FIRST IMPRESSIONS

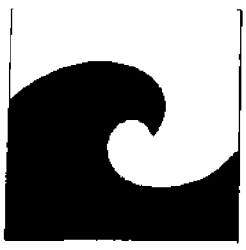
A Sea Grant
First Impressions
Report, July, 1986

CONSTRUCTION TECHNIQUES, ENVIRONMENTAL IMPACTS AND LAWS/REGULATIONS FOR RECREATION DEVELOPMENT ON THE GREAT LAKES: AN ANNOTATED BIBLIOGRAPHY AND DISCUSSION OF CRITICAL NEEDS IN NEW YORK

Kathleen A. Poulin and James M. Haynes, Department of Biological Sciences, SUNY College at Brockport, Brockport, New York 14420

• Albany, NY 12246

NEW YORK SEA GRANT INSTITUTE
State University of New York
& Cornell University
37 Elk Street
Albany, New York 12246



Communications
New York Sea Grant Institute
State University of New York
and Cornell University
411 State Street
Albany, New York 12246

ACKNOWLEDGMENTS

The New York Sea Grant Institute/NOAA provided financial support for this project (Grant 122-S004G). The Sea Grant Office in Albany, Chuck O'Neil and Michael Voiland in the Extension Office at SUNY Brockport, and Cyndi Krenicki in the Sea Grant Depository at the University of Rhode Island provided assistance by locating and supplying literature helpful for this review.

We wish to thank the staff at Drake Memorial Library, SUNY Brockport, most especially Robert Gilliam, Lori Lampert, Marghi Rich and Darlene Gruder, who provided much assistance with literature searches.

Additional thanks go to Michael J. Donahue, Natural Resource Specialist for the Great Lakes Commission, and Lily Jarman, Coordinator of Research Information and Publications for the Sea Grant Program at the University of Michigan, both in Ann Arbor, MI. They provided publications and contacts that greatly assisted this project.

We also wish to thank Donald Squires and William Wise, Sea Grant, Albany, who provided input throughout our research and critically reviewed this report; and George Stafford, Director, NYS Coastal Zone Management Program, who provided helpful insights.

INTRODUCTION

With the social and technological revolutions of the 20th century, Americans work fewer hours at less strenuous occupations. Consequently the desire for coastal-based recreation has increased. At the same time increasing human populations and rising technology have placed great demands and stresses on coastal resources. Without adequate safeguards, expanding coastal development pressures will lead to further environmental stress and degradation, species extinctions and irretrievable losses of coastal habitats (Darnell et al. 1976; United States Congress, Office of Technology Assessment 1984).

On Lake Ontario an increasingly successful sport fishery, as well as other recreation interests (e.g., boating, summer homes), has dramatically increased the number of people using existing facilities (Schwartz and Voiland 1979; Brown and Decker 1979). Recreation access to New York's Great Lakes coastline has been severely restricted because less than 15% of the shoreline is public (Schwartz and Voiland 1979), yet demands for further recreation development are certain to increase as economic and social pressures build. Much of the public land that has remained undeveloped is now targeted for the planned expansion of recreation and lake access facilities (New York State 1982).

Coastal areas provide too much social and economic value to be maintained solely in their "natural" states, and some negative consequences must be tolerated as a result of the overall positive benefits of "wise" development. Unfortunately, because of convenience and lower short-term costs, recreation development on Lake Ontario has most often occurred in and is planned for bays, tributaries, wetlands and other coastal habitats (New York State 1982).

These are critical areas because they function as wildlife and aquatic nurseries, erosion and pollution control bodies and natural areas for education and aesthetic enjoyment (United States Congress, Office of Technology Assessment 1984; Reppert et al. 1979). Thus building marinas, boat launches, homes, docks, retaining walls and other structures in these sensitive areas has the potential to destroy the very resources upon which recreation development depends (Chmura and Ross 1978; Heikoff 1975).

The critical questions for the future of the Lake Ontario (and Great Lakes) coastal zone are:

1. Should certain coastal areas be developed further? If so how should development occur, and where, so as to maximize benefits while minimizing environmental and other costs?
2. Can society properly determine short-term, long-term and cumulative benefits and costs of developing, or not developing, coastal resources for recreational use?
3. Are some coastal environments (e.g., wetlands, bluffs) too ecologically important to be altered for recreation activities?

