfaction from contributing to the public good, or other benefits (tangible or intangible).

Social costs:

- reduced tax revenues from lands protected (see discussion of Social costs in the analysis of the previous Management Action);

- for land that has been converted to farmland, possible decrease or lost potential for increase of regional farming or forestry activity, due to decline of regional farming or forestry infrastructure[4]; and

- reduction in farming/forestry operations in a community could result in loss of jobs. This is unlikely to be a major problem regionwide because lands enrolled will be distributed throughout the APES region. Loss of wage labor jobs in farming or forestry in any one locale might be offset by increased values of surrounding land and the creation of other job opportunities.

Social benefits:

- greater participation in conservation efforts, better public awareness of conservation needs in their communities;

- more acreage preserved and protected; and

[4]This refers to the so-called "impermanence syndrome." Farm or forestland owners who perceive the inevitability of urbanization may neglect such long-term investment and stewardship activities as soil conservation, purchase of capital equipment, clearing of land, forest stand thinning, etc. Similarly, owners of related businesses (e.g., feed, seed, equipment and fertilizer operations) might also disinvest or close down. The impermanence syndrome is manifest by underutilized land, sales to large lot housing developments, etc. (Keene, 1975; Healy, 1985).

- possible increase in tax revenues from land adjacent to protected land in some cases (the potential for this is likely to be very minor from the perspective of the regional economy).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Agricultural Conservation Program, Wetlands Reserve Program, Conservation Reserve Program
USFWS Partners for Wildlife program for landowners
State appropriations to the N.C. Division of Forest Resource, Soil and Water Conservation Districts, and agricultural extension services

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Healy, Robert G. 1985. Competition for Land in the American South: Agriculture, Human Settlement and the Environment. Washington, DC: The Conservation Foundation.

OBJECTIVE B
MANAGEMENT ACTION 3:
Enhance the ability of state and federal agencies to enforce existing wetland regulations by 1995.

REVIEW AND GENERAL COMMENTS

This Management Action calls for starting an aerial surveillance operation under the Division of Environmental Management and the Division of Coastal Management. This surveillance operation would monitor the wetlands of the region for violations of permit requirements or unpermitted activities. In addition, the Management Action calls for added staff for coordinating monitoring activities and for enforcement. The CCMP suggests a level-of-effort of 12 staff and one plane as a reasonable estimate of what is needed to meet enforcement needs.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

It is assumed that this action could be implemented with an estimated 12 additional staff members in the Division of Environmental Management and the U.S. Army Corps of Engineers, and one plane and pilot for surveillance activities.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The N.C. Division of Environmental Management has estimated that it would require 12 additional law enforcement officials (in both DEM and the Corps of Engineers) to adequately enforce existing wetlands regulations. At an average of $50,000 per person per year, this implies an incremental cost of $600,000 per year. Aerial surveillance would cost an estimated $175,000 per year. This assumes the pilot is not one of the 12 staff included in the $600,000 figure, and 25 hours of flight time per week (based on estimates from pilots familiar with this type of operation) at $100 per hour, which includes fuel, maintenance, upkeep, flight planning, administration. 25 flight hours per week reflects an estimated average maximum level-of-effort for one plane and one pilot. Total incremental cost to government: $775,000 per year.

Practice costs to government:
None as defined here.

Revenues generated under this action: None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Better enforcement of regulations increases the compliance costs of those activities requiring permits as well as non-permitted activities. It should be noted that these increased costs are borne by developers, farmers, etc., who are currently not in compliance with the law or who would be inclined to cheat in some manner on the terms of their permits.

Practice benefits to affected private sector groups:
Farmers, developers, and others who currently are regulated and who are in compliance with the law or the terms of their permits would benefit by decreasing or eliminating the competitive advantage (if any) that wetlands resource users who do not currently comply have. These non-compliers may enjoy some advantage because they assume lower compliance costs and therefore may profit or enjoy the benefits of some unregulated use. Other users of wetlands and water resources would benefit from the added protection of wetlands and regional water quality. These users include, among others, municipal water users, fishing interests and nature-related tourism/travel industry and consumers.

Social costs:
(Does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues.) The costs of complying with laws and regulations are the principle costs of increased enforcement. These costs include both actual expenditures of money and effort related to compliance as well as the reduction in the environmental goods and services resulting from compliance. Those who are affected by a given regulation determine their behavior based on their judgement of whether they should comply or whether they can avoid compliance and risk the cost of fines and penalties. Thus, a complete assessment of the costs of compliance with a regulation should adjust the costs of expenditure, effort and lower productivity assuming full compliance by some factor which depends on the "deterrence effect" of enforcement efforts.

Social benefits:
Improved compliance with regulations and laws leads to better environmental quality (see General Discussion of Economic Issues and the Introduction to the Vital Habitats analysis).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations

OBJECTIVE B
MANAGEMENT ACTION 4:
Strengthen regulatory programs to protect vital fisheries habitats, which include submerged aquatic vegetation, shellfish beds and spawning areas.

REVIEW AND GENERAL COMMENTS

This Management Action includes the designation, delineation and regulation of vital fisheries habitats not currently protected by the Marine Fisheries Commission and the Wildlife Resources Commission. The areas to be protected include submerged aquatic vegetation (SAV), shellfish beds, and anadromous fish spawning areas (anadromous fish return to fresh water to spawn). These designations would increase the areas that could be protected with regulatory mechanisms currently used to protect nursery areas, SAV and shellfish beds. This protection includes use standards imposed on dredging for boat basins and navigational channels, for example. The CCMP suggests some practices that could be targeted for restriction by the relevant commissions, including long-haul seine fishing, trawling, clam kicking, dredging, and certain types of general boating that disturb habitats. Many existing rules for these activities already exist under the Coastal Zone Management Act and Marine Fisheries Commission rules which could be expanded as necessary to protect these habitats. Water quality designations (High Quality Waters and Outstanding Resource Waters) could be used to further protect vital fisheries habitats, as is currently done for primary nurseries.

Also, various fishing practices, boating practices, land uses and types of development would be assessed for their cumulative effects on vital fisheries habitats under this Management Action.

Fisheries habitats would be considered in the siting of dischargers of point source water pollution, as well as in the design and siting of agricultural, forestry and other best management practices for the reduction of non-point source water pollution. However, no institutional mechanism for incorporating these considerations is suggested.

Finally, the Management Action calls for coordination among the agencies involved with fisheries habitat resources as well as with the Department of Transportation, whose public works projects are perceived to have a tremendous impact on these resources. For instance, the method for crossing streams in road projects can have a great impact on anadromous fish migration routes. Some culvert designs can cut off fish from their upstream spawning areas. Non-point source pollution from roads and road construction is another major consideration.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

Estimates of the level-of-effort required made by APES staff in the course of developing this Management Action include no additional staff, but considerable investment in research, interagency coordinating activities, and contracting of services related to criteria development, rule development, and delineation.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Developing the vital fisheries habitat designation process, developing delineation methods, delineating habitat areas, interagency coordination and the consideration of vital fisheries habitat study finding in on-going governmental activities (the Coastal Area Management Act review, Department of Transportation planning, the siting of government facilities, etc.) is estimated by APES to require $100,000 per year. Note that the CCMP recommends the development of a comprehensive marina siting policy, best management practices, and public education programs in Management Action 7, Objective B of the Water Quality Plan. Developing and implementing use standards is estimated to require another $100,000 per year, which would include the cost of cumulative impact studies of fishing practices, boating practices, land use and development practices, etc. The total incremental cost to government of $200,000 per year does not include added costs created by siting and construction restrictions on public works projects like roads and bridges and other government construction efforts.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Groups most likely to be directly impacted by the imposition of use standards and regulations in and near designated vital fisheries habitats include marina operators or developers, fishermen (especially commercial trawling operations and shellfishermen), and landowners now undertaking or considering land-disturbing activities on shore areas adjacent to designated sites. Without further specific information on the rules and standards that would be issued by the relevant commission it is not possible to characterize or estimate the economic impacts of these restrictions. The impacts would depend largely on the size of the areas designated for protection. Siting

restrictions for point-source pollution developments and standards for transportation projects are also likely to be important factors in determining overall social costs of this action.

Practice benefits to affected private sector groups:
Fishermen (both recreational and commercial) could benefit from any increases in harvestable fish populations resulting from increased protection of fisheries resources.

Social costs:
The major negative economic impact of this Management Action would be to fishing interests. See preceding Benefits section. It is unlikely that restrictions on land uses would be extensive enough to impact the regional economy. However, the restrictions could heavily impact certain individuals or communities if these groups are left with few alternative uses for their land.

Vital fisheries habitat restrictions would reduce the social benefits enjoyed from fishing in the protected areas themselves (commercial production, recreation, boating, etc.). However, this reduction presumably would be offset to some extent by increases or enhanced stability (i.e., reduced the chance of declines) in fish stocks over the medium to long run in the region as a whole. This will be the central question dealt with in the development of specific regulations for designated areas. See the following Social benefits section.

Social benefits:
Protecting vital fisheries habitats is essential to fish and shellfish propagation. If destroyed, habitats may not be replaceable. Efforts to replace lost habitats in the future may be much more costly than efforts to protect them now. Higher quality fisheries habitats could help generate larger harvests or lower harvest costs over the long run. Recreational fishing could also benefit to the extent that protection leads to improved fish stocks. In addition, these protected areas could also provide water quality or other habitat protection benefits even if these are not the primary reason for protection.

The benefit of protecting vital fisheries habitats is the value of what would have been lost if the resources were not protected, plus the value of any enhancement of the resource. The costs may be local impacts in fishing communities. Potential short-term decreases in harvests may be balanced or exceeded by long-term benefits in stock recovery. These benefits should be judged against what would happen if this action were not implemented; presumably, fisheries habitats would degrade and eventually lead to deeper reductions in fishing activity.

For commercial fishermen, this strategy could change the value of harvests, but the magnitude of that change is difficult to predict. Restrictions to protect habitats could reduce harvests in the short-term, but the recovery of stocks as a result of the protection measures would then cause harvests to rise again. This strategy may result in higher catch rates for fishermen in non-designated areas. The impact of this strategy also depends on how changes in harvest levels affect the price of fish and how consumers react to these changes. In addition, the effectiveness of this strategy depends on the effective implementation of other strategies in this plan for protecting water quality and for improving the management of fisheries resources. To achieve the long-term benefit of an increase in fish and shellfish populations, habitat protection must be complemented by strategies that prevent future surplus from being overharvested.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Cooperative Extension Special Research Grants Program, National Research Initiative grants, Water Quality Initiative Program
NOAA Saltonstall-Kennedy Grant Program
USFWS Sport Fish Restoration Fund, North American Wetland grant

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OBJECTIVE B
MANAGEMENT ACTION 5:
Enhance existing efforts to restore wetlands and vital fisheries habitats. Develop and implement a program to restore wetlands by 1995.

REVIEW AND GENERAL COMMENTS

The principle objectives of this Management Action are the development and demonstration of restoration technology and the prioritization of restoration sites. The prioritization function would be accomplished through the assessment of mapped data gathered as a part of activities described in Objective A, Management Action 2, of this plan. The strategies and priorities developed under this Management Action would in turn be incorporated into the basinwide habitat planning process described in Objective A, Management Action 1, of this plan.

Both state and federal agencies would be affected - the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the N.C. Wildlife Resources Commission, the N.C. Division of Coastal Management, the N.C. Division of Environmental Management, the N.C. Division of Forest Resources, among others, would be involved. No attempt to allocate the estimated costs to each agency was made in the CCMP and so no allocation of costs is assumed in this analysis either.

The specific recommendations of the Management Action are:

- select and prioritize sites for restoration as part of the mapping, assessment and planning activities described in Objective A of this plan;
- develop and demonstrate restoration technology;
- evaluate the potential for restoring submerged aquatic vegetation;
- plan and implement a restoration program for anadromous fish migration routes; and
- develop and implement a statewide wetlands restoration strategy for areas under the authority of wetlands regulations, to the extent possible in consideration of the priorities and goals of the basinwide habitat plans.

Coordination and planning activities discussed in Objective A of this plan would also help insure that public funds used in this Management Action are used such that the benefits per dollar spent are greatest.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

The costs of incorporating state wetlands strategies and priorities into the basin habitat plans (Objective A, Management Action 1, of this plan) are included in that Management Action.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
$100,000 per year would be a reasonable estimate of the cost of restoration technology development and demonstration activities. Prioritization and planning costs are included under the Management Actions of Objective A. Feasibility studies and demonstration projects for vital fisheries habitat restorations (submerged aquatic vegetation and anadromous fish migration routes) would cost an estimated $300,000 per year (according to APES staff estimates developed after consultation with the Division of Marine Fisheries, the U.S. Fish and Wildlife Service and the Wildlife Resources Commission). Finally, the development and implementation of a statewide wetlands strategy under the Wetlands Enhancement, Restoration and Creation (WERC) program would require an estimated $100,000 per year (based on APES staff estimates in consultation with DEM).

Program costs to government:
Costs of restoration can vary greatly depending on the type of habitat and restoration needed. For instance, a recent review of representative wetlands restoration projects revealed a range from $40 per acre for seeding in a bottomland forest to over $2,500 per acre for restoring a major riparian wetland, including extensive grading, riprap installations and plantings. To evaluate the feasibility of any specific restoration project or program, information would be needed on the effectiveness of different technologies in specific applications, on potential restoration sites and on the question of whether original sources of disturbance are abated to the point where restoration would be successful. Because the costs and benefits of restoration vary greatly, careful feasibility studies and prioritizations are essential. No precise restoration costs were developed for this analysis since the scale, complexity, siting, etc. of specific projects would depend greatly on the restoration selected through strategic planning.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
No major costs accrue to specific user groups (such as farmers, developers, fishermen, etc.) as defined here. The scale of wetlands restorations is not expected to be large enough to affect the land base or employment in any major resource industries such as farming or forestry.

Practice benefits to affected private sector groups:
Fishermen, recreationists, and others who would benefit from enhanced wetlands and fisheries habitat would benefit from this Management Action.

Social costs:
The benefits that are foregone by restoring areas to wetlands or fisheries habitats, instead of using them for some other purpose, would be the major social cost of this plan (apart from the opportunity cost of public spending).

