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Foreword

The goals of this book on beach nourishment are to be reasonably comprehensive and to find application in the designer's office, in the classroom, to be readable by and of general interest to the layperson and to provide a starting point for researchers. As a formal technology, beach nourishment is fairly young having only achieved solid physical underpinnings and predictive capabilities in the last decade or so. Although our capabilities to design projects effectively has improved substantially, most projects still perform in some detail different than or to a degree which was not anticipated in the design phase. Thus, beach nourishment continues to offer many fascinating research challenges. These projects can be considered as large scale perturbations to the natural nearshore system which the natural forces commence to modify in both the cross-shore and longshore directions. The nourishment sand is usually not of the same size characteristics as the native and will approach a profile that is unique to its gradation. The time scales of this cross-shore equilibration and evolution of the planform perturbation are of considerable importance to the designer and the sponsor in assessing the economic viability of the project. Although the economic viability of a beach nourishment project depends to a substantial degree on the value of the upland property being protected, a project requiring renourishment at two year intervals will probably not be economically justified whereas if the renourishment interval is five to seven years, the project will be judged a success.

The benefits of beach nourishment can include storm damage reduction, recreation and environmental enhancement. A wide beach serves as both an effective energy absorber during periods of elevated water levels and storm waves and also provides a reservoir of sand which can be transported and

deposited offshore as a bar on which the larger waves break thereby further reducing the wave energy which reaches the shore. As will be seen later, the reductions in wave height and wave forces due to relatively small additional beach widths are surprisingly large! Tourists are attracted to beaches and a wide recreational beach can result in a significant increase in tourist related income to resort areas. Many beaches considered for nourishment have been stabilized by hard structures: seawalls and/or revetments, possibly in combination with groins leaving little sea turtle nesting habitat. Most nourishment projects constructed in areas where turtle nesting occurs require fairly comprehensive monitoring and possible nest relocation programs. In general, where the project provides a wide berm where there was previously little nesting habitat, nesting density has increased markedly. In areas where suitable habitat existed prior to the project, the monitoring results indicate that the turtles are affected negatively to a relatively minor degree during the first year following project construction and in subsequent years the nesting density may increase slightly above or be indistinguishable from pre-project conditions.

A relevant comment regarding beach nourishment is that much misinformation has been disseminated regarding the effectiveness of this shore protection method. The statement that "the project will wash away with the first good storm" has been frequently expressed. Beach nourishment has now been performed and monitored in the United States on several significant projects for up to nearly thirty years. Analysis of these data suggests a far different assessment of project performance and provides a basis for evaluating and improving design methodology. The test of the efficacy of a methodology (beach nourishment in this case) is reflected in whether its use is continued over the years. By this measure, beach nourishment has been quite effective as it is being applied as a method for shore protection and stabilization on an increasing and continuing basis.

Prior to nourishment, shorelines are in quasi-equilibrium with the waves and offshore bathymetry. Offshore borrow pits from which sand is removed for nourishment can represent substantial perturbations to the nearshore bathymetry, lowering the profile by one to 6 meters over plan areas of one or more square kilometers. Through wave modification, this depth perturbation has the potential to cause a modified equilibrium planform with shoreline recession in some areas and advancement in others. These borrow

pits are one of many possible causes of localized erosional zones, termed “erosional hot spots” which are of considerable concern in design.

The actual (documented through monitoring) performance of a beach nourishment project vis a vis its predicted performance is of interest to individuals ranging from laypersons to the design engineer to the public official who promoted (or resisted!) the expenditure of funds to construct the project. Thus, considerable effort is devoted in later chapters to first develop predictive techniques and later to evaluate these by comparison with monitoring results. Predictions can be carried out with relatively simple models which is the primary focus of this book or with very detailed numerical models. It will be shown that our capability to predict the performance of beach nourishment projects with the simple models is almost as good, or in some cases better, than the more complex models. It is anticipated that predictions conducted with the more complex models will improve considerably over the coming decades. In general, predictability is much better for the overall performance of the project than, for example, the performance at a particular location within or adjacent to the project. Finally, predictability depends significantly on the setting of the project and on the “match” between the native and nourishment sediments. Projects nourished with compatible sediments on a long straight shoreline are relatively insensitive to wave direction and the planform centroid remains nearly fixed. It can be demonstrated that the planform centroid of a project migrates if the project is located near a littoral barrier and/or if the project is constructed in the presence of oblique waves with sediment characteristics that are different than the native.

A note on the organization of this book is appropriate. An attempt has been made to use the appendices as repositories for the technical details which may be valuable to students and researchers but would be of little interest (or even discouraging) to designers and laypersons. Thus in many cases, the phenomena and results which are applicable to understanding and design are presented in the main body of the text and the development which may be required for detailed understanding or of research interest are the subjects of individual appendices.

There are several good references and sources containing valuable background and detail relating to beach nourishment. The National Research

Council (NRC, 1995) report on “*Beach Nourishment and Protection*” provides a comprehensive evaluation of the methodology and constraints as of 1995. The volume “*Beach Nourishment: Engineering and Management Considerations*” edited by Stauble and Kraus (1993) includes a number of relevant papers. The report “*Manual on Artificial Beach Nourishment*” published by the Delft Hydraulics Laboratory of the Netherlands (1987) also provides a comprehensive assessment at that time. The proceedings of the “*Beach Technology Conferences*” published by the Florida Shore and Beach Preservation Association contain a large number of case studies of beach nourishment projects. Some articles in *Shore and Beach* also provide nontechnical discussions and case studies of particular value to the layperson. Finally the proceedings of the biennial International Conferences on Coastal Engineering contain a broad range of nourishment papers with descriptions of international case studies.

Beach nourishment literature includes both the metric (International) and customary English systems of units. Because the student and practitioner of beach nourishment will encounter both systems of units, this book will utilize both systems in the case studies and examples presented. Table F.1, below provides several useful conversion factors.

Table F.1. Useful conversion factors between metric and Customary English Units found in beach nourishment literature.

To convert	From	To	Multiply by
Distance	m	ft	3.28
Distance	ft	m	0.305
Distance	km	miles	0.621
Distance	miles	km	1.610
Volume	m ³	cubic yards = yd ³	1.307
Volume	cubic yards = yd ³	m ³	0.765
Volume density	m ³ /m	yd ³ /ft	0.398 (≈ 0.40)
Volume density	yd ³ /ft	m ³ /m	2.51 (≈ 2.50)
Longshore diffusivity, <i>G</i>	m ² /sec (= m ² /s)	ft ² /s	10.75
Longshore diffusivity, <i>G</i>	ft ² /s	m ² /s	0.093
Longshore diffusivity, <i>G</i>	m ² /s	km ² /year	31.54
Longshore diffusivity, <i>G</i>	ft ² /s	mile ² /year	1.13

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The two agencies owed the greatest debt are the State of Florida Beaches Program within the Department of Environmental Protection and the U.S. Department of Commerce's Sea Grant Program, both of which have provided sustained funding over several decades which allowed pursuit of either specific related research topics or documentation of the performance of particular projects. Those individuals who have contributed to motivation and stimulating discussions cannot all be acknowledged properly here; however, I will mention a few. M. P. O'Brien (deceased) is remembered as a great inspiration due to his curiosity, interpretative capabilities and stimulating discussions. Professor Bob Wiegel has encouraged the collection of large scale field data and emphasized its significance. Tony Dalrymple has always provided encouragement and interesting discussions on topics ranging from waves to sediment transport. His physical insight and facility with mathematics enable him to contribute in unique ways. Bob Dolan was instrumental in the arrangement of a five year field study opportunity on

the large scale Perdido Key, FL project. Tom Campbell, an active supporter and practitioner of beach nourishment technology, has provided observations, interpretation and insight relating to project performance and evolution that have been invaluable. Finally, to the many students who participated in the field and laboratory studies of beach nourishment, my heartfelt “thanks” for your support and contributions!

Robert G. Dean
December 30, 2001

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