Answers to these questions are complicated. Depending on geographic location, previous development history, local values, environmental conditions and other factors, answers will vary among coastal areas (cf. Clark 1977; Hite and Laurent 1972; Ducsik 1974). Of greatest importance is basing development decisions on reliable information about development practices and costs and environmental impacts and mitigations. Important development decisions are made by elected or appointed officials, who often lack technical or environmental training and who must rely on experts for information upon which to base

decisions. Without clear information on relevant issues, well-informed decision-making that is both socially and environmentally sound is unlikely.

Much has been written about the design and construction of facilities associated with coastal recreation development and their environmental impacts. Additionally, numerous state (e.g., Freshwater and Tidal Wetlands Acts; State Environmental Quality Review Act, both in New York State) and federal laws (Mandelker 1976; Baram 1976; Dennis 1981) have created multitudes of coastal zone regulations (e.g., Coastal Zone Management Act 1972; Clean Water Act Amendments of 1977, Sections 208 and 404) that attempt to govern coastal development on the Great Lakes and elsewhere. Lacking has been an integration and synthesis of the large and diverse literature on coastal development that would permit designing low impact/high benefit development strategies and practices.

The objectives of this project (Poulin 1984) were to:

1. Develop an annotated bibliography that reviews coastal recreation development practices and relevant environmental impacts, mitigations, laws and regulations, especially for the Great Lakes.
2. Evaluate the results of Objective 1 to determine a) whether major gaps in technical/environmental knowledge exist and b) whether sufficient information currently exists to rationally plan coastal development (short-term vs. long-term vs. cumulatively) on the Great Lakes generally and Lake Ontario specifically.

METHODS

A keyword list (Table 1) was developed by scanning coastal development literature and through discussions with knowledgeable New York Sea Grant and New York State Department of Environmental Conservation staff. The keyword list was utilized to search the Environline computerized data base and for manual searches of: Environment Index (1975-82), Environment Abstracts (1975-83), Applied Science and Technology (1978-83), Selected Water Resources Abstracts (1976, 1982-83), U.S. Government Documents (1975-83), and National Sea Grant Depository Listings (1975-83). Visits to technical libraries at the University of Michigan, Great Lakes Fishery Commission, International Joint Commission, Great Lakes and Marine Waters Center, Michigan Department of Natural Resources, and Michigan Sea Grant Institute completed search activities.

Information was sought specifically on coastal construction techniques and practices, environmental impacts and mitigations, and laws and regulations relevant to coastal recreation development. The annotated bibliography was organized alphabetically by author and each entry was sequentially numbered. Since many publications dealt with more than one aspect of coastal development an index is included that uses 15 subject categories to access single and multiple topic references by entry number.

Table 1. Literature Search Key Words

*Aesthetics

*Aquatic communities/ecosystems

*Beaches

*Boating

*Coastal waters

*Coastal Zone Management Act

*Coastal zone

*Construction

*Dredging

*Environmental engineering

*Environmental law

*Erosion

*Estuaries

*Great Lakes

*Inlets

*Lake Ontario

*Littoral zone

*Marinas

*Marshes

*Outboard motors

*Recreation

*Swamps

*Water law

*Water resources

*Wetlands

DISCUSSION

Coastal construction techniques and practices are well understood and documented. They are often presented in the form of design and construction manuals (Adie 1975; Carroll 1975; Collier 1979; Burgess and Kulhawy 1983; Chaney 1961; Cheung and Kulhawy 1982; Coastal Plains Center for Marine Development Services 1973; Dunham and Finn 1974; Ehrlich and Kulhawy 1982; Freese and Kulhawy 1983; Mulvihill et al. 1980; Saczynski and Kulhawy 1982; Schnick et al. 1982; United States Army Corps of Engineers 1981; United States Office of Coastal Zone Management 1976). Manuals emphasizing environmental impact mitigations also exist (Koehn and Rispoli 1982; United States Department of Interior 1974; United States Environmental Protection Agency 1971, 1973; Versteeg and Earley 1982). However, this knowledge may not be utilized because of cost or time constraints or because mitigations may not be required (United States Environmental Protection Agency 1973; Versteeg and Earley 1982).

