



EDITORIAL

The Fox Guarding the Hen House

Orrin H. Pilkey

Department of Geology
Duke University
Durham, NC 27708

To date more than 200 beaches in the U.S. have been replenished on coasts in a wide variety of oceanographic settings. A careful review of that experience should provide a sound basis for improvement of beach design parameters.

A recent report by the U.S. Army Corps of Engineers provides such a review of the federal experience with replenished beaches. Unfortunately, the document presents a defense of the agency's actions rather than an objective analysis of them. The report can not provide a basis for objective examination of beach design.

In 1992 the Office of Management and Budget (OMB) requested that the Corps of Engineers report on their record of success in predicting the costs and sand volumes required for replenished beaches. The OMB request was in response to the public debate concerning our findings (For example, PILKEY and DIXON, 1989; LEONARD *et al.*, 1990; HOUSTON, 1990, 1991a,b; PILKEY and LEONARD, 1990; PILKEY, 1991, 1992) that the Corps has consistently underestimated the costs and required sand volumes for replenished beaches, with a few exceptions in South Florida. The result of the Corps' self examination, published in 1994, is IWR Report 94 PS-1 entitled "Shoreline Protection and Beach Erosion Control Study—Phase I: Cost Comparison of Shoreline Protection Projects of the US Army Corps of Engineers." It is available from The U.S. Army Corps of Engineers, Water Resources Support Center, Casey Building, 7701 Telegraph Road, Alexandria, VA 22310-3868. This 119 page report is sandwiched between striking purple covers and is hereafter referred to as the purple report. Aspects of the report were also

summarized by HOUSTON (1995) and SUDAR *et al.* (1995).

Using data from more than 100 replenished beaches, all Corps of Engineer projects, the purple report concludes that Corps cost performance has been excellent: "Considering the program as a whole, the actual and estimated costs for those projects . . . are \$1,340,900,000 and \$1,403,000,000 respectively." Similar success is claimed for the Corps sand volume predictions ". . . there has been an actual placement of 72.5 m cu yds of sand fill compared to an estimated 64.7 m cu yds." "For both volumes and costs the actual and predicted totals fall within 5% of one another." "Costs and volume estimates have been quite good in the aggregate" according to HOUSTON (1995).

I don't dispute these numbers but they are misleading. I disagree with the interpretation that the report demonstrates that the Corps knows how to successfully estimate replenished beach lifespans. Perhaps the most fundamental problem is that the OMB, an agency that impacts on the budgets of other agencies, has asked an agency to evaluate its own success. The truth is best served by an independent review.

The Corps' review of the national beach replenishment experience and their assertion of successful beach behavior prediction has other problems.

Problem #1. Was a beach always present throughout the duration of the project? The purple report fails to take into account whether or not the beach was maintained between nourishments. PILKEY (1988) summarizes published reports on the success of East Coast replenished

beaches. In many cases, replenished beaches are substantially gone before the time has come for the next nourishment. If between scheduled nourishments, a beach has disappeared or if a significant number of erosion hot spots has resulted in total beach loss in front of previously recognized critically eroding shoreline reaches, the beach is not a success. Shoreline retreat was not halted, a recreational beach was not maintained and buildings were not protected. In this situation, simple comparison of cost and sand volumes predictions is not a measure of the agency's success.

For example, the Corps notes correctly that the 1976 to 1987 Tybee Beach, Georgia, project was under budget in terms of both dollars and sand volume but fails to note that the beach disappeared within a year along the critically eroding north and south ends of the island. For 10 years (between 1977 and 1987) Tybee Beach had no beach where it needed one or when it needed one had a hurricane occurred. The Corps assertion, in the purple report, of being under budget at Tybee Beach is meaningless!

Problem #2. What was used as the "original" estimate to be compared with the actual experience? During the long process of justification, planning and design before a project is emplaced, a number of sand volume and dollar estimates are made. The Northern New Jersey project has at least tripled in cost since the first estimate. What should count is the estimate that the Corps used as a basis for determining the economic viability of the project (the benefit/cost ratio). This is the estimate of cost used to determine the feasibility of other management alternatives such as the retreat option or the do-nothing option. These are the estimates of societal importance but the report does not document which estimates are used. The lack of documentation in the purple report makes it impossible to directly compare our actual/estimated ratios with theirs. Clearly, however, the Corps' view is more optimistic than ours. According to PILKEY and DIXON (1989), the actual/estimated cost ratio (inflation corrected in all cases) at one point for the Wrightsville Beach and Carolina Beach, North Carolina, projects are 6.53 and 13.12 respectively. The same ratios in the purple book are 1.10 and 0.87.

Problem #3. The importance of U.S. beach replenishment. The purple report notes that only 0.3% of our shoreline has been replenished. In determining this number the Corps uses the total mileage (84,000 plus) of all U.S. shorelines in-

cluding bays, estuaries, the Great Lakes and Alaska! But replenishment is primarily an open ocean or lake phenomenon. Including vast areas of estuarine, rocky and undeveloped shoreline downplays the importance of beach replenishment in application and in ultimate cost. A more realistic value would be the percent of the total length of developed open ocean shoreline fronted by pre-existing sandy beaches that has been replenished. All major coastal resort communities on the U.S. east coast are replenished or soon will be. Fully 50% of the developed open ocean shoreline mileage along the East Coast of Florida, south of Cape Canaveral, is replenished or is about to be. Sound coastal management in the future requires an accurate understanding of the role that beach replenishment is playing.

Problem #4. Part of the analysis in the purple report involves comparison of the actual and estimated costs and sand volumes for the *initial* replenishment. Such comparisons, concerned with the first time sand is pumped on a beach, have little bearing on the Corps design success or predictive capabilities. Not surprisingly, the purple report finds that the agency has been quite successful in predicting how much sand would be pumped in the initial effort. How could they miss?

The drumbeat continues. Beaches continue to be emplaced using non-probabilistic design methods which would only work if we knew the schedule and intensity of storms for the next few decades. Since this will obviously not happen, such a design approach can't possibly work. Costs and sand volumes for the latest new projects on the East Coast have been very poor. Ocean City, Maryland, has already emplaced (in three years) about one-third of the volume of sand predicted to be needed over the next fifty years. The initial 1993 nourishment project at Folly Beach, South Carolina, was predicted to have a nourishment interval of 8 years. Sand loss has been very rapid and based on our own observations, the nourishment interval stage was achieved in less than one year. New projects on the drawing board have predicted cost and sand volume requirements which are highly unlikely. Predicted nourishment intervals of ten years for Myrtle Beach, South Carolina and North Myrtle Beach and a prediction of six years for the Northern New Jersey project are at considerable odds with experience on nearby earlier replenished beaches (*e.g.*, Folly Beach, South Carolina and Sandy Hook, New Jersey).

The shortcomings in the purple report highlight what is needed in the American approach to beach replenishment.

- (1) Monitoring of all beach replenishment projects.
- (2) Consistent reporting of economic, environmental and engineering aspects of replenishment projects. Currently it is nearly impossible to do more than a cursory analysis of the national replenishment experience which has limited value for evaluation of design principles.
- (3) Measures of replenished beach success that are not simply internal accounting. Success measures must consider community views of the situation.
- (4) Recognition of the random occurrence of storms which would lead to probabilistic estimates of beach durability.
- (5) Recognition that foxes should not be recruited to guard hen houses. A government agency should not be requested to evaluate the success of its own activities. The purple report should be done again, this time by an independent panel of scientists and engineers.

LITERATURE CITED

- HOUSTON, J.R., 1990. Discussion of Pilkey, O.H. and Leonard *et al.* 1990. *Journal of Coastal Research*, 6, 1023-1036.
- HOUSTON, J.R., 1991a. Beachfill performance. *Shore and Beach*, 59(1), 15-24.
- HOUSTON, J.R., 1991b. Rejoinder to discussion of Pilkey and Leonard (1990). *Journal of Coastal Research*, 7, 565-577.
- HOUSTON, J.R., 1995. Beach replenishment. *Shore and Beach*, 63(1), 21-24.
- LEONARD, L.; DIXON, K., and PILKEY, O.H., 1990. A comparison of beach replenishment on the U.S. Atlantic, Pacific and Gulf coasts. *Journal of Coastal Research*, Special Issue No. 6, pp. 127-140.
- PILKEY, O.H. and DIXON, K., 1989. Testimony of Orrin H. Pilkey Jr. before the Environment, Energy and Natural Resources Subcommittee of the House Committee on Government Operations, April 28, 1989.
- PILKEY, O.H., 1988. A thumbnail method for beach communities: Estimation of long term beach replenishment requirements. *Shore and Beach*, 56, 23-32.
- PILKEY, O.H. and LEONARD, L.A. 1990. Reply to Houston (1990). *Journal of Coastal Research*, 6, 1047-1057.
- PILKEY, O.H., 1991. Reply to Houston (1991). *Journal of Coastal Research*, 7(3), 879-894.
- PILKEY, O.H., 1992. Another view of beach fill performance. *Shore and Beach*, 60, 20-25.
- SUDAR, R.A.; POPE, J.; HILLYER, T., and CRUM, J., 1995. Shore protection projects of the U.S. Army Corps of Engineers. *Shore and Beach*, 63(2), 3-16.