This final report will be based upon the findings of the committee and will provide recommendations, and the technical basis for them, that will provide guidance for decision makers concerned with designing, funding, permitting, constructing and evaluating beach nourishment projects for erosion control, the creation of recreational beaches and shoreline stabilization. In addition, these recommendations are expected to assist in policy decisions concerning flood insurance and the placement of material from maintenance dredging projects. The report will be subject to intensive peer review and approvals from the National Academies and is expected to be disseminated in April of 1994.

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THE ECONOMIC ANALYSIS OF BEACH RESTORATIONS: THE STATE OF THE ART

by

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ABSTRACT

This paper provides an overview of the economic analysis of beach restorations. A review of the standard methodologies for determining the benefits from beach restorations shows them to define benefits very narrowly, and to have the characteristics of a compromise whereby benefits are deliberately under-estimated to appease opposition to restorations.

The methodology for determining storm damage prevention benefits fails to allow for development and redevelopment of properties and for benefits outside the project area, and under-estimates public infrastructure benefits. The methodology for determining recreation benefits devotes excessive resources to parking and access constraints, fails to allow for demographic and income effects in demand and to project increases in the value of beach visits after the restoration.

The best approach to developing the methodology for determining beach restoration benefits is through follow-up studies when political controversy has died down and an objective evaluation of the benefits is possible.

INTRODUCTION

This paper provides an overview of the economic analysis of beach restorations. In order to justify a project on economic grounds, an economic analysis must be conducted to demonstrate that the benefits from the restoration exceed the cost. The economic analysis will also determine the project which yields the greatest net economic benefits, subject to budget and other relevant constraints. Finally, the economic analysis of benefits may be apportioned among benefitting property owners, local businesses and local governments in order to develop a funding plan for the beach restoration (Fischer 1990, Regional Research Associates 1987, 1990a).

The paper concentrates on the measurement of economic benefits from restorations. Benefits include direct benefits which accrue to affected properties, such as storm damage prevention and recreational benefits, and indirect benefits which accrue to the community as a whole. There may also be disbenefits which reduce the quality of life for the local community, such as increased commercialization of the beach, increased traffic congestion and even increased crime.

A review of the standard methodologies for determining the benefits from beach restorations shows them to define benefits very narrowly, and to have the

characteristics of a compromise whereby benefits are deliberately under-estimated to appease opposition to restorations. The implicit assumption appears to be that if a project is economically justified with a narrow definition of benefits, the opposition will not attack the benefits methodology so that the restoration will not be delayed by endless wrangling over the appropriate methods for measuring benefits.

Opposition to beach restorations usually comes from two groups: environmentalists who dislike the interference in natural processes, and taxpayers who dislike the use of public funds on ineffective efforts to protect the value of private beachfront property owned by relatively affluent members of society. A significant coalition of these two groups usually is sufficient to defeat beach restorations in Florida[1]. A project facing significant opposition from just one of these two groups can usually be successful, if appropriate compromises are made[2].

Because the methodology for measuring economic benefits represents a political compromise, there has been no incentive to extend the narrow methodology prior to the construction of the project. As Federal and State funding for beach restoration becomes more difficult to obtain in the years ahead, the proper evaluation of benefits will become more important[3].

The best approach to developing the methodology for determining the benefits of beach restorations is through follow-up studies. After a project is completed, political controversy tends to die down and an objective evaluation of the benefits (and disbenefits) is possible. To date few follow-up studies have been undertaken (Regional Research Associates 1990b and Stronge 1992). These studies point out a number of directions in which the "state of the art" economic methodology needs to be broadened in order to produce more accurate measures of economic benefits.

STORM DAMAGE PREVENTION BENEFITS

A restored beach provides protection to upland properties by reducing the distance traveled inland by waves during storms. Typically, the shorter is the distance traveled inland by a storm, the lower is the resulting damage to upland properties.

The standard methodology calculates the difference between expected losses due to storm damage with and without the restoration. Storms of different probabilities are assumed to travel different distances inland from the mean high water line (MHW) destroying varying amounts of property. These potential losses are valued and weighted by their probabilities.