In 1978 Chmura and Ross wrote "...much of the literature available today adequately describes the components of...impacts on the envrionment, but it provides little hard scientific data to support any conclusions as to the severity of that impact." Today more and better information exists about the components of coastal development and environmental impacts (Morrison 1979; Allen and Hardy 1980; Mulvihill et al. 1980; Johnston 1981; Tilton 1981; Koehn and Rispoli 1982; Schnick et al. 1982), but discussions about long-term cumulative impacts of coastal development remain few. Studies that have addresed

such impacts were limited by a lack of research data and only speculated about potential long-term/cumulative impacts (Mulvihill et al. 1980; Schnick et al. 1982).

Lack of complete knowledge about long-term and cumulative consequences of coastal development does not preclude rational development. It does indicate a great need for more carefully focused basic science studies, specifically on long-term and cumulative effects. More importantly, the relatively advanced state of knowledge about construction techniques and associated impacts and mitigations suggests the real problems of coastal development center around social values and systems not the state of technology and environmental science (Poulin 1984). To maintain adequate natural coastal environments, social units must address two questions: 1) is there a commitment to develop, or not to develop, coastal environments only after assigning appropriate values to natural conditions, appropriate costs to development impacts, and after evaluating development on long-term and cumulative bases and 2) will lack of commitment (often disguised as a lack of knowledge) lead to assigning only short-term costs and benefits in economic terms only while pursuing one-project-at-a-time planning and decision-making?

Values of a society are embodied in law and in many of the restrictions society places on its members through regulations. As currently constituted, federal and state laws protecting Great Lakes coastal resources appear adequate, as do regulations governing development practices. We are not prepared to comment on other states, but in our view a critical problem in New York is that current laws and regulations are not being fully translated into effective planning and management (especially long-term) for coastal recreation development.

A disturbing aspect of coastal regulation is that many state agencies (including New York's) have the dual functions of promoting and regulating coastal development. These differing roles give the appearance of and can actually produce conflict, inertia and contradiction within agencies that results in public uncertainty about actual policy (e.g., the former Atomic Energy Commission had conflicts of interest that were finally resolved by splitting it into two agencies: one to regulate atomic power, the other to develop/promote it; however, even this action did not resolve disputes over the uses of nuclear power). It is even more disturbing when agencies appear to apply different standards to private vs. state initiated coastal development (New York State 1982; SEQR 1978).

Further, despite clear NEPA and SEQR guidelines to consider long-term and cumulative consequences of development, current agency review practices for coastal development projects are generally case and site specific, with little or no attention to the long-term and cumulative impacts of many such projects (cf. New York Department of Transportation 1984). While no one recreation facility is likely to have a major impact on a Great Lakes coastline, a whole series of such developments may have important deleterious cumulative effects (cf. New York State 1982).

With the important exception of a critical need for much better data on long-term/cumulative environmental effects, there appear to be no major gaps in knowledge about construction practices or short-term environmental impacts and mitigations relevant to coastal recreation development. We believe two major problems must be addressed before New Yorkers can be reasonably certain of having recreational development compatible with acceptable environmental costs:

1. The citizens of the state should discuss and approve a coastal zone land-use policy. The current plan (New York State 1978; New York Department of State 1982) possesses some inadequacies, such as limited cumulative planning. Presently sites considered for development are evaluated solely for the effect development will have on specific coastal areas (e.g., Local Waterfront Revitalization Programs; Squires and Stafford, personal communications).
2. The regulatory and promotion/development functions for coastal resources by state agencies should be made independent to avoid potential (actual or perceived) conflicts of interest.

The beaches, bluffs and wetlands of the coastal zone constitute an interacting system that serves to stabilize the shoreline environment. Yet our society demands development that alters the system. If we respond only to immediate user demands and develop coastal resources one-site-at-a-time without regard to long-term and cumulative consequences, we risk damaging ecological resources important to our state. One way to resolve these conflicts is to create a reliable evaluation system that will rationally consider overall costs and benefits (e.g., the short-term economic benefits and long-term environmental costs of building boat launches in wetlands vