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Ecological effects of waste water

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with Hydrographic Characteristics by

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To my wife, Karen, whose positive, steady, and generous support is a critical ingredient in all my endeavors, including this one - and to the late Helen Burton, my dear aunt, who was so fond of the printed page.

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PREFACE

The study of applied ecological concepts in relation to the impact of man's wastes on aquatic environments should be an integral part of any environmental engineering curriculum. A general understanding of such concepts is necessary not only for biologists, but also for engineers, chemists, and other nonbiologists, because planning and implementation for water-quality control requires knowledge of the complete process, from problem identification and an understanding of the cause(s) to an analysis of alternatives. For example, one should recognize the quality level of an environment, the degree to which that quality departs from a natural level, the relative effect of any waste(s), and the degree and rate of improvement if wastes are reduced.

Water-pollution control has gone through an interesting evolution - from one of benign neglect to the institution of minimum controls when the cause and level of severity could be demonstrated by the plaintiff and finally to a hard-line emphasis on polluters rather than the water. With the water-pollution act of 1972 and common-law cases such as the State of Illinois versus the City of Milwaukee for contamination and eutrophication of Lake Michigan, it may seem to some that an accurate analysis of ecological cause and effect is becoming unnecessary. Actually, however, it is becoming more and more necessary and is compounded by the need to be able to predict the impact resulting from changes in waste input. The original problem was to demonstrate the amount of damage; now the question is more sophisticated: How much improvement will occur and how soon?

The course upon which this text is based, which is offered by environmental engineering conjoined with fisheries at the University of

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Washington, has been very successful in drawing seniors and graduate students from biological as well as nonbiological curricula. By emphasizing the synecological approach to practical pollution problems, via a rather thorough analysis of several water-quality variables, the text challenges biologists and nonbiologists alike. Other texts on water-pollution biology have inadequately discussed plankton and periphyton and the causes and control of eutrophication. Plankton is emphasized in this text, but the other more normal components, such as benthos and fish, are also included. The value of this text is breadth, appealing to biological and nonbiological students alike, with its greatest appeal directed to interdisciplinary programs.

Aquatic ecology is a rapidly advancing field and many of the concepts covered in this text are as yet not completely understood. The student and professional reader should not consider any writings in this field, including this one, as the last word, but only as a point of departure for further learning. In this view it is my hope that the student's appetite is whetted for more knowledge of aquatic ecology and the effects of wastes, which in the long run should lead to better environmental protection.

I am indebted to many who have assisted in countless ways in the development of this text; to my colleagues and students, too numerous to mention individually, who have contributed data and ideas, to my friends and colleagues R. C. Averett and I. and G. Ahlgren who reviewed the manuscript, and especially to T. Lindell, who contributed the chapter on hydrographics, and to R. E. Nece, who reviewed it.

E.B.W.