Social benefits:
Enhancing vital wetlands also can play a role in regulating the storage and movement of water in a river basin, and can be a component of strategies for flood control, stormwater control and treatment, wave and river channel scouring control, water quality maintenance and vital fisheries habitat protection. Restoring wetlands as part of basinwide water quality initiatives could generate some savings by reducing the need for water treatment facilities, flood and wave control structures, stormwater runoff control and treatment facilities, capital-intensive fisheries stocking and habitat restoration. However, the magnitude of this savings cannot be estimated with available data. Restoration is unlikely to be a major factor in overall water quality management efforts for the region because of the relatively small scale of likely restoration projects compared to the amount of wetlands and fisheries habitats involved in the provision of significant water quality services. Protection of existing wetlands is more likely to play this role. However, in some locales wetlands restoration may prove to be a cost-effective alternative to other water quality management measures, especially if in those locales the restoration of wetlands would fulfill several needs at once (recreational areas, fisheries enhancement, endangered species habitat, flood control, etc.).

The restoration of submerged aquatic vegetation, anadromous fish migration routes and other vital fisheries habitats is an important part of restoring vital ecological links or processes in the APES region. Achieving this should help stabilize populations of all endemic species in the region, commercial and otherwise. Available data do not allow for a quantification of the magnitude of the potential habitat enhancement described above nor for the valuation of benefits that would accrue to the full restoration of

these resources. This is not to say that the potential benefits are not significant. The relevant question for policy makers is whether the potential for realizing these benefits is worth the investment into research and demonstration projects.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA, NOAA, USFWS and the U.S. Army Corps of Engineers have funds for projects developed through the Coastal America Program. In the APES region, these funds currently are being used to restore anadromous fish migration routes by removing barriers. Other possible sources of funding include:
USEPA continued funding of the WERC program
NOAA Saltonsall-Kennedy grants
USFWS Sport Fish Restoration Fund, Pittman-Robinson for wildlife restoration, Endangered Species Conservation Fund, North American Wetland grants, North American Wetland grants, Land and Water Conservation Fund
USDA Agricultural Conservation Program and Water Quality Initiative Projects

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OBJECTIVE B
MANAGEMENT ACTION 6:
Establish a consistent and effective mitigation program to compensate for unavoidable, permitted wetlands losses by 1995.

REVIEW AND GENERAL COMMENTS

The Management Action has the following main elements:

- to continue to develop effective wetland mitigation procedures;
- explore new wetlands mitigation procedures that would allow for increased effectiveness of wetlands mitigation driven restoration and creation activities, in particular, the use of mitigation banking; and
- education and public awareness campaigns of new mitigation procedures.

The primary economic issues that would be raised by the implementation of this Management Action are the cost of the research, planning, standards development, monitoring and enforcement, the impact to developers (and subsequent secondary economic impacts to the regional economy) of increased mitigation and restoration costs, and the increase in the social value of wetlands benefits per dollar spent on mitigation and restoration.

This Management Action would not necessarily change current wetlands regulations. Increased requirements for mitigation are possible, however, as a wetlands mitigation program is developed for the state. It is assumed that such changes would be made through normal channels of decisionmaking (legislative and adminstrative), since it is not proposed here that any policymaking authority be transferred to any wetlands protection/mitigation program.

While there could be some increase in mitigation costs to the regulated community attributable to this proposal, the main impact is to improve the cost-effectiveness of mitigation. That is, the effect will be to maximize the benefits of every mitigation action required through research, the development of mitigation/restoration technology and better management.

This Management Action would apply to the entire State of North Carolina, though the bulk of the state's most important wetlands are in APES area.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

Actual costs of mitigation are not considered here. Mitigation costs are largely funded by participants required to mitigate wetland impacts, and these requirements are already in place and would not necessarily be affected by this proposal.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Coordinating activities, meeting among the several state and federal agencies involved with wetlands protection, and research related to developing a mitigation program is expected to cost approximately $100,000 in 1994. Not estimated here are the adminstrative costs of any mitigation program that results from this initial effort.

Practice costs to government:
None. If a mitigation program is recommended and established, land management, restoration and creation costs are assumed to be covered by charges to the regulated community.

Revenues generated under this action:
Any mitigation program established would generate proceeds from development credits sold to developers who are required to mitigate.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Presumably, the regulated community could face the same costs of mitigation as they currently do, with the difference being that the resources generated in this way are deployed in a more effective way. On the other hand, their costs may rise, but this would depend on how the mitigation program were designed.

Practice benefits to affected private sector groups:
No additional benefits as defined here would accrue to the regulated community. Groups that would make use of or derive benefits from the restored/created wetlands would enjoy those benefits. These benefits would be determined by the specific location, magnitude and design of the restoration/creation.

Social costs:
It is not clear whether or not there would be incremental social costs as a result of this Management Action. The costs of mitigation borne by the private sector may or may not be affected by this proposal, and if they are they could have secondary impacts on

the regional economy in terms of a reduced potential for development-related activity.

Social benefits:
Possibly reduced transactions costs of permitting, information gathering, and management of wetlands resources, to the extent that this Management Action enhances the public administration of existing programs.

The primary environmental benefit of this proposal would be any enhancement of water quality due to a significant increase in the effectiveness of wetlands mitigation and restoration activity; in turn, this could enhance both recreational and commercial activity associated with wetlands (especially recreational fishing and downstream commercial fisheries). The nature and magnitude of this benefit cannot be estimated before feasibility studies are completed and the mitigation program is clearly defined.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Once established, any mitigation program would be funded by entities (public or private) that are required to compensate for the development or alteration of wetlands. Potential sources of funds for research, feasibility studies, etc. include:
USFWS Pittman-Robinson for wildlife restoration, North American Wetland grants, North American Wetland grants
USEPA continued funding of the WERC program, State Development Fund
U.S. Department of Transportation (USDOT) Intermodal Surface Transportation Efficiency Act (ISTEA) funds

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Chapter 6
ECONOMIC CHARACTERIZATION OF THE FISHERIES PLAN

The Management Actions of the Fisheries Plan are as follows:

OBJECTIVE A: ***"Control over-fishing by developing and implementing fishery management plans for all important estuarine species."***

Management Action 1:

"Develop and implement management plans for fisheries that are important to recreational and commercial fishing interests. These plans would include recovery objectives for severely depleted stocks by 1999."

Management Action 2:

"Modify the existing marine fisheries license structure to improve data collection with respect to landings, demographics and fishing effort, and to generate increased revenues for fisheries management."

OBJECTIVE B: ***"Reduce the harmful effects of bycatch on fish populations."***

Management Action:

"Continue and expand development of bycatch reduction gear and practices, and require their use as their practicality is demonstrated. Aim to reduce inside trawl, long haul seine, pound net, and gill net bycatch by at least 50% by 1995."

OBJECTIVE C: ***"Promote the use of best fishing practices that reduce bycatch and impacts on fisheries habitat."***

Management Action:

"Institute a cost-share program for best fishing practices for commercial fishing gear."

The Management Actions in the Fisheries Action Plan focus on controlling overfishing, reducing bycatch, and strengthening fisheries management efforts.

The types of governmental costs of the recommendations in the Fisheries Action Plan include program staffing and administration, state cost share financing, and management related data gathering and research. Private costs include fishermen's costs of complying with new management actions to control overfishing, any costs of adopting new bycatch reducing gear that are not covered by the state, the cost to fishermen of the reduction of areas available for fishing due to protection of vital fisheries habitats, and the costs of license fees.

Private costs would include not only costs to the commercial fishermen in the form of lost producer surplus, but also lost consumer surplus from the commercial and recreational fisheries. In the long term, however, fisheries management efforts that result in an increase in the abundance of fish stocks can yield consumptive and non consumptive benefits. These long term benefits may offset short term losses of foregone producer and consumer surplus from commercial and recreational consumptive uses.

In cases where fish species are overfished, the lack of prudent fisheries management to control overfishing may result in the depletion of stocks to such low levels that the species can be considered to be threatened or endangered. In these cases, lack of action to protect short term benefits can result in long term losses.

Although the costs of adopting new gear to reduce bycatch depend on the type of existing gear, these costs can be significant to commercial fishermen. To lessen the burden of these costs, the Fisheries Management Plan has recommended a cost-share program in which the state would pay 75% of a commercial fishermen's costs of adopting new gear. Other costs associated with bycatch reduction include the foregone producer surplus to fishermen who would have sold their bycatch.

The benefits of bycatch reduction include those benefits that result from stock enhancement, as well as reduced conflicts between commercial and recreational fishermen. These conflicts can also be reduced when managers have more accurate data on the commercial and recreational fishermen, such as information on areas commonly fished and gear used. This data collection would be facilitated by the modifications to the existing marine fishing license structure.

OBJECTIVE A: "Control over-fishing by developing and implementing fishery management plans for all important estuarine species."

MANAGEMENT ACTION 1:
Develop and implement management plans for fisheries that are important to recreational and commercial fishing interests. These plans would include recovery objectives for severely depleted stocks by 1999.

REVIEW AND GENERAL COMMENTS

This action recommends that Fishery Management Plans (FMPs) be established for each fishery in the APES region by 1999. FMPs are intended to protect the stocks of the fisheries and ensure their health and survival. In some instances, overfishing may threaten fisheries stocks. Those developing management plans would evaluate the efficiency of current techniques now in place to protect stocks from the effect of overfishing, including effort control schemes and regulations. Before recommending changes in the management of any fisheries stocks, those charged with developing the FMPs would ensure that the socioeconomic effects of any proposed effort control schemes are analyzed. The effects of any effort control schemes on part-time commercial fishermen and those who are economically dependent on a variety of seasonal fisheries would be evaluated and plans would include ways in which these fishermen can be protected from any socioeconomic hardships.

The following are guidelines for development of the fisheries management plans:

- The Marine Fisheries Commission (MFC) would establish requirements and protocols for the development of FMPs.

- The Division of Marine Fisheries (DMF) would:
  - develop a strategic planning process;
  - expand the data base for completion of stock assessments; and
  - work with the Wildlife Resources Commission (WRC) to develop FMPs by 1998.

- The DMF, WRC, Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) would consider restocking efforts for severely depleted native stocks such as Atlantic and shortnose sturgeon.

- The DMF would regularly monitor and reassess the FMPs and would amend them whenever necessary.

The Status of North Carolina's Estuarine Dependent Fish Stocks

More than 90% of North Carolina's economically important fish species are estuarine dependent. These include red drum, spotted sea trout, weakfish, striped bass, croaker, spot, flounder, black sea bass, and Spanish mackerel. The DMF uses commercial data to look at the status of these fish species. According to Easley and Smith (1992), the commercial harvest of edible N.C. finfish has declined approximately 40% in the past 10 years. According to DMF director Bill Hogarth, since 1980, the recreational as well as the commercial catch has declined. Recreational landings for species such as croaker and weakfish in the Pamlico Sound have declined, as have landings of striped bass and white perch in the Albemarle Sound.

Data Collection and Analysis

FMPs would provide coherent systems, direction and guidance for reporting, sampling and analyses. Sufficient data is needed by fisheries managers and regulators to allow them to make informed decisions that protect and promote wise use of fisheries resources. Data gaps for the North Carolina fisheries have been identified by researchers at the DMF and at universities in the state. Recommendations on how to fill these gaps have also been made. The most important types of data that are needed for stock assessments include long term data on landings, effort, age and size composition, and year class abundance (Street and Phalen 1989).

No sampling is now being performed on the clam, oyster, shrimp bycatch, or the majority of estuarine gill net fisheries. A clam house survey, a fishery independent study of oysters, sampling during bycatch reduction research and development, and inclusion of the estuarine gillnet fisheries into the existing adult finfish sampling program have been suggested (Street and Phalen 1989).

Although a telephone survey is performed to collect data on recreational catch, it has been difficult to differentiate marine sport fishing data from that of freshwater fishing. Water body and species specific data needs to be collected for species such as striped bass, white perch, croaker, spot, weakfish, clams, blue crabs, oysters, bay scallops, and shrimp. Implementation of a recreational saltwater sport fishing license could facilitate better and more specific data collection and analysis. (See separate analysis of Fisheries Plan Management Action 2 under Objective A).

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

Effort Control

A major consideration in the development of fisheries management plans is the protection of the fisheries against stock depletion from overfishing. Effort control schemes have been developed with the intention of reducing overfishing to protect fish stocks. Those charged with developing FMPs would consider the following effort control scheme options:

- limited entry
  (taxes, individual quotas, and licenses are sometimes considered together as limited entry approaches);
- individual vessel trip limits;
- annual trip limits;
- time restrictions;
- area restrictions;
- season and area closures;
- vessel quotas;
- size limits; and
- various gear restrictions.

The economic impacts of effort control are important. Economic considerations include:

- Maximizing net benefits;
- Reducing effort in the open access fishery to the point of maximum sustainable economic yield; and
- Creating incentives that promote efficient harvesting methods and expenditures.

Economic Effects of Harvest Reducing Requirements

The fisheries of North Carolina can be viewed as a publicly owned asset. They are valuable not only for their direct uses: seafood consumption and recreational fishing, but also for their non-consumptive uses. For example, people may value a resource for the opportunities it can afford their grandchildren.

Fisheries managers are charged with the task of managing fisheries for optimal current benefits, while at the same time ensuring that the stocks remain plentiful over time for future benefits. When stocks decline, fisheries managers may decide to protect fish stocks from overfishing through requirements designed to reduce effort by reducing the amount of fish harvested.

Economic Effects from Commercial Fishery Requirements

In the case of the commercial fishery, the economic effects of harvest reducing requirements such as seasonal and areal closing can be measured in the changes in net benefits to seafood consumers plus the changes in profits of fishermen, processors, and distributors to the consumers. The net benefits to seafood consumers are measured by the difference between the consumer's willingness to pay for the seafood and what the consumer actually paid for the fish. The changes in net benefits and profits depend on the change in prices in these markets in response to changes in quantities harvested.

Economic Effects from Recreational Fishery Requirements

In the case of the recreational fishery, the economic effects of requirements such as bag and size limits can be measured by looking at the changes in net benefits to the recreational

fishermen. Net benefits for the recreational fisherman depend on individual preferences. The benefits are measured by the difference between what the fisherman would have paid rather than forego the experience, and what the fisherman actually paid for the trip.

Different harvest-reducing and effort control policies have different economic effects. Gear restrictions can raise the cost of fishing and reduce fishing activity. Total harvest quotas may create incentives to the commercial fishermen to invest in larger vessels and more harvest intensive equipment, which can vastly increase the cost of fishing.

Many economic studies have been conducted to determine which effort control schemes are best at protecting fishing stocks from depletion from over fishing with the least cost to fishermen and society. To determine which limited entry scheme protects a continuous stock growth rate fishery at the least cost to fishermen and society, Eric Anderson (1988) compared a harvest rate quota to a per unit tax. His findings suggest that the type of effort control recommended in FMPs should be decided on a case by case basis, because the economic efficiency of the control depends on the parameter values of the individual fishery in question.

Jonathan Karpoff (1989), an economist from the University of Washington, also studied the characteristics of limited entry fisheries. He found that fishermen advocate entry restrictions when they expect net benefits from fishing as a result of the restrictions. Fishermen are more likely to expect to benefit from the restrictions when minority groups are targeted for exclusion, expected fishing incomes are low, and when returns from fishing vary widely. According to Karpoff, the benefits of limited entry licenses are that they limit competition when the fishery becomes profitable (limiting new entry can avoid a recurrence of stock depletion from overfishing), but do not force participation when the fishery is unprofitable, such as when catch per unit effort is low due to depleted stocks.

Individual Transferrable Quotas

Working in Iceland, a country whose economy is dependent on fishing, Ragnar Arnason (1990) found that many fisheries management schemes that are theoretically capable of generating economic efficiency are actually not practical, because they require huge amounts of information that can be costly to obtain. Arnason argues for market based management systems such as individual transferable share quotas, which, under fairly unrestrictive conditions, require minimal information for their operation, but lead nevertheless to efficiency in common-property fisheries.

According to Tietenberg (1988), to be economically efficient, a quota system should have the following characteristics:

- "The quotas entitle the holder to catch a specified weight of fish;
- The total amount of fish authorized by the quotas held by all fishermen should be equal to the efficient catch for the fishery; and

- The quotas should be freely transferable among fishermen."

The distribution of the benefits of quotas depends on how they are initially allocated to the fishermen. One possibility is for the government to auction the quotas to the fishermen. Theoretically, through the bidding process, those who purchase the quotas would pay market price for them. In this case, the government would keep the proceeds from the initial sale of the quotas, but fishermen would keep the proceeds when and if they subsequently sold them.

Another method of distributing the initial quotas is to give them to the fishermen based on their historical catch. By then trading the quotas among themselves, the fishermen would determine the fair market price of the quotas. In this instance, the fishermen who received the initial allocation of quotas would keep the proceeds of the first sale of the quotas. Although they would benefit from this system, fishermen who want to enter the market would have to pay for the quotas just as in the system where the government auctions them.

According to Tietenberg (1988), if the current fish population is overfished, the second method can reduce harvesting in a way that seems fair to the current generation of fishermen. This is because the current generation, unlike future generations, would not have to pay for the valuable quotas, but then could earn money from their sale or use. If the quotas could be used to reduce the current catch, and the profits are large enough, the current generation of fishermen might be better off from owning the valuable transferable quotas, even if their catch is substantially reduced.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Administrative costs for developing a fishery management planning process have been estimated at $300,000 per year for five years. Staff requirements to implement planning include at least one biologist, one economist, one population dynamics specialist and three data collection technicians.

Administrative costs would include start up costs; yearly costs, including monitoring and FMP review costs; and restocking program costs.

Implementation of effort control schemes would likely involve large staff requirements in order to enforce and monitor fisheries. Staff would also need to obtain input from affected fishermen.

Practice costs to government:
None.

Revenues generated under this action:

A license to sell fish and a recreational saltwater fishing license could provide a source of revenue which could be directed toward supporting fishery management efforts, including enforcement efforts (See analysis of Fisheries Plan Management Action 2 under Objective A).

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Possible decreased income to commercial fishermen as a result of limited access to fisheries.

Practice benefits to affected private sector groups:
If stocks increase due to better fisheries management, then the cost per unit effort of fish and shellfish harvest may decrease due to an increase in supply of fish and shellfish. Commercial fishermen with access may increase profits if pressure on fish stocks decreases and stocks become more plentiful.

Recreational Fishermen
Larger stocks of species important to recreational fishermen create incentives for existing recreational fishermen to take more trips, and for more recreational fishermen to enter the fishery. This leads to greater net benefits to recreational fishermen, however, bag limits, minimum size limits and other regulations may be imposed on them to ensure that larger future stocks will be available to meet the greater recreational demand.

Secondary Benefits of Recreational Fishery Improvements
Although not net benefits to stock enhancement, the local impacts of increased expenditures by recreational fishermen are important. Healthy stocks in general will lead to more local sales and employment in service industries. As sport fishermen increase their fishing trips, local expenditures increase for such things as lodging, vessel and tackle rentals, bait, food, and fuel. These expenditures represent increased sales to local firms.

Social costs:
Regulations to prevent stock depletion from overfishing can reduce the supply of fish. Reduction in the supply of fish from fishermen can have two effects. First, prices of fish and shellfish may rise to consumers, decreasing their net benefits. Second, reduced volumes of fish reduce profits to fishermen, processors, and distributors, including restaurants. The amount of the reduction in profits, however, depends on how consumers react to the increased prices.

Social benefits:

Careful fishery management would result in long-term benefits through improved stocks. These benefits could include larger harvests; lower costs and greater profits for commercial fishermen; lower prices for consumers; better trips for recreational fishermen; and economic benefits to communities with ties to commercial and recreational fishing. Where management plans result in greater restrictions, some fishermen may experience short-term economic losses. Consideration of socioeconomic characteristics can help address the equity of such regulations.

Effective management can result in elimination of overfishing for important species and recovery of severely depleted stocks. Better management can provide a sound basis for further regulation where necessary and increase the predictability of fisheries management and regulation.

Social benefits would depend on how effective the effort control is at decreasing fishing pressure and at increasing fish stocks. A major benefit would be the recovery of a severely depleted commercially or recreationally important species.

Society can realize net benefits from increases in fish stocks that result from stringent regulations that reduce the commercial and recreational harvest of overfished stocks. Considering the stocks as publicly owned assets, society forgoes the current benefits of using the stock now so that it can benefit from the stock in the future. Easley and Smith (1992) liken this to an investor setting aside current earnings to build savings for retirement.

As the fish stock grows, society gains as a result of lower prices for consumers and enhanced fishing trips for recreational fishermen. If larger harvests are allowed, then lower prices to consumers and larger commercial profits can be expected. Higher local wages and increased rates of local employment may also result from larger harvests.

Harvest restrictions alone are usually not a cure all for overfishing. The benefits and profits from improved catches create incentives for additional commercial fishing vessels to enter the fishery. Once additional vessels begin fishing, then the stocks can again become depleted. For this reason, restricting harvests and controlling access to fisheries may be necessary to protect fisheries stocks. This can be done by issuing a limited number of individual transferable quotas, as in the South Atlantic wreckfish fishery and others.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

NOAA Inter-jurisdictional Fisheries Act
NOAA Southeast Area Monitoring and Assessment Program (SEAMAP)

USFWS Sport Fish Restoration Fund
EPA Clean Water Act Water Quality Management Planning

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OBJECTIVE A
MANAGEMENT ACTION 2:
Modify the existing marine fisheries license structure to improve data collection with respect to landings, demographics and fishing effort, and to generate increased revenues for fisheries management.

REVIEW AND GENERAL COMMENTS

The information that could be collected from the licenses and from surveys of the licensed population of recreational and commercial fishermen could be used to improve fisheries management. It could also help to increase federal funding of fisheries management, and enforcement of commercial and recreational fishing regulations that protect the fisheries.

A license to sell fish has already been authorized by the North Carolina legislature. The license could improve the collection of data concerning commercial fishing effort, catch, areas fished, and other information which would improve the ability of the state to manage commercial fisheries.

Following public hearings which included representatives from the commercial fishing community as well as elected and administrative officials, the Joint Legislative Commission (JLC) concluded, "Many [fishermen] expressed concern that they were already overregulated, but felt that the license would provide valuable information needed to improve the State's data which could lead to increased stock allocations, and would ease pressure on some marine resources. Most people support a license that will provide necessary data for proper management provided that the fee is minimal and that all persons who sell fish be required to purchase the license." (JLCSA, 1992).

One of the purposes of a license to sell fish is to allow the state to accurately count the number of commercial fishermen in the state. Because recreational fishermen often sell a part of their catch to help pay for their fishing trips, they could be mistakenly counted as commercial fishermen if they were required to purchase a license to sell. One way to avoid this would be to include an income requirement in the license to sell. In other words, to be eligible to be licensed to sell fish, a fishermen would be required to show that he earned a certain amount of money a year, or a certain percentage of his income per year from the sale of fish. The exemption of recreational fishermen from the requirement of a license to sell fish would help with data gathering and analysis, however, the exemption would also ban recreational fishermen from selling fish. This is because it would be illegal under the current legislation to sell fish without a license. In addition, an income limit could also exclude part-time commercial fishermen from the right to sell fish, which is not the intent of the license.

Despite the benefits to data collection and analysis that an income requirement would provide, provisions for income requirement are not included in the Commission's recommendations. The Joint Legislative Committee report explains: "[Although] a number of full time commercial fishermen favored [the income requirement], many part time commercial fishermen and recreational fisherman saw the provision as a form of limited entry which would eliminate them."(JLCSA, 1992).

- ***Persons required to apply for a license to sell*:**
Any person who takes or lands any species of fish under the authority of the MFC and wishes to sell fish taken would be required to purchase a license to sell fish (JLCSA, 1992).

- ***Conditions of sale*:**
A licensed "fish seller" may either sell to a licensed fish dealer or, if the seller is a licensed fish dealer, he is permitted to sell to the public (JLCSA, 1992).

- ***Dealers' requirements*:**
Fish dealers are required to buy fish from licensed persons only (JLCSA, 1992).

Recreational Saltwater Fishing License:
A recreational saltwater fishing license could improve data collection concerning marine recreational fishing. In addition to effort, data could be collected regarding catch, number of fishermen, and areas where recreational fishermen fish, along with other information that would enhance fishery management.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government: The costs of modifying the existing marine fisheries license structure will depend on how data gathering is improved and whether new licenses are implemented.

- ***Administrative Costs of a License to Sell Fish Taken from Coastal Fishing Waters*:**
The JLC recommended that the 1993 General Assembly appropriate $50,850 for FY 1993-94 for start-up costs to administer the license to sell program. These start-up costs include "the establishment of a fisheries data information system established by the license to sell [program]." (See Legislative Proposal I-A). After the first year, the [DMF] estimates that fees generated from the license will cover expenses related to the program."(JLCSA, 1992).

- ***Administrative costs of a marine recreational fishing license*:**
Like the license to sell program, the marine recreational fishing license program would

probably require a one time appropriation from the General Assembly for the first year to cover start-up costs. States that have already implemented a marine recreational fishing license have been able to cover the administrative costs of their programs with 5% to 10% of the annual revenues they collect from the sale of the marine recreational fishing licenses. In the case of Virginia, this would range from $100,000 to $200,000 annually, in South Carolina, this could range from $25,000 to $100,000 per year.

Practice costs to government:
None.

Revenues generated under this action:
The revenues from the license to sell and the recreational salt water fishing license's fees could be earmarked solely for the purpose of administering the license programs and for improving fisheries management.

In addition to facilitating better data collection and generating revenue to fund marine recreational fishing enhancement, revenues from the implementation of a marine recreational fishing license could help the state secure more federal Wallop-Breaux matching funds for fisheries management enhancement. If the revenues from the fees from a recreational salt water fishing license were required to be dedicated to the purpose of improving recreational fishing, then those revenues collected from the recreational salt water fishing license fees would qualify as State funds that are eligible for federal matching funds from the Sport Fish Restoration Fund of the Wallop Breaux Trust Fund, administered by the USFWS. The recreational license would not only increase the amount of funds that could be matched by Wallop Breaux funds, but would also serve to provide a more accurate estimate of the number of salt water sport fishermen fishing in N.C. waters. This number figures into the USFWS's decisions on allocations made to each state.

Although the amount of the N.C. marine recreational fishing license fees has not yet been determined, other states which have implemented MRF's have projected revenues from the fees collected. Virginia estimates that it will collect $2,000,000 per year (Travelstead, 1993). South Carolina, which has more recently adopted an MRF, has collected $500,000 in the first six months of the license's implementation (Moore, 1993). The Atlantic Coast Conservation Association of North Carolina (ACCA of N.C., 1992) estimates that with between 750,000 and 1,000,000 saltwater sport fishermen in North Carolina, recreational saltwater fishing license fees of between $6 and $10 could generate from $5 to $10 million annually.

States such as Virginia and South Carolina that have implemented marine recreational fishing licenses pay the fees into a state saltwater recreational fishing development fund, and spend between 5% and 10% of the revenues on administration of the license

programs. The rest of the annual revenues are often earmarked for spending on research, public education, enforcement, habitat protection and acquisition, and other programs that benefit recreational fishing (Moore, Travelstead, Street, Cole, and Vail, 1993).

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
License modifications may result in new licenses, which would probably have fees. At the date of this writing, (September 7, 1993) annual fees for the license to sell fish had not been decided upon.

Although there is no recreational salt water fishing license in North Carolina, Virginia and South Carolina have each implemented a such licences. Their fee structures are as follows:

State	Annual Resident	Annual Non-resident	Daily Resident	Daily Non-resident
VA:	$7.50	$7.50	$5/10 days	$5/10 days
SC:	$5.50	$5.50	None	None

Ten other states have also implemented marine recreational fishing licenses. Their annual resident fees range from $3.00 to $19.25, and their annual non-resident fees range from $9.00 to $51.25. (Maiolo and Tripp, 1990).

Practice benefits to affected private sector groups:
The marine recreational fishing license could allow marine recreational fishermen to be counted for statistical purposes, which will enable the state to secure more federal Wallop Breaux funds which are spent solely on programs that benefit sport fishing, such as fisheries habitat protection and acquisition, access through fishing piers, research activities on recreationally important finfish, crustaceans and shellfish, and education programs.

The fees collected by the state from saltwater recreational fishing licenses could be earmarked solely for spending on programs that benefit marine sport fishermen directly. In addition to augmenting programs funded by Wallop Breaux monies, a marine recreational fishing license could fund enforcement activities, which are not funded by Wallop Breaux.

The benefits of both the marine recreational fishing license and the license to sell fish are that they could not only help to get a more precise count of the recreational and

commercial fishermen in the state, but also help to distinguish them from each other to yield better data for fisheries management that could benefit both groups. These licenses could allow the commercial and recreational saltwater fishermen to be counted and to participate in the system. The license to sell could help to better measure effort and catch from commercial fishermen. Similarly, the marine recreational fishing license could help to better measure recreational catch. According to the Sport Fishing Institute, "in some places, very poor data causes the recreational catch to be underestimated from 30 to 400 percent."(Felder, in Murray and Faris, 1992).

Social costs:

Implementation of a license to sell fish could cause an increase in the price of fish and shellfish paid by the consumer if the supply of fish is decreased is a result of the requirement. Implementation of a recreational saltwater fishing license could decrease demand for recreational fishing resulting in decreased tourism income to hotels, restaurants, etc. and decreased demand for fishing equipment as well as fishing opportunities (Deep sea charter fishing, pier fishing etc.).

Social benefits:

As a mechanism to protect and enhance sport fish populations through the funding of programs to improve fisheries management, the marine recreational fishing license could help to protect marine fish and their environment for the use and enjoyment of the public today and in the future. In addition, benefits include the protection of recreational fishery resources that are vital to the tourism industry of the N.C. coastal region.

The license could allow state specific data to be collected which would be more precise than that derived from regional data collected by the National Marine Fisheries Service. State specific data would be useful for economic studies of the impacts of recreational fishing in the state.

As coastal populations and numbers of fishermen increase, loss of habitat and pollution create great pressures on coastal fishery resources. A license could allow for long-term, quality management of marine fish and shellfish.

Specifically, the marine recreational fishing license could improve management in the following ways:

- Provide a data base so that:

  - the number of resident and non-resident marine recreational fishermen can be counted;
  - changes in catch rates can be measured;
  - fisheries managers can determine appropriate fish stock allocations between commercial and recreational fishermen;
  - the state can qualify for increased federal Wallop-Breaux fisheries funding; and
  - tourism benefits from recreational marine fishing can be more easily measured.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

No additional costs are anticipated to be needed to modify the existing marine fisheries license structure. Establishing a new marine recreational fishing license would entail first-year start-up costs. The most likely source of funding would be state appropriations. After the first year, revenues from license fees would cover administration of the licenses as well as research and other initiatives to enhance marine recreational fishing.

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OBJECTIVE B: "Reduce the harmful effects of bycatch on fish populations."

MANAGEMENT ACTION:
Continue and expand development of bycatch reduction gear and practices, and require their use as practicality is demonstrated. Aim to reduce inside trawl, long haul seine, pound net, and gill net bycatch by at least 50 percent by 1995.

REVIEW AND GENERAL COMMENTS

The goal of this action is to guide the development of bycatch reduction gear and practices to facilitate the timely adoption of their use. According to this action, the Marine Fisheries Commission should be able to require the use of each specific gear or practice as soon as research demonstrates that it works well, is affordable, and results in minimal loss of target fish. Research would aim to minimize the loss of catch per unit effort of target species as well as other costs associated with the adoption of bycatch gear.

The following are specific aims of this action:

- To reduce bycatch from trawling, long haul seines and pound nets by 50% of the total weight of bycatch by 1995; and

- Once a bycatch reduction practice is demonstrated to be practical and effective, the Marine Fisheries Commission would require its use (See Fisheries Plan Management Action under Objective C for a description of the cost-share program which would be used to help implement new requirements related to bycatch reduction).

Researchers and managers would consider reducing existing bycatch allowances in the trawl, pound and gill net, long-haul and swipe seine fisheries. Currently, estuarine crab and shrimp trawl fisheries are allowed to possess up to 1000 pounds of finfish bycatch on board a working vessel, while pound net and long haul seine fishermen can keep up to 5000 pounds per vessel.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

The benefits and costs of this initiative would vary by type of fishing operations and by bycatch species. The magnitude of the costs and benefits depend on:

- The cost efficiency of the bycatch reduction gear and practices (the reduction of bycatch, as well as the reduction of culling and hauling costs achieved compared with the costs associated with bycatch reduction);

- The impact of bycatch reduction gear and practices on bycatch and target fish stocks;
- The effect of increased stocks on subsequent fishing costs and the resulting impact on fish prices; and
- Changes in costs of fuel, labor and supplies.

It may be difficult to assess the level of benefit in the absence of more solid information about the impact of bycatch reduction gear and practices. In many cases, there are insufficient data to estimate or project trends in important measurements such as catch per unit of effort for bycatch species.

ASSUMPTIONS

1. Depending on the type of gear, the use of bycatch reduction gear can result in a 1% to 5% reduction in catch per unit effort of target species (Hawkins, 1993). Researchers have recommended the use of bycatch reduction devices that reduce bycatch with no significant difference in target catch, such as the Florida Finfish Excluder and the Georgia TED (Pearce et al., 1989). Research would aim to minimize the loss of catch per unit effort of target species as well as other costs associated with the adoption of bycatch gear.

2. Yearly chartering and leasing costs would be fully funded by Tier 1 of the BFP Cost Share Program described in the Management Action under Objective C. These costs are discussed and included in the analysis of that Management Action.

3. Up to seventy-five percent of the purchase costs to commercial fishermen to comply with requirements to convert their old gear to new bycatch reduction gear would be subsidized through a state cost share program (See the Fisheries Plan Management Action under Objective C).

4. A full time Biologist II would be hired to work on and supervise long haul seine, pound net and gill net research.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
It is estimated that $200,000 per year for five years is needed to establish a gear development program in the Division of Marine Fisheries and to fund gear research in the trawl, long haul seine, pound net and gill net fisheries. This number represents all administrative and practice costs associated with this action except the yearly chartering and leasing costs listed in Table 3 of this action: these costs would be paid

by the cost share program recommended in the following Fisheries Plan Management Action under Objective C.

Start-up costs for the establishment of a gear development program in the Division of Marine Fisheries are estimated at $60,500 (See Table 1). The costs of gear research in the trawl, long haul seine, pound net and gill net fisheries are estimated at $242,268 for the first year, $262,268 for the second year, $272,268 for the third year, and $204,326 for the fourth year (See Table 2).

Table 3 includes a breakdown of the costs to the DMF of leasing and chartering boats for bycatch reduction research. Because these costs would be fully funded by Tier 1 of the BFP cost share program (recommended in the Fisheries Plan Management Action under Objective C), they are counted as costs to that program, and are not discussed in the following description of research costs. The costs and benefits of leasing and chartering fishermen's boats are discussed in the analysis of the BFP cost share program.

Requiring the use of bycatch reduction gear would have implementation costs, including new gear licensing, the costs of enforcement and enforcement staff.

Description of Research Costs:
The following is a preliminary breakdown of research costs determined in consultation with research managers from the North Carolina Division of Marine Fisheries. Estimations are made with the best available information from the following sources: results of preliminary research, the 1992 North Carolina Salary Schedule, operating costs from recent years, including mileage allowances for State of North Carolina employees for 1992, and current rental costs from the Regional Office of the Department of Environment, Health, and Natural Resources in Washington, N.C.. Additional yearly costs may be incurred for the rental of space for vehicles, boats, trailers, and work areas. Personnel costs estimated below include salary and fringe benefits.

A. Recreational Fishing:
An estimated $20,000-$30,000 would be required per year for two years of research on bycatch reduction in recreational fisheries. Research would be performed through the most cost-effective means, either by graduate students or temporary technicians.

B. Shrimp trawls:
Because research to refine finfish excluders (FEDS) is already in progress, no start-up costs will be required for FEDs. Yearly costs for FEDS are estimated at $54,697.

Yearly costs:

1 full time Biologist I	$34,000/yr
1 seasonal (9 month)	$14,040/yr
motor vehicle operation	$ 4,000/yr
travel	$ 500/yr
office supplies	$ 500/yr
communications	$ 500/yr
office rent (141 sq. ft. * $8.21/sq.ft.)	$ 1,157/yr
TOTAL:	**$54,697/yr**

C. Long haul seines:

1) Start-up costs are estimated at $18,500. Yearly costs of research to develop excluder panels are estimated at $49,070.

2) Included in these costs are the salaries of two seasonal temporary technicians, who would examine data base information on long haul seine catches to determine the potential seasonal and areal patterns of fish species and sizes as a basis for possible strategies to reduce the harvest of small fish.

Breakdown:

Start-up costs:

Purchase of gear, panels	$ 5,000
computer,printer and software	$ 4,000
office furniture	$ 1,500
boat, motor and trailer (optional)	$ 8,000
cost of rigging boat	$ 0
TOTAL:	**$18,500**

Yearly costs:

1 full time Biologist II (1/3 @$40,000)	$13,333/yr
2 seasonal 9 mo. temp technicians @$14,040	$28,080/yr
boat operation	$ 1,000/yr
motor vehicle operation	$ 4,000/yr
travel	$ 500/yr
office supplies	$ 500/yr
communications	$ 500/yr
office rent (141 sq. ft. * $8.21/sq.ft.)	$ 1,157/yr
TOTAL:	**$49,070/yr**

D. ***Pound nets:***

Start-up costs are estimated at $28,500 and yearly costs of research on escape panels, materials and mesh sizes are estimated at $51,570.

Breakdown:

Start-up costs:

Purchase of gear, including panels	$ 2,000
computer,printer and software	$ 4,000
office furniture	$ 1,500
boat, motor and trailer	$20,000
cost of rigging boat	$ 1,000
TOTAL:	**$28,500**

Yearly costs:

1 full time Biologist II @ $40,000	$13,333/yr
2 seasonal 9 mo. technicians @ $14,040	$28,080/yr
motor vehicle operation (from Beaufort to the Albemarle Sound)	$ 6,000/yr
boat operation	$ 1,000/yr
travel	$ 1,000/yr
office supplies	$ 500/yr
communications	$ 500/yr
office rent (141 sq. ft. * $8.21/sq.ft.)	$ 1,157/yr
TOTAL:	**$51,570/yr**

E. ***Gill nets:***

Start-up costs are estimated at $14,500 and yearly costs of research on mesh sizes, areas and seasons are estimated at $46,490.

Breakdown:

Start-up costs:

Purchase of gear	$ 5,000
office furniture	$ 1,500
medium to small boat, motor and trailer	$ 8,000
cost of rigging boat	$ 0
TOTAL:	**$14,500**

Yearly costs:

1 full time Biologist II @ $40,000	$13,333/yr
1 full time technician	$28,000/yr
motor vehicle operation	$ 1,500/yr

boat operation	$ 1,000/yr
travel	$ 500/yr
office supplies	$ 500/yr
communications	$ 500/yr
office rent (141 sq. ft. * $8.21/sq.ft.)	$ 1,157/yr
TOTAL:	**$46,490/yr**

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:

- The fishing industry may lose income from the loss of bycatch sales.
- Commercial fishing vessels may incur costs to convert to new bycatch reduction gear. Costs of conversion would vary widely per vessel. A large portion of conversion costs would be subsidized through the state cost share program described in the Fisheries Plan Management Action under Objective C.
- Commercial fishermen would incur costs of time and labor expended in learning about new regulations, gear, practices, and in converting equipment and adapting it for use.

Practice benefits to affected private sector groups:

- Commercial as well as recreational fishermen would experience an increase in catch per unit effort of fishing for some bycatch species as stocks become more plentiful.
- Commercial fishermen would realize cost savings from a reduction in culling costs.
- Commercial fishermen would realize cost savings from reduced operating costs such as fuel and wear and tear on equipment per unit harvest of target species as stocks become more plentiful.

Social costs:
When fishermen are required to incur practice costs to convert to new bycatch

reduction gear, fishing communities could experience secondary economic costs. The one time payment of either all or part of the costs of bycatch reduction gear could diminish the amount of available cash that fishermen would otherwise spend on goods and services in their local communities. The resulting decrease in expenditures could negatively affect retailers and restaurants, for example. The degree to which the local community would experience secondary economic cost would depend on the number of fishermen affected and the amount and type of bycatch gear they must adopt.

Even when a cost share program to cover the cost of Best Fishing Practices such as bycatch reduction is instituted, fishermen would still have to pay a portion (25%) of the costs of the bycatch reduction gear, and may have to pay the full or total cost of the gear initially before being reimbursed by the state for up to 75% of the costs (See analysis of the Fisheries Plan Management Action under Objective C for complete analysis of State BFP Cost Share Program recommendation). The costs of bycatch reduction gear vary widely. Estimated total costs per net in the shrimp trawl fishery, where nets would require modification, may be as low as $20, but are conservatively estimated at $30. Using the more conservative figure, if a fisherman had 4 nets, then the total cost before cost share would be $120. Estimated total costs in the gill net fishery are expected to be much higher, because the gill nets must be replaced. At replacement costs of $1.75 per linear yard, approximate total costs for a vessel with 1330 linear yards of gill net would be $2330.

Social benefits:

- As stocks of bycatch species become more plentiful, consumers may benefit from a reduction in the price of those bycatch species that are target species for other commercial fishermen.

- Recreational fishermen may benefit from an increased catch rate of bycatch species. Preliminary findings by Smith and Palmquist suggest that a 25% increase in the catch rate for all boat fishermen would increase the value to a recreational fisherman of a typical fishing trip to the Pamlico area by between $10 and $71 in 1981 dollars (Smith & Palmquist, n.d.).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

NOAA Sea Grant support
NOAA Fisheries Development, Utilization and Research Grant Cooperative Agreement Program (Saltonstall Kennedy)
USFWS Sport Fish Restoration Fund
State appropriations
Private foundations

TABLE 1

ESTIMATED START-UP COSTS OF BYCATCH REDUCTION RESEARCH (DOES NOT INCLUDE YEARLY, CHARTERING OR LEASING COSTS)

RESEARCH	START-UP COSTS
Shrimp trawl	$ 0
Long haul seine	$ 18,500
Pound Nets	$ 28,500
Gill Nets	$ 14,500
TOTAL	**$ 61,500**

TABLE 2

ESTIMATED YEARLY COSTS OF BYCATCH REDUCTION RESEARCH (DOES NOT INCLUDE START-UP COSTS OR CHARTERING AND LEASING COSTS)

RESEARCH	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Shrimp Trawl	$ 54,697	$ 54,697	$ 54,697	$ 54,697
Long haul Seine	$ 49,070	$ 49,070	$ 49,070	$ 49,070
Pound Net	$ 51,570	$ 51,570	$ 51,570	
Gill Net	$ 46,490	$ 46,490	$ 46,490	$ 46,490
SUB TOTALS	**$201,827**	**$201,827**	**$201,827**	**$150,257**
Short term research contracts:				
Recreational Fishing			$ 30,000	$ 30,000
TOTALS	**$201,827**	**$201,827**	**$231,827**	**$180,257**

TABLE 3

ESTIMATED YEARLY CHARTERING AND LEASING COSTS OF BYCATCH REDUCTION RESEARCH TO BE FULLY FUNDED BY TIER 1 OF THE BFP COST SHARE PROGRAM

RESEARCH	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Shrimp Trawl: Vessel charter @ $500/day for 45 days	$22,500	$22,500	$22,500	$22,500
Long haul Seine: Vessel charter @ $500/day for 40 days	$20,000	$20,000	$20,000	$20,000
Pound Net: Net leasing	$10,000	$10,000	$10,000	
TOTALS	**$52,500**	**$52,500**	**$52,500**	**$42,500**

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OBJECTIVE C: "Promote the use of best fishing practices that reduce bycatch and impacts on fisheries habitat."

MANAGEMENT ACTION:
Institute a cost-share program for best fishing practices for commercial fishing gear.

REVIEW AND GENERAL COMMENTS

The goal of this action is to facilitate the implementation of important measures to protect fisheries resources.

The action recommends that the General Assembly enact legislation to establish the Best Fishing Practices (BFP) Cost Share Program by the end of FY 1993. The purpose of the program is to facilitate and implement BFPs that mitigate impacts on fishing stocks and protect fisheries habitats.

A priority for the BFP cost share program would be to facilitate and implement bycatch reduction gear and practices. In addition to gear and practices that reduce bycatch, gears or practices that are found to reduce habitat damage would also be considered for cost-sharing.

The program would be implemented in coastal waters, all of which are under the jurisdiction of the Marine Fisheries Commission (MFC).

Through the Division of Marine Fisheries, with assistance from the regional advisory committees, the MFC would allocate funds from the BFP program for cost-sharing of different practices and gear development experiments and prioritize the use of the funding. The BFP cost share program would be divided into three parts, or "tiers" for the allocation of funds.

Funding may be allocated according to the three tiers as follows:

Tier 1. to pay commercial fishermen for the chartering or leasing of their equipment for use in BFP developmental experimentation and research, referred to in this analysis as bycatch reduction research chartering and leasing costs (See Table 2 of this Management Action);

Tier 2. to share costs spent by commercial fishermen to implement required BFPs; and

Tier 3. to share costs spent by commercial fishermen to voluntarily implement BFPs approved by the MFC.

Funding of tiers two and three would be limited to a percentage of the cost incurred by commercial fishermen; the percentage is to be established by the Commission.

The BFP cost-share program is to be modeled after the USDA's Agricultural Cost-Share Program. In that program, the percent of government funding of costs incurred by participating farmers varies between 25% and 75% of practice costs.

ASSUMPTIONS

1. The state would pay 75% of the total physical practice costs of BFP commercial fishing gear.

2. Private commercial fishermen's costs of equipment would be 25% of total costs of new BFP gear and expenditures.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

The costs and benefits discussed below include those associated with government subsidization of commercial fishermen's purchase of bycatch reduction gear, which is a priority of the BFP cost share program. The portion of commercial fishermen's bycatch reduction equipment costs not subsidized by the state is also discussed below. Although the benefits and costs to affected private sector groups and to society of the research and required use of bycatch reduction gear are discussed under the Fisheries Plan Management Action under Objective B, some of the costs of research will be covered by the cost share program, and thus are included here and in Table 2 of this Management Action.

An average of $200,000 per year for five years is needed to establish and implement a cost share program for Best Fishing Practices for commercial fishermen through the Division of Marine Fisheries. Program costs include start up costs, yearly administrative costs, leasing of commercial fishermen's boats and payment for their participation in gear research projects, technical assistance and the provision of cost share funding to commercial fishermen to phase in gear changes and modifications for their trawls, long haul seines, and pound nets.

The 25-percent share borne by fishermen has been estimated at $5 to $10 per net for installing revised finfish excluder devices on trawls, $37.50 per rig for long haul seine modifications, and $12.50 per net for pound net modifications.

The following cost figures have been estimated by Michael W. Street, Research Section Chief of the North Carolina Division of Marine Fisheries. Estimations are made with the best available information from the following sources: results of preliminary research; the North Carolina-National Marine Fisheries Cooperative Commercial Statistical Program's April 1991-March 1992 Annual Progress Report; 1991 Commercial Vessel License data from the North Carolina Division of Marine Fisheries; the 1992 North Carolina Salary Schedule; operating

costs from recent years, including mileage allowances for State of North Carolina employees for 1992; and current rental costs from the Regional Office of the Department of Environment, Health, and Natural Resources in Washington, N.C..

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:

The state will incur program management costs to administer and implement the cost share program. Start-up costs are estimated at $7,500 and yearly costs are estimated at $57,142.

Breakdown:

Start-up costs

2 computers, 1 laser printer and software including dbase programs	$ 6,000
office furniture	$ 1,500
TOTAL	**$ 7,500**

Yearly costs

1 full time manager:	$34,000/yr
1 perm. part time clerical at 30 hrs/wk	$15,000/yr
motor vehicle operation:	$ 4,000/yr
travel	$ 500/yr
office supplies	$ 500/yr
communications	$ 1,500/yr
office rent (200 sq. ft. * $8.21/sq.ft.)	$ 1,642/yr
TOTAL	**$57,142/yr**

Practice costs to government:

A. *Shrimp trawls:*

Estimated total cost per vessel depends on the number of trawls (nets) per vessel. The number of nets per vessel ranges from 2 to 6. Estimated total cost per net is $20 to $40. Costs would be limited to Panels, Florida Finfish Excluders (FEDs), funnels, and holes and flaps in the nets. In 1991, there were an estimated 1465 full time and 1000 part time licensed commercial vessels using shrimp trawls in the APES region.

Assumptions

1) Average number of nets/vessel is 4.
2) All 2,465 full and part time commercial vessels participate.

3) Cost per net is $30.

Estimated total costs per "average vessel"
Total cost per vessel is $120.
Total cost is $295,800.
At 75%, total cost to the state is $221,850.

B. Long haul seines:

From preliminary research, estimated total cost per rig is $150. In general, a vessel would have only one rig. Researchers estimate that there are between 20 and 25 active commercial long haul seine rigs now operating in the APES region (Phalen, 1992). Excluder panels would be the primary bycatch reduction device for long haul seines.

Assumption
25 commercial long haul seine rigs participate.

Estimated total costs per rig
Total cost per rig is $150.
Total cost is $3,750.
At 75%, total cost to the state is $2,813.

C. Pound nets:

Estimated total cost per net is $50. A vessel may have several pound nets. 1992 pound net permit records show that there are approximately 900 commercial pound nets in the APES area. An estimated 162 full time and 56 part time commercial vessels are currently using pound nets in the APES region. Bycatch reduction in pound nets would consist of adding small escape panels and webbing to the corners of the nets.

Assumption
All 218 full and part time commercial vessels participate with a total of 900 pound nets.

Estimated total costs per pound net
Total cost per pound net is $50.
Total cost is $45,000.
At 75%, total cost to the state is $33,750.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:

A. Shrimp trawls:
Estimated total cost per net is $20 to $40. At 25%, fishermen's estimated cost per net is $5 to $10.

B. Long haul seines:
Estimated total cost per rig is $150. Estimated number of rigs per vessel is 1. At 25%, fishermen's estimated cost per rig is $37.50.

C. Pound nets:
Estimated total cost per net is $50. A vessel may have from 3 to 24 nets. At 25%, fishermen's estimated cost per net is $12.50.

Practice benefits to affected private sector groups:
See Fisheries Plan Management Action under Objective B.

Social costs:
None as defined in this analysis.

Social benefits:
See Fisheries Plan Management Action under Objective B.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

NOAA Federal Ship Financing Fund and Liquidating Account
USFWS Sport Fish Restoration Fund
State appropriations

REFERENCES AND RELATED RESEARCH

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Street, M.W., Research Section Chief, North Carolina Division of Marine Fisheries, Morehead City, N.C.. Personal communications 11/12/92, 11/25/92, 12/15/92, 12/16/92.

TABLE 1

BFP COST SHARE PROGRAM
ESTIMATED COST TO THE STATE FOR ADMINISTRATION AND 75% OF PRACTICE COSTS

COST TYPE	START-UP COSTS	YEARLY COSTS	PRACTICE COSTS TO THE STATE FOR COST SHARE
Administrative	$7,500	$57,142	
Shrimp trawl			$221,850
Long haul seine			$ 2,813
Pound net			$ 33,750
TOTAL	**$7,500**	**$57,142**	**$258,413**

TABLE 2

BYCATCH REDUCTION RESEARCH
ESTIMATED YEARLY CHARTERING AND LEASING COSTS
TO BE FULLY FUNDED BY TIER 1 OF THE BFP COST SHARE PROGRAM

RESEARCH	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Shrimp Trawl: Vessel charter @ $500/day for 45 days	$22,500	$22,500	$22,500	$22,500
Long haul Seine: Vessel charter @ $500/day for 40 days	$20,000	$20,000	$20,000	$20,000
Pound Net: Net leasing	$10,000	$10,000	$10,000	
TOTALS	**$52,500**	**$52,500**	**$52,500**	**$42,500**

Chapter 7
ECONOMIC CHARACTERIZATION OF THE STEWARDSHIP PLAN

The Objectives and Management Actions of the Stewardship Plan are as follows:

OBJECTIVE A: ***"Promote local and regional planning that protects the environment and allows for economic growth."***

Management Action 1:

"Support local planning by providing funding and economic incentives to local governments to integrate environmental and economic planning by 1999."

Management Action 2:

"Provide to local governments affordable and accessible data from the state Geographic Information System for use in planning and public education within the region by 1996."

Management Action 3:

"Implement a comprehensive, coordinated and proactive approach to managing the state's public trust waters by 1996."

OBJECTIVE B: ***"Increase public understanding of environmental issues and citizen involvement in environmental policy making."***

Management Action 1:

"Develop an organizational framework that would foster public education and involvement in decision making on estuarine issues by 1995."

Management Action 2:

"Create innovative environmental education opportunities for adults, and for young people outside of school settings."

Management Action 3:

"Produce and distribute on a regular and widespread basis information on estuarine ecology and management issues, including cultural and economic aspects of these issues."

Management Action 4:

"Increase opportunities for citizens to communicate with members of environmental agencies and policy-making commissions."

Management Action 5:

"Enhance and heighten local public involvement in issues affecting the estuary."

Management Action 6:

"Expand involvement in the Citizen's Water Quality Monitoring Program (CWQMP) and make the program more interactive with regulatory agencies."

Management Action 7:

"Create a citizen ombudsman position within the Department of Environment, Health and Natural Resources (DEHNR)."

OBJECTIVE C: ***"Ensure that all students, particularly in grades K-5, are exposed to science and environmental education."***

Management Action 1:

"Support the development of a comprehensive environmental science and education curriculum."

Management Action 2:

"Provide for teachers at all levels ongoing opportunities to gain renewal credits in workshops on environmental and estuarine education."

The CCMP presents the three objectives listed above as the best means of achieving the overall goal of the Stewardship Plan, which is to "promote responsible stewardship of the natural resources of the Albemarle-Pamlico region." The fundamental strategy for achieving the local and regional planning objective (Objective A) is to augment existing regulations with a proactive, voluntary planning initiative. Specifically, the state would fund local plans that address the combined goals of economic growth and environmental protection. The state would provide six GIS-proficient planners who would give technical assistance in local economic and environmental planning. As an incentive, the state would give localities with approved environmental plans higher priority for construction funds from the State Revolving Fund, and would provide needed technical services, especially geographic information systems (GIS) services, equipment and data.

The strategy for achieving Objective B, public awareness and involvement efforts, is essentially to provide more information to the public through a variety of means, and to provide more opportunities for the public to contribute meaningfully to the decisionmaking

process and the management of regional natural resources. The overall strategy for achieving Objective C, science and environmental education for primary school students, is to enhance the linkages between the N.C. Department of Environmental, Health and Natural Resources and the N.C. Department of Public Instruction in the development of learning opportunities in these areas. This would occur in both curriculum development and through teacher training.

OBJECTIVE A: "Promote local and regional planning that protects the environment and allows for economic growth."

MANAGEMENT ACTION 1:
Support local planning by providing funding and economic incentives to local governments to integrate environmental and economic planning by 1999.

REVIEW AND GENERAL COMMENTS

This Management Action calls for the North Carolina state government to strongly promote integrated environmental and economic planning for all counties and municipalities within the North Carolina portion of the APES region. The State also would provide incentives for planning by local governments.

The main components of this Management Action are to:

- develop guidelines for integrated environmental/economic planning, plan implementation, and plan updates;

- fund local environmental and economic plans through grants made contingent on compliance with planning and implementation guidelines;

- establish a joint committee of both the Division of Coastal Management and the Division of Environmental Management that would review and approve plan proposals, plans and plan implementation;

- create an incentive structure in which local communities with approved plans would be given a higher priority for State Revolving Fund public water system construction money;

- approve local plans that include sections on land use, water supply and disposal, and the use of public trust areas; the guidelines would address needs for implementing other elements of the CCMP, such as vital habitats protection strategies, water quality strategies and fisheries protection strategies; the guidelines would also encourage cooperation among counties and between state, federal and local agencies;

- fund six planners, who would be proficient with geographic information systems (GIS), staff the joint planning committee, develop both planning and implementation guidelines, and work with local governments on environmental planning and intergovernmental coordination; and

- make Coastal Area Management Act (CAMA) counties and municipalities in North Carolina eligible for funding through this action for augmenting or implementing their existing CAMA plans.

In Virginia, funding would be channelled through an agency selected by the Commonwealth of Virginia. Costs in Virginia are not discussed here.

Finally, the plan calls for DCA to periodically inventory and assess local planning documents, "implementation strategies" (e.g., zoning, other ordinances, land use maps, etc.), and environmental plans. DCA would survey local governments and the public to gauge the effectiveness of the planning support they provide and to assess unmet needs for more/other services. DCA would also study each river basin in the APES region to assess impacts of population, development, land use, etc. on regional environmental quality and the effectiveness of local planning efforts in this regard.

While the form of the planning and implementation guidelines is unknown, any arrangement is likely to incur the following types of costs to governments:

- Setting of planning standards and guidelines for specific forms of development;
- Plan preparation;
- Costs of the state review and approval process to both state and local governments;
- Consistency reviews (of federal, state and local actions, as well as local ordinances); and
- Enforcement costs.

These costs are dependent on the final mechanisms selected for implementing this Management Action.

More important to this analysis, however, is the potential impact on local economies and the regional economy. The implementation of this plan would presumably entail controls on development through restrictions and guidelines for land and water use. These may not be absolute caps on development as much as restrictions and guidelines that would, nevertheless, be likely to raise the cost of development in certain areas. On the other hand, well-planned growth can help diffuse conflicts over land uses and raise both the general level of property values and the general quality of life (including but not limited to environmental quality). The net economic impact for a community, county or the region depends entirely on the form that growth management controls take.

Good planning can undoubtedly create net economic benefits for a local economy (both in terms of market values as well as in quality of life, including environmental quality) and can increase the values of property and resource-related activities for some individuals (improving amenity values, protecting open space, recreational opportunities, etc.). However, it can also create costs for certain segments of the population (reduced opportunities for development on certain tracts). These negative impacts may or may not be adequately mitigated by government compensation or other active measures. These positive and negative impacts are complex and would vary throughout the APES region from locale to locale. It is not feasible to discuss them here. The point here is that the questions of "private rights versus public interest" and "who should pay for environmental quality" must be addressed in any planning process that is established.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. All eligible counties would participate in the grant program.

2. All municipalities opt to be included in the county plans (i.e., none choose to do their own plans).

3. Costs of needed GIS and related technical assistance are assumed to be covered through the implementation of Management Action 2 under this Objective.

4. This Management Action entails no programs for permitting in designated "areas of environmental concern" or similar vital terrestrial areas and wetlands beyond that recommended in other Management Actions and Action Plans or that already required by law and existing state regulations.

5. Local in-kind funding would equal 20% of the amount of state funding.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The two cost items of this Management Action are the funding of the plans and the funding of the planners. The costs of guideline development, interagency coordination activities, the targeting strategy, the review and approval process, the integration of other elements of CCMP in the plans, the periodic surveys and evaluations of the overall planning program, any other costs resulting from this action are considered to be part of the costs of the planners, of the plan development process, or of existing activities within the agencies involved.

Six GIS-proficient regional planners in the NC Division of Community Assistance (DCA), at an average of $50,000 per person per year, would cost an estimated $300,000 per year, or $1.5 million over the five-year time period considered in this proposal.

Twenty North Carolina counties would need full funding for planning. Sixteen coastal North Carolina counties would need partial funding to augment existing CAMA plans. Local plans and implementation strategies would receive funding for 80% of the cost of developing plans. Plans are estimated to cost an average of $37,000; amendments to existing plans for coastal counties would cost an estimated $12,500. With twenty counties needing full plans and sixteen needing amendments to their CAMA plans, the estimate cost to the state would be:

($37,500 X 80%) X 20 = $600,000
\+ ($12,500 X 80%) X 16 = $160,000 = $760,000

Assuming that municipalities are covered under county plans, and that there all eligible counties choose to participate, the total estimated cost of completing all plans would be $760,000. Local governments would pay an estimated $190,000 to cover their 20% of the plan costs.

The total (five year) cost to state government for implementing this management action is $2,260,000 ($760,000 to fund N.C. plans, and $1,500,000 for planners).

Local governments would incur other costs apart from their share of plan development costs, including the following:

- Costs to local governments of plan approval process;

- Cost to local agencies of consistency reviews of proposed federal and state actions impacting environmental resources; federal, state and local agencies undertaking actions will be required to be consistent with local land and water use plans and water supply and disposal plans. The review of federal and state plans for such actions and the monitoring of the actions themselves will incur costs. Which governmental entity pays for these costs, or how these costs are divided among levels of governments, would depend on the final form of the planning process;

- Costs to local agencies for review and revision of local ordinances for consistency with plans; and

- Cost to local agencies of enforcement to ensure that actions taken by public and private entities are in compliance with plans.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups: (Kniesel, 1979):

- increase in costs of approving development plans, and other costs of compliance with the plans (e.g., mitigation);

- costs of participation in the process of developing the plan itself; and

- costs of delay in project development
  (most of these are not real losses to the economy, but transfers to landowners, subcontractors, financial institutions, etc.)
  - land holding costs
  - building cost inflation
  - overhead costs
  - foregone revenues.

Practice benefits to affected private sector groups:
Better predictability of future development patterns could be of benefit to developers.

Social costs:
To the extent that planning leads to restrictions on development opportunities that would present themselves otherwise, the regional economy would forego the value of this development and related secondary economic activity. A review of land use control programs over the last fifteen years suggests that such controls generally have the effect of raising the value of existing improved/developed land relative to similar and adjacent sites outside of regulated areas, and of reducing the relative value of vacant and agricultural land in those zones (Fischel, 1990; Beaton and Pollock, 1992[5]). A potentially important negative impact of this manifestation of land use controls is increased housing costs and decreased availability of low-cost housing (Downs, 1992). Concerns over the decrease in the value of vacant land (its "developability") and the increase in low-income housing costs are legitimate. But the net effects of proposals

[5]Beaton and Pollock actually found that vacant land in designated critical areas in Maryland were not affected relative to nearby vacant lands, but this was due to provisions in the law that gave local governments "growth allocation permits", extensive floating growth zones. This provision has allowed Maryland to postpone (not avoid) the market's internalization of restriction on development, along with accompanying equity issues.

in the CCMP must be measured in terms of their overall impact on development throughout the region, not just in areas or development types that may become more stringently regulated. The total level of development achievable in the region depends on the potential for development on non- or less-regulated areas and on the cost of changing development plan to meet standards.[6] (Kneisel, 1979; Batie and Shabman, 1982.)

Social benefits:

- reduction in externalities - conflicts between conflicting land uses maximizes the value within each use. Farms can produce negative externalities to residential areas, and vice-versa (Nelson, 1992); industry can have the same kind of mutually conflicting relationship with other uses. Land use planning can help avoid these kinds of conflicts, maximizing the total economic benefits of land. Actual results depend on effectiveness of the planning process in each locale;

- provision of public goods - parkland, public access to beaches and water bodies, including the provision/protection of environmental quality (discussed in the Introduction); specifically for local economies, improved planning of environmental resources could create amenities in certain areas (e.g., adjacent to areas designated for parkland or open space, along streams with improved water quality) that might raise property values and development potential on some sites. In general, planning for the protection of environmental resources could make a community more attractive to new businesses and residents;

- establishing, preserving and enhancing a diverse economic base - planning allows a county or municipality to diversify its economic base;

- preserving option value of land and other resources for use in the production of goods and services in the future; and

- assuming that certain resource uses and activities must be regulated or restricted in some manner, then local land use, water resources and water use planning could possibly be the least costly means of implementation and enforcement. Well-executed planning could save money compared to the costs of regulating and enforcing given environmental protection measures in the absence of planning. If the alternative to local planning is not an absence of any planning or regulation, but more direct

[6]Note that this ignores important questions about equity - specifically, individual landowners who own undeveloped parcels on which land use controls are imposed will see a decline in that parcels value, reflecting its lower "developability." Such landowners may feel that they are bearing an unreasonable cost for the provision of a public good, but this is more of a legal issue and is not typically included in an assessment of impact to the regional economy.

regulation by the state or federal government, then planning provides the additional benefit of allowing considerable flexibility and control at the local level.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL SUPPORT

State appropriations
NOAA Coastal Zone Management Act grants, sections 6217 and 306
USEPA Clean Water Act section 205 grant, State Development Fund, Near Coastal Waters grants
Local matching funds

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OBJECTIVE A
MANAGEMENT ACTION 2:
Provide to local governments affordable and accessible data from the state Geographic Information System for use in planning and public education within the region by 1996.

REVIEW AND GENERAL COMMENTS

This Management Action would significantly boost the capacity of the N.C. Center for Geographic Information and Analysis (CGIA) to provide geographic information system (GIS) data to local governments for use in their planning efforts. Specific elements of this Management Action are as follows:

- to fund the N.C. Center for Geographic Information and Analysis (CGIA) for the development and provision of access to the APES GIS database;
- for CGIA to develop and implement a reasonable pricing system for access and use of the CGIA database by 1995;
- for CGIA to establish three GIS work stations in the regional offices of the Department of Environment, Health and Natural Resources (DEHNR), by 1995, with the six planners described in the preceding Management Action providing technical assistance to local governments, including workshops and other forms of outreach and assistance;
- to educate the public on GIS technology with public displays and demonstrations of GIS systems at a pilot "education station" in an aquarium or other eco-tourism location within the region by 1995;
- to work to coordinate APES GIS data protocols;
- to evaluate the use of GIS by local government on a periodic basis;
- to oversee the process of updating GIS data; and
- develop and periodically update land cover maps statewide.

CGIA is not currently funded through the state budget, instead it recovers its costs from users of their facilities, expertise, and data. The CCMP recognizes that most local governments in the APES region would not have the means to purchase GIS data and technical assistance on their own, and so funds would be allocated for this purpose. Furthermore, this Management Action proposes to fund CGIA directly to develop facilities and services that would be useful regionwide or even statewide, such as the public education facility and the development of

data capability protocols and a land use/land cover classification system. A complete analysis of system requirements for a comprehensive APES GIS database management program can be found in N.C. Center for Geographic Information and Analysis (1990).

One problem with assessing the relative costs and benefits of this Management Action is that GIS activities are typically used for a range of public services, not only for environmental quality and natural resource management. GIS has been adopted by state and local governments for such activities as gas line, water line, road and other utility maintenance, police and fire protection, zoning activities (if used), and more efficient property tax assessment and collection. Thus, only a portion of the resources used to set up and operate a full-scale GIS at the local government level would correspond to land use planning, water resources, water use planning, and other natural resource management activities. Indeed, about half the counties and many cities in North Carolina have already begun to adopt GIS without any requirements for its use in natural resource management.

GIS is a tool for integrating, analyzing and presenting spatially referenced data (N.C. Center for Geographic Information and Analysis, 1990). GIS can dramatically reduce staff time spent on tedious tasks such as the drafting of maps and engineering drawings and dramatically increase the productivity of local government in certain areas (Curtis Hinton, City of Wilson Planning Department, pers. comm. 1993). Assuming that the data referred to in this Management Action are already required, the effect of the implementation of the Management Action would be to make the information more accessible and more easily used, analyzed and kept up-to-date.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:

APES staff, based on CGIA information, estimates that CGIA would require $250,000 per year to support general GIS activity of regionwide or statewide benefit. These actions would include the public education facility, provision of GIS workstations in DEHNR regional offices, some general work with the six planners discussed in the previous Management Action, database updates, land use/land cover classification system development, and administrative costs related to this Management Action.

APES also estimated that $200,000 per year would need to be appropriated to subsidize the GIS costs of local governments in the region via reimbursements to CGIA. This would include the provision of data, technical assistance, training and other services and products at affordable prices. Other costs incurred because of this Management Action are assumed to be absorbed within existing budgets allocations.

Local governments would not be required to implement GIS programs under this Management Action.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Charges for data, access fees, and other GIS services and outputs.

Practice benefits to affected private sector groups:
Access to publicly subsidized GIS could help improve strategic business and development planning, marketing, siting issues, etc. Also could lower costs of complying with regulations by lowering data gathering, storage, analysis and presentation costs.

Social costs:
None, as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
Enhancing the use of GIS at the local level in the APES region could result in some or all of the following benefits:

- allow agencies, businesses, landowners, and others to access and share up-to-date information, improving resource and land management;
- ease and improve efforts to monitor changes in the extent and quality of ecological resources;
- help agencies monitor and assess the nature and degree of threatening sources of disturbance or pollution;
- aid in the spatial analysis of ecosystem processes, disturbances, pollution and resource use patterns on a regional scale (e.g., for the study of cumulative effects of pollution); and
- to some extent, facilitate extension work, permitting, enforcement and monitoring activities of cooperating agencies in the field due to the availability

of high-quality, reliable maps and other geographically-referenced information (e.g., the locations of erodible soils, rare communities/species, permitted activities, etc. could be readily mapped, analyzed together, and used in the field).

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations to CGIA
USEPA State Development Fund, Near Coastal Waters grants Environmental Monitoring and Assessment Program
USGS (for technical assistance only)

REFERENCES AND RELATED RESEARCH

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OBJECTIVE A
MANAGEMENT ACTION 3:
Implement a comprehensive, coordinated and proactive approach to managing the state's public trust waters by 1996.

REVIEW AND GENERAL COMMENTS

The State of North Carolina has sovereign title to all navigable waters and the land beneath them, as well as to the animals living on/in them. These resources are known as public trust resources. This Management Action was developed in response to concerns that there will be increasing conflicts between users of the state's public trust resources. Boaters can conflict with fishermen, shellfish beds can impede marina or pier development as populations increase in some areas. The CCMP calls on state government to be more proactive in the management and planning of public trust uses, based on the concept that the state has the legal duty to manage these resources in the public good. Sound management and planning would balance the multiple uses of the public trust, and assure the protection of public trust areas in perpetuity.

This Management Action has the following components:

- the creation of an interagency committee composed of all state agencies with responsibilities for managing the public trust (the Departments of Administration, Justice and Environment, Health and Natural Resources (DEHNR); in DEHNR the Divisions of Environmental Management, Coastal Management, Marine Fisheries and the Wildlife Resources Commission would participate; other agencies would be consulted as well); the goal of the committee would be to seek a balance among uses and users of public trust resources;

- ensure coordination in the development of public trust policy; and

- evaluate the feasibility of a system for compensation for activities which make use of the public trust, e.g., fees for marinas and piers, or a recreational saltwater fishing license.

Funding being recommended in the CCMP would be directed specifically toward research of public trust issues and feasibility studies. Costs of participating in interagency activities (apart from the studies) incurred by state agencies would presumably be absorbed under existing budget authorities.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. There are no incremental costs of interagency activities in this Management Action; expenses would come from existing budgets.

2. No specific compensation scheme can be assessed here. The form of compensation for use of the public trust (if any is recommended) would be entirely contingent on the results of the feasibility studies. Fees are contemplated, but no indication is given regarding who would be charged, the level of charges, the intended use of proceeds, or any other guidance as to the nature of the charges.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
This Management Action would cost the state agencies involved an estimated additional $75,000 over the next two years for feasibility studies of compensation mechanisms for the private use of public trust resources. Note that Objective B, Management Action 7, of the Water Quality Plan calls for the development of a statewide comprehensive marina siting policy, which to some extent would either draw upon or serve as a foundation for the feasibility study discussed here. Other components of this Management Action would incur no incremental costs to government unless some compensation mechanism is established. If so, a fee system would incur additional administrative costs that would be determined by the complexity of the system. Such a fee system could be very simple and modest in scope, or complex and comprehensive; the fees themselves could be nominal, mainly serving to cover some administrative costs, or they could be relatively high, with the intent of discouraging behavior or raising revenues for other public trust management activities. Expenditures of interagency activities, such staff time devoted to interagency meetings or report writing, are assumed to come from existing budgets.

Practice costs to government:
None.

Revenues generated under this action:
None from the feasibility study phase of this action; future actions could result in revenues being generated by public trust user fees.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
No major impacts would result from the feasibility phase of this action. Significant impacts would result from any fees or restrictions on public trust use imposed as a result of these studies and subsequent policy changes in the legislature and administration. These impacts could include any reduction in value of land adjacent to public trust areas due to increased restrictions on level and types of development on the public trust area, as well as the costs of fees or leases for allowed development or use (the amount of any fees would have to be set by legislation; no amount is recommended in the CCMP).

Practice benefits to affected private sector groups:
None, as defined here (see preceding paragraph).

Social costs:
Fees or other forms of compensation that the interagency committee might recommend could have a significant economic impact on the most directly affected users. Specifically, the regional economy would forego the value of any development or economic activity that would take place if public trust laws and any lease/fee system are not promulgated and enforced. The magnitude of this impact is entirely dependent on the fees that could be proposed; they might be nominal or they might be large enough to significantly reduce profitability of private operations or inhibit new development in public trust areas. These impacts are unlikely to be large from a regional perspective but could be important locally if there is a strong likelihood of marina development, commercial oyster bed development, or other public trust use development and if there are only a limited number of alternative sites for this development.

Social benefits:
Balancing the economic cost of any fees or restrictions would be the fact that funds raised by compensation mechanisms could be reinvested by the state into improving public access to estuarine areas and other improvements in public trust management. Any compensation mechanism should be designed to assure that the economic and environmental benefits outweigh the expected economic costs. This would include taking into consideration the impact on local communities as well as on vital estuarine resources. For instance, a fee system could be used to minimize the impacts of new development on vital fisheries habitats that would be affected (see Objective B, Management Action 4, of the Vital Habitats Plan). Depending on the area and the nature of the rules instituted, the benefits of better public trust management include:

- reduced conflicts among users; this would be a benefit to each user group, but this benefit may be outweighed by reductions in activity allowed or afforded under new rules/fee systems;

- reduced threats to habitats could help commercial and recreational fishing; public trust compensation policies could be used to protect shellfish beds, in particular;

- improved quality of recreational experiences on public trust waters; and

- improved public trust resource protection could directly benefit commercial fishermen via protection of nursery areas, submerged vegetation and reduced sediment loadings.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations
NPS Land and Water Conservation Fund

REFERENCES AND RELATED RESEARCH

Bell, Frederick, and Vernon Leeworthy. 1987. "Economic Demand for Marinas and Projected Impact on Wetlands." Land Economics 63(1):79-91.

Epstein, Richard. 1988. "The Public Trust Doctrine" *in* James Gwartney and Richard Wagner, eds. Public Choice and Constitutional Economics [no volume number]:315-33.

Lawler, James, and William Parle. 1989. "Expansion of the Public Trust Doctrine in Environmental Law: An Examination of Judicial Policy Making by State Courts." Social Sciences Quarterly 70(1):134-48.

OBJECTIVE B: "Increase public understanding of environmental issues and citizen involvement in environmental policy making."

MANAGEMENT ACTION 1:
Develop an organizational framework that would foster public education and involvement in decision making on estuarine issues by 1995.

REVIEW AND GENERAL COMMENTS

Under this Management Action the state General Assembly would fund the Partnership for the Sounds, a non-profit organization devoted to unbiased public education on estuarine ecology and management issues. A primary goal of Partnership is the promotion of forms of ecotourism, a form of tourism focused on ecological resources as attractions to visitors. Ecotourism promoters usually stress nonconsumptive and educational uses of these resources, such as interpretive tours, birdwatching, etc. However, ecotourism is also often associated with other non-consumptive recreational uses like hiking, camping, and canoeing, and sometimes with consumptive activities such as fishing and hunting as long as they are conducted within the regenerative capacity of the ecosystem.

The General Assembly would also be asked to fund three major centers for environmental education/interpretive centers in the region, which in addition to the many state and federal parks and refuges in the areas would constitute the "infrastructure" of ecotourism. These three centers, the Walter Jones Center for the Sounds in Columbia, the Estuarine Education Center in Washington, and the Mattamuskeet pumping station restoration (used as a hunting lodge), have already received some support from local governments and federal agencies. Appropriations for the bulk of the estimated costs of $13 million dollars are being sought in state legislature and in the U.S. Congress. These costs are not included in this assessment since APES staff considers these to be funding efforts that are already underway.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

Funding efforts for the three estuarine centers are already underway. For this reason these costs are assumed to not be incremental to this proposal.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
A state budget has already passed which includes $846,000 for start-up of the Partnership for the Sounds. This is expected to pay for the first two years of

operations. It is likely that Partnership will seek expanded funding for future years from the legislature as well as from corporations, private foundations, and individuals. As a non-profit operation, is could be expected that incremental costs to government could feasibly be reduced to the extent that fundraising is successful. Government spending could include contributions to major capital projects (such as new exhibits or buildings), salaries, and in-kind provision of services such as printing and publishing operations, transportation, etc. The three educational centers discussed above will cost an expected $13 million. Since these fundraising activities are all underway, there are assumed to be no incremental costs to this Management Action.

Practice costs to government:
None; see assumptions.

Revenues generated under this action:
None. Any admission fees that might charged at the educational center would not go to government but directly into operating expenses.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
Students, tourists, and other visitors to educational facilities would benefit from the subsidization of operations by government and/or private foundations, individuals, corporations, etc.

Social costs:
No major negative impacts would be expected from Partnership or from the estuarine education facilities (not including the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues). Minor potential impacts include the development and disturbance necessary to construct facilities, possible disturbances caused by crowding tourists, and the fact that private donations to Partnership would be either drawn away from other donation recipients, or spent, saved or invested in some way in the general economy.

Social benefits:
Social benefits include a better informed public with respect to estuarine ecology and management issues, and some economic benefits from tourism generated by educational facilities and other "ecotourism" facilities. The beneficial effects of this tourism would mainly accrue to the communities and counties nearest the facility.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

A significant amount has already been pledged by local governments and private entities, as well as the National Fish & Wildlife Foundation. State appropriations are another likely source of funding.

REFERENCES AND RELATED RESEARCH

Flink, Chuck et al. 1991. The North Carolina Estuarine Resources Center; a Feasibility Study for Developing an Estuarine Education Center. Raleigh: APES Report 91-07.

OBJECTIVE B
MANAGEMENT ACTION 2:
Create innovative environmental education opportunities for adults, and for young people outside of school.

REVIEW AND GENERAL COMMENTS

Under this Management Action, the N.C. Department of Environment, Health and Natural Resources would hire a staff person for its Office of Environmental Education to expand work with community colleges, state parks and other educational centers to develop interactive learning experiences on estuarine ecology and issues, and to develop partnerships between government, industry and the public.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
One staff person in the Office of Environmental Education in DEHNR, at $50,000 per year.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None as defined here.

Social costs:
None as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
If successful, this action could yield important benefits in the form of a more efficient policy making process. This would occur because of better interaction among groups with disparate interests and perceptions about the health and status of estuarine and related natural resources, the needs for management, and the manner in which government should approach management, funding and regulations. Better

communication among these groups could lead to a better understanding of each others needs and interests, more trust among conflicting groups, and better chances for a consensus on policy issues.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

National Science Foundation - Informal Science Education Program.
State appropriations to DEHNR.

OBJECTIVE B
MANAGEMENT ACTION 3:
Produce and distribute on a regular and widespread basis information on estuarine ecology and management issues, including cultural and economic aspects of these issues.

REVIEW AND GENERAL COMMENTS

Under this Management Action, Partnership for the Sounds, the Office of Environmental Education, or a similar organization, would produce a newsletter with a circulation of approximately 16,000. An annual state of the estuary report is discussed, but the costs of this annual report are assumed to be covered under Objective B of the Implementation Plan. These costs are therefore not discussed here.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

The annual state of the estuary report is discussed in Objective B of the Implementation Plan. The costs of this report are discussed there.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Publication of a bi-monthly 4-page newsletter, including postage and mailing, costs $25,000 annually (67% of which is postage), not including writing staff.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None.

Social costs:
None as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues)

Social benefits:
This action could improve the information available to citizens regarding the state of the region's environment, resource use, environmental management, and other related issues. It is important that citizens have unbiased information regarding the state of

the estuary, management problems, user conflicts, etc. in order for them to make the best decisions regarding regulations, local land use plans, the pros and cons of proposed developments, or any other action with an impact on regional resources.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USDA Cooperative Extension Service
Private foundations

OBJECTIVE B
MANAGEMENT ACTION 4:
Increase opportunities for citizens to communicate with members of environmental agencies and policy-making commissions.

REVIEW AND GENERAL COMMENTS

Several suggestions for improving communications between government and the public are made in this action. Included are relatively simple ways that meetings could be improved or that news releases could be more effectively used. References are made to other components of the CCMP that would have the impact of improving communications between government and the public, including, for instance, agricultural and forestry extension programs discussed in the Water Quality and Vital Habitats Plans.

The principle incremental costs identified in this action are a toll-free ("800") telephone line in the Department of Environment, Health and Natural Resources (DEHNR), with recorded information on meetings, the use of display ads in newspapers to announce upcoming meetings, and more public meetings to encourage interaction between commercial and recreational fishermen.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

1. There will be no incremental costs of this action except for the toll-free telephone service, display ads, and more meetings for fishermen. Outreach efforts for forestry and agriculture are covered in the Water Quality and Vital Habitats Plans. Such actions as issuing press releases after meetings and the costs of updating phone recordings, etc. are assumed to only require a minor shifting of resources within existing budgets.

2. The actual amount is a matter of policy/budget decisions. The figures used here are considered to provide reasonable levels-of-efforts for meeting the goals of this action.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The cost of a toll-free phone service would be essentially the cost of the long distance service, which is dependent on usage. For this analysis it is estimated that instituting and operating an "800" number would cost approximately $5,000 year.

No estimates are given in the CCMP for the expected number of display ads or public meetings for fishermen. For this analysis $5,000 for display ads per year and $5,000 for more public meetings is assumed.

See Assumptions above regarding other actions discussed in the plan.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
Various interest groups would benefit from better access to information regarding the meetings and decisions of environmental agencies. Fishermen would especially benefit from more meetings aimed at confronting increasingly difficult conflicts between commercial and recreational fishermen.

Social costs:
None, as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
The potential benefits of this action include reduced conflicts between commercial and recreational fishermen and a public which is better involved in the policymaking process through better access/information on public meetings.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations to DEHNR

OBJECTIVE B
MANAGEMENT ACTION 5:
Enhance and heighten local public involvement in issues affecting the estuary.

REVIEW AND GENERAL COMMENTS

This Management Action calls on local governments to establish local Environmental Advisory Boards (EAB), composed of citizens with backgrounds in natural sciences, public health and resource management. Such EABs could focus on complex environmental issues, on what courses of action are available, on how those alternatives would affect various sectors of the community, and on strategies for implementing the best alternatives. EABs would not need to have any regulatory or policy making authority. They would however help guide the decisions of city or county councils since they would have more time to look in-depth at specific issues, to absorb background information and comments from the community, and to attempt to reach a consensus on the issues. These issues might include landfill and roadway siting, water supply and sewage discharge, land use planning and stormwater control. N.C. General Statutes already allow for the creation of local EABs.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

No assumptions are made regarding the form, activities or authority of EABs. These are purely decisions to be made at the local level. No specific costs can therefore be estimated.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
Unknown; the costs of an EAB to a local city or county would depend on the form, activities and decisions of the EAB in that community. A city or county may elect not to have an EAB, or to have a highly active EAB with considerable decision making authority. The costs to government would be negligible in the former case and possibly high in the latter case. No staff requirements would be expected in any case. The administration of EABs could pose some administrative costs in the form of meetings, meeting announcements, transcripts, and other expenses associated with public meetings.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None.

Social costs:
None as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues)

Social benefits:
EABs could benefit the community by fostering creative thinking, conflict resolution, and consensus on ways to deal with local environmental concerns. It would provide another avenue for citizens to provide input to important decisions regarding environmental issues as well as for citizens to become involved in the decision making process.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

Local government general funds (overhead, materials, etc.)

OBJECTIVE B
MANAGEMENT ACTION 6:
Expand involvement in the Citizen's Water Quality Monitoring Program (CWQMP) and make the program more interactive with regulatory agencies.

REVIEW AND GENERAL COMMENTS

This Management Action would secure long-term funding for the Citizen's Water Quality Monitoring Program (CWQMP). Current levels of funding would be increased to allow for an expanded number of sample sites and for more intensive monitoring in areas of particular concern. CWQMP would also work with state and federal agencies involved in water quality monitoring (e.g., the state Division of Environmental Management, the U.S. Geological Survey) to look at ways to better use CWQMP volunteers in water quality activities and to use volunteers for monitoring other resources such as habitat and wildlife.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

The costs of this action are limited by budget constraints. The figures used here indicate an estimate of a level-of-effort reasonable for accomplishing the goals of this action.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The CWQMP would require $70,000 a year for staff, equipment and housing/administration.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None, as defined here.

Social costs:
None, as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:

In addition to the benefits of water quality monitoring (see Costs and Economic Considerations in Management Action 6, Objective A of the Water Quality Section), this Management Action would have the additional benefit of providing opportunities for citizen involvement in the stewardship of the region's water resources. Such local participation would tend to buttress public understanding of water quality issues in general.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA Clean Water Act section 106 grants; NEEG for Water Quality training.

OBJECTIVE B
MANAGEMENT ACTION 7:
Create a citizen ombudsman position within the Department of Environment, Health and Natural Resources.

REVIEW AND GENERAL COMMENTS

This Management Action would establish a citizen ombudsman position in the Department of Environment, Health and Natural Resources. A citizens ombudsman would be an independent advocate for citizen concerns within the Department who would respond to citizen concerns about DEHNR's activities. The ombudsman would be appointed by the Governor. It is not clear how the ombudsman's impartiality or non-partisanship would be assured.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The cost of one staff position would be approximately $50,000 per year, including overhead and miscellaneous expenses.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None as defined here.

Social costs:
None as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
The benefit of having an ombudsman in DEHNR would be greater accountability of state employees to the public. The benefit of this action is contingent on the ombudsman's ability to be impartial and apolitical, and on his or her ability to work effectively with state employees and provide constructive assistance to them.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations (funding would have to be independent of DEHNR in order to avoid conflict of interest)

OBJECTIVE C: "Ensure that all students, particularly in grades K-5, are exposed to science and environmental education."

MANAGEMENT ACTION 1:
Assist DPI as necessary to develop a comprehensive environmental science and education school curriculum.

MANAGEMENT ACTION 2:
Provide for teachers at all levels ongoing opportunities to gain renewal credits in workshops on environmental and estuarine education.

REVIEW AND GENERAL COMMENTS

These Management Actions are considered here together since they would provide the same type of social benefits and are likely to be funded through the same mechanisms. Under Management Action 1 the state would fund one staff position in DEHNR's Office of Environmental Education (OEE) as a permanent liaison between DEHNR and the Department of Public Instruction (DPI), as a source of technical assistance and information on environmental education, and as a coordinator of environmental education workshops. Management Action 2 outlines the content and purpose of these workshops.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

There are no incremental costs of this action apart from the cost of hiring one staff person and the direct costs of the workshops. Other expenses incurred by this person are assumed to come from existing budgets.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
An additional staff position would cost $50,000 per year. An additional $10,000 per year would be required to pay for travel, materials and other direct expenses related to the workshops. Local school districts would bear the costs of time spent by teachers in in-service workshops, which would be run by the OEE/DPI liaison.

Practice costs to government:
None.

Revenues generated under this action:

None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None.

Social costs:
None as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
The benefits of these Management Actions would be to develop an better awareness of all sides of environmental issues among teachers and their students. In the long term, these students would eventually be in the position of influencing policy makers (or being policy makers themselves). Developing critical thinking skills and exposing students to the difficult problems faced in the management and wise use of natural resources can improve the ability of these future citizens to make decisions that best serve their interests.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

State appropriations to DEHNR; Department of Education - Eisenhower Program

Chapter 8
ECONOMIC CHARACTERIZATION OF THE IMPLEMENTATION PLAN

The Objectives and Management Actions of the Implementation Plan are as follows:

OBJECTIVE A: ***"Coordinate public agencies involved in resource management and environmental protection to implement the recommendations of the CCMP."***

Management Action 1:

"Reconvene the APES Management Conference to include a coordinating council and regional advisory committees by 1994."

Management Action 2:

"Coordinate implementation of the CCMP."

OBJECTIVE B: ***"Assess the progress and success of implementing CCMP recommendations."***

Management Action 1:

"Develop an annual 'progress review' to assess the success of implementation by the Management Conference and other involved organizations."

Management Action 2:

"Assess the health of the Albemarle-Pamlico Estuary and the success of implementation strategies in protecting the environment."

The stated goal of the Implementation Plan is to "implement the Comprehensive Conservation and Management Plan in a way that generates the greatest level of environmental quality while using the most cost-effective and equitable strategies." In essence, the Implementation Plan establishes an oversight mechanism for the CCMP implementation and for state-federal-local-private sector coordination in general. The Management Actions of this plan therefore have no direct impact on the environment. Their intended impact is instead to improve the efficiency of resource agencies and of the environmental decision making process in general. The funding requirements of the proposed Management Conference and the annual reporting and review functions is modest compared to the funding requirements of actual implementation in other plans. However, the role of this oversight function is potentially critical to assuring that the CCMP is both successfully implemented and actually effective in improving or protecting environmental quality in the region. This role would be to assure that resource and environmental management programs are as "cost effective" as possible

(that the benefits they provide are worth their cost) and that they are equitable (which means that when the rights of various groups are in conflict a fair balance is struck).

It is difficult to rely on an agency to assess its own program in these terms. If the Conference can retain its impartiality with respect to the different agencies involved, it could be a means of weighing the benefits and costs of all environmental programs in the region and determining if and how public resources can be shifted to maximize their "return" (measured in terms of environmental quality).

OBJECTIVE A: "Coordinate public agencies involved in resource management and environmental protection to implement the recommendations of the CCMP."

MANAGEMENT ACTION 1:
Reconvene the APES Management Conference to include coordinating council and regional advisory committees by 1994.

MANAGEMENT ACTION 2:
Coordinate implementation of the CCMP.

REVIEW AND GENERAL COMMENTS

The costs of reconvening the APES Management Conference are administrative in nature (cost of staff and meetings). The justification for this spending is that the APES Technical and Policy Committees have agreed that there is a need for coordination among existing programs at the regional level, and a need for more involvement of local governments and the public in this regional process.

Management Action 1 establishes the Management Conference and Management Action 2 sets out the activities of the Conference. These activities include:

- pursue a Memorandum of Agreement between North Carolina and Virginia for implementation of the CCMP's goals in the Virginia portion of the APES region;
- continue to pursue funding for CCMP implementation;
- pursue CCMP goals within constituent agencies and develop Memoranda of Agreement as necessary;
- review and revise management and research priorities;
- address topics of special concern to many of the participating agencies/governments;
- pursue expertise to consult on technical issues of special concern;
- conduct federal consistency reviews;
- brief the Legislative Environmental Review Commission on legislative matters;
- sponsor public education and involvement programs; and

- cross-train environmental compliance enforcement officers, permit review officials, etc. in the environmental enforcement/monitoring aspects of fields other than their own.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

All costs involved in this action are assumed to be absorbed or shifted within existing budgets of the participating agencies, a part of the costs of APES staff costs listed below or part of the costs of the cross-training workshops and possibly some other minor special projects.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
$300,000 per year for staff costs and for meetings, materials, etc. The estimated costs of the cross-training workshops and other minor special projects is $50,000 per year. The remaining costs of this action are assumed to come from existing budget authorizations.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs to affected private sector groups:
Non-governmental groups, individual and local governments would incur some costs of participating in the reconvened Management Conference (travel, materials, time spent on additional reading/preparation for meetings, etc.). These expenses may be highly significant to the individual or entity involved, but from the perspective of the regional economy this cost is negligible.

Practice benefits to affected private sector groups:
Non-governmental groups and individuals would benefit by the increased opportunity for participation and influence over regional resource management questions. There may be some benefit to those who do not directly participate, assuming that better management and a more open decisionmaking process results from this action.

Social costs:
None, as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
Potential gain in efficiency in the use of public funds for resource management. Benefits of improved public participation, awareness and appreciation for resources and resource management issues.

As an entity apart from its constituent agencies and other members, the Conference may be more apt to appraise environmental management in the region in a comprehensive way rather than program by program. It may be more willing to confront trade-offs among the objectives of different programs or resource user groups. It could also be more free to explore alternative management strategies that would involved multiple agencies, partnerships between state, federal and local programs, or cut across traditional categories of environmental management issues (for example, national wetlands policy, fisheries habitat and local land use planning). Finally, it would provide a forum in which new research findings, shifting public views, new legal precedents or challenges, etc. could be presented and discussed. Ultimately, the benefits of this action would be expressed in terms of greater success of the other individual management actions of the CCMP. See these as well as the general discussion of economic issues.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA National Estuarine Program
State appropriations
Foundation grants and other donations

REFERENCES AND RELATED RESEARCH

USEPA, Office of Water. 1993. National Estuary Program Guidance, Base Program Analysis. EPA 842-B-93-001. Washington, DC: U.S. Environmental Protection Agency.

OBJECTIVE B: "Assess the progress and success of implementing CCMP recommendations."

MANAGEMENT ACTION 1:
Develop an annual "progress review" to assess the success of implementation by the Management Conference and other involved organizations.

MANAGEMENT ACTION 2:
Assess the health of the Albemarle-Pamlico Estuary and the success of implementation strategies in protecting the environment.

REVIEW AND GENERAL COMMENTS

These Management Actions are reviewed together since it would be difficult to differentiate analysis, writing, publication, distribution and other costs between them without further elaboration on their content and expected distribution. They may even be produced as components of the same document in order to streamline some production costs.

Both assessment reports would essentially be progress reports written by the APES staff to the members of the Management Conference and other interested parties. Their content would presumably be based on other studies and monitoring analyses discussed in several other sections of the CCMP. Because much of the analysis and other materials involved are included as parts of other Management Actions, relatively small writing/editing costs are included in the cost estimate developed here.

ANALYSIS OF ECONOMIC COSTS AND BENEFITS

ASSUMPTIONS

The costs of the "state of the estuary" report discussed in Management Action 3 of Objective B in this plan is assumed to be covered here.

GOVERNMENTAL COSTS AND BENEFITS

Administrative costs to government:
The two annual reports would cost an estimated $20,000 per year for editing, graphics, printing and distribution.

Practice costs to government:
None.

Revenues generated under this action:
None.

PRIVATE COSTS AND BENEFITS

Practice costs and benefits to affected private sector groups:
None as defined here.

Social costs:
None as defined here (does not include the foregone benefits of alternative uses of the public funds spent on this use; see General Discussion of Economic Issues).

Social benefits:
The information provided in these reports could be expected to improve decisionmaking on estuarine issues as well as to broaden public awareness of estuarine ecosystems, their values, and issues in their management.

MOST LIKELY SOURCES OF FUNDING AND TECHNICAL ASSISTANCE

USEPA National Estuarine Program
State appropriations
Foundation grants and other donations

Chapter 9
RECOMMENDATIONS FOR FURTHER STUDY

Based on RAI's review of the CCMP's component Plans, the following data needs, studies, and pilot programs have been identified as being needed to maximize the benefits from the implementation of the CCMP. Taken together, their goals are to provide policymakers with the best possible information on the consequences of their choices, to help make the Management Actions as effective as possible, and, ultimately, to help prioritize the Management Actions.

1. On-Going Information and Data Needs

The on-going collection and analysis of data on resources (water quality, fish populations, fisheries harvests, wetland status and trends, etc.) is critical to the success of the CCMP. As a part of the process of measuring impacts, establishing goals and setting priorities, information regarding economic behavior will also need to be gathered and analyzed. Such information will include basic demographic and economic indicators (taken mainly from existing sources), information regarding resources and resource use, and data on people's preferences and values regarding resource use and protection. After new initiatives are established more detailed and focused information on costs and benefits should be gathered as a part of periodic policy, strategy and management reevaluations.

The following were identified by RAI as priority *on-going* information/data needs:

A. For commercial fishermen -
This information should include numbers of fishermen, their origin, demographics data and resource use information, including trip and seasonal data on catch and level of fishing effort.

B. For recreational fishermen -
This information should include numbers of fishermen, their origin, demographics data and resource use information, including trip and seasonal data on catch and level of fishing effort.

C. Information on requirements for permits related to environmental protection -
Information should include the number and type of permit application requirements placed on businesses, developers and landowners. Related data on permit violations, costs of compliance and costs of enforcement are also needed.

D. Tourism and recreational use information -
Data collection would be done using surveys of tourists and recreational users of the region's natural resources.

2. Impact Studies

These studies are needed in order to plan and implement several of the Management Actions in the CCMP. More detailed and quantitative knowledge of the potential economic impacts of the Management Actions is needed in order to recommend optimal levels of regulation, land acquisition, fisheries management, etc. Specifically, the following impact studies have been identified as priorities for further research:

A. Fiscal impacts of land acquisition on local communities.

B. Impacts of farm and forestry Best Management Practices and Fisheries Management Plans on commercial operations and local economies.

C. Identification of communities that would bear a disproportionate share of the costs of implementing the CCMP.

D. Impacts of not implementing the CCMP.
It was noted in the general discussion of economic issues that there are significant difficulties in defining the benefits and costs of the CCMP because it is unclear what could be expected to happen to resources and environmental protection programs in the absence of the CCMP. This study would clarify this baseline case, against which the various Management Actions of the CCMP could eventually be measured as they are further developed and implemented.

3. Policy Studies

This group of recommendations focuses on evaluating alternative strategies and policy tools that would be most effective in the implementation of the CCMP. Like the preceding recommendations, the results of these studies would feed into the cost effectiveness studies described in the last group of recommended studies.

A. Local resource protection policy development -
This study could take the form of a case study or case studies in which one or more of the Management Actions of the CCMP is implemented at the local level. Local decision makers would be assisted in developing local policy through a facilitated process with the "Alternatives-Consequences" framework of public policy education. Problem areas would be identified, and strategies for resolving problems and conflicts could be tested.

B. Analysis of the efficacy of taxes versus subsidies, incentives versus regulatory programs, and other policy instruments

4. Cost Effectiveness Studies and Pilot Implementation Programs

The general goal of these studies would be to provide guidelines to insure that the highest level of environmental protection is provided at the lowest possible cost, both in terms of public expenditure and of impacts to the economy. Such studies may also identify areas where environmental protection best complements or even enhances economic development opportunities, where these opportunities exist.

The studies recommended in the previous sections would form a foundation of data and methodologies on which full cost effectiveness studies and pilot programs could be built.

A. Best Management Practices for agricultural, forestry, and urban development -

Cost effectiveness studies of specific management options would include studying the costs of commercial operations, estimating the costs of Best Management Practices, and comparing costs with expected benefits they provide. These studies would involve detailed budgets, surveys of operations costs in each area, estimation models of the impacts of relevant management actions, and models of benefits generated.

B. Fisheries Management Plans -

Cost effectiveness studies should be performed as a part of the process of developing Fisheries Management Plans (FMPs). These studies would help those developing fisheries management plans to evaluate the efficiency of current and proposed techniques in protecting stocks from the effect of overfishing, and would help ensure that the socioeconomic effects of any proposed effort control schemes are considered before implementation. The effects of recommended effort control schemes on part-time commercial fishermen and those who are economically dependent on a variety of seasonal fisheries would be evaluated and plans would include ways in which these fishermen can be protected from any socioeconomic hardships.

C. License to sell fish taken from coastal waters and marine recreational fishing licenses -

Socio-economic analyses of a license to sell fish and a marine recreational fishing license could be performed in states similar to North Carolina that have had licenses in place long enough for data to reveal significant trends. These studies could reveal important impacts, such as the effect of the license to sell fish on fish prices and numbers of commercial fishermen, and the effects of a marine recreational fishing license on the number of recreational fishermen and federal funding.

D. Goal and priority setting at the local and regional level -

Goals and priorities set at the local level are likely to be different from those set at the regional level. One of the main purposes of the CCMP is to be a means of resolving diverse federal and state mandates with local and regional needs. The methods developed here could be applied to this task.

E. Methods for setting priorities across different resource types -

Studies A through C above essentially deal with measuring benefits that are easily compared. For instance, several approaches to reducing sediment loading in rivers could be compared on the basis of their cost per unit of sediment reduction or the cost of meeting certain standards. Fisheries management options could be compared based on their cost per unit of increase in fish populations. But water quality improvements can also help improve fisheries. Is a unit of spending on water quality improvements more effective than a unit of spending on fisheries management? It is difficult to weigh benefits across resource types or government program areas because the benefits and costs are often cross-linked and because it is hard to weigh different types of benefits (recreational fishing quality vs. wetlands services, rare species habitat vs. sediment load reductions).

These problems raise the issue of how to allocate public spending between resource management areas (forestry, soil conservation, fisheries management, water quality, natural heritage programs, land use planning, etc.) so that net benefits are maximized. Our economic characterization study has endeavored to show that these benefits and costs depend not only on resource information but on preferences and values of citizens at many different levels (the local, regional, state, and national levels). One approach to this problem might be to develop quantitative indices and models of the policy trade-offs that were identified in the Economic Characterization. These indices or models could be used to evaluate the relative benefits of programs for different resource types. The information generated regarding likely outcomes of various policy choices would be a tremendous aid to policymakers and citizens as Management Actions are further developed. The ultimate goal of this study would be to help prioritize the Management Actions of the CCMP.