The benefit of a beach restoration is that many storms travel inland shorter distances so that there is a smaller expected loss. The extent of loss depends on the characteristics of the upland properties, including distance from MHW, elevation, pilings, whether revetted and so on (Regional Research Associates 1987, 1990a).

The narrowness of the "state of the art" methodology is seen in the following criticisms. First, undeveloped land is assumed to remain undeveloped so that storm damage prevention to un-built properties is not included in the analysis. This is indefensible on economic grounds, but it appeases project opponents who believe that public funds should not be used to stimulate development of undeveloped coastal properties on environmental grounds, or because such development might reduce public access.

Second, the state of the art methodology does not allow for redevelopment of upland properties. There are abundant examples of such redevelopment from beach restorations, even on relatively upscale upland properties on Captiva Island. A beach restoration raises the land value of upland properties and can alter the equilibrium ratio between structure values and land values in such a way as to lead to the replacement of existing structures with more valuable structures.

A third weakness of the current methodology is that it does not consider benefits to properties outside the

immediate project areas. The great advantage of placing sand on eroded beaches is that more sand is put into the "system". As "advance fill" erodes, and the newly restored beaches experience "end losses", sand may be released to neighboring properties and provide additional storm damage protection outside the project limits.

Finally, it appears public infrastructure benefits are poorly accounted for in the "state of the art" methodology. The usual approach to measuring these benefits is to use the cost savings from alternative methods of property protection. However, protection of critical public infrastructure (such as a hurricane evacuation route, or a road vital to the delivery of fire and emergency medical services) yields benefits beyond these cost savings. This is because properties dependent on critical public infrastructure are discounted from market values because of the risk of the loss of the infrastructure. Benefits to critical public infrastructure may need to be measured using willingness to pay techniques discussed in the next section, rather by cost savings techniques as in the standard methodology.

RECREATIONAL BENEFITS

A beach functions as a park or recreational facility so that one of the obvious benefits of a beach

restoration is the increased and enhanced beach experiences of recreational beach users.

The standard methodology determines recreational value based on an estimate of the number of beach visits times the value of a beach visit (Bell and Leeworthy 1990, Lindsay et al. 1992, Regional Research Associates 1990c, 1990d, Stronge 1991). The value of a beach visit is obtained from a survey of users or by the "travel cost method" which bases value on the cost of traveling to the site. The survey method is more accurate, but it is biased downward due to non-cooperation (Mitchell and Carson 1989).

The state of the art methodology spends enormous effort to project future demand subject to parking and access constraints. This allocation of effort to prevent over-estimation of recreational benefits reflects the need to appease critics of the project. Economic theory can make a case that if there is a large unsatisfied recreational demand and an under-utilized beach adjacent to that demand, human ingenuity will eventually solve the access and parking constraints.

An additional general comment is also in order in relation to recreational benefits. Federal government policy under the Reagan-Bush Administrations stressed the importance of storm damage prevention benefits, as opposed to recreational benefits. These Administrations

believed that the provision of recreational facilities should primarily be a task for the states and local governments, with the Federal interest being primarily in property protection.

Under these Administrations, it was not helpful to demonstrate large recreational benefits for proposed projects; it was far more helpful to demonstrate large storm damage prevention benefits. As a result of the lack of incentive for demonstrating recreational benefits, there was little advance in the methodology for estimating recreational benefits in the last decade.

The standard methodology for determining recreational benefits in many cases was based on very simple assumptions. For example, the projection of recreational demand often did not allow for changing demographics and incomes. Additionally, the value of beach visit is usually assumed to be the same after the restoration as it was before although data indicate that beach visits are more valuable on restored beaches (Regional Research Associates 1992).

Finally, there is a need to allow for "options" to use beach as well as use itself. Many individuals would be willing to pay to have the beach available as an option, even if their own use is relatively rare (Edwards 1987).

INTEREST RATES

An interest rate is needed for the economic analysis of beach restorations because the benefits and costs of a beach restoration occur at different points in time over the life of the project. The "state of the art" methodology discounts future benefits and costs to present worth and amortizes them into equivalent annual figures over the life of the project.

In essence, the methodology assumes that a mortgage loan is taken out at the beginning of the project to cover the initial restoration and succeeding renourishments, and that annual recreation "revenues" (benefits) are used to make the payments on the loan.

The curious feature of the methodology is the "official" interest rate used by the Corps of Engineers. The methodology requires the use of a "real" interest rate (published interest rate less a projection of the average annual rate of inflation over the course of the project)[4].

For example, an obvious interest rate would be the government long term borrowing rate, currently 7 percent, less a historic average of annual inflation rates of 4 percent. The resulting real interest rate would be about 3 percent.

The higher is the interest rate, the more difficult it is to justify a project, because beach restorations

have large first (immediate) costs and delayed benefits. The higher is the interest rate the lower is the present worth of the delayed benefits, and so the ratio of benefits to costs is reduced.

As a result, the size of the interest rate is a subject for political compromise. The compromise is to use an interest rate considerably higher than 3 percent and, in fact, the actual level (around 8 percent) is set on the basis of a nominal interest rate.

One justification for the use of such a high interest rate is to argue that since government borrowing costs are lower than private borrowing costs, the use of the government borrowing rates will bias investment in the economy away from private sector investments towards government investments.

An alternative is to use the long term borrowing rates of taxpayers less expected inflation. A home equity mortgage is an obvious taxpayer borrowing rate. Such a rate of 12 percent less anticipated inflation of 4 percent would yield the 8 percent used by the Corps.

OTHER BENEFITS AND DISBENEFITS

A number of other benefits could be included in addition to storm damage prevention and recreation benefits. There are also some disbenefits that would need to be factored into the analysis.

One additional benefit is beautification brought about by a beach restoration. This is difficult to measure ex ante, although it will be partly accounted for if the recreational value of a beach visit is projected to rise as a result of the restoration. A comparison of pre-project and post-project "option" values will also provide data on this effect.

A second benefit of a beach restoration may be the impact on the economy of the local community. This type of benefit cannot be directly added to the direct benefits of the project, but estimates of this benefit provide justification for the use of public funds for beach restorations.

There are, of course, some negative externalities associated with beach restorations. These may include increased commercialization of the beach area and local community, increased traffic congestion, crime and environmental damage. To deal with these problems it may be necessary to view a beach restoration as part of a packet of projects designed to restore the beach but minimize the adverse consequences for the local community.

CONCLUSION

A review of the state of the art methodologies for determining the benefits from beach restorations shows

them to define benefits very narrowly, and to have the characteristics of a compromise whereby benefits are deliberately under-estimated to appease opposition to restorations.

Because the methodology for measuring economic benefits represents a political compromise, there has been no incentive to extend the narrow methodology prior to the construction of the project. As Federal and State funding for beach restoration becomes more difficult to obtain in the years ahead, the proper evaluation of benefits will become more important.

The best approach to developing the methodology for determining the benefits of beach restorations is through follow-up studies. After a project is completed, political controversy tends to die down and an objective evaluation of the benefits (and disbenefits) is possible.

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ENDNOTES

1. The Vero Beach project was defeated by such a coalition in 1990.

2. The successful Boca Raton project was strongly opposed by environmentalists but had little opposition from taxpayers because the local share of the cost was spread over a very large local tax base. The successful Captiva Island beach restoration was strongly opposed by taxpayers but had little opposition from environmentalists because it was preceded by the South Seas project which had limited negative environmental impacts.

3. Federal funding of beach restorations primarily benefits the east coast of the country. As federal spending is cut there is a view that spending programs that benefit only certain regions of the country including beach restoration funding in the East and supplying water to the West should be eliminated in favor of programs that benefit many regions of the country. See the article by Howard Gleckman in Business Week, March 8, 1993.

4. See the discussion on interest rates in Dixon and Meister 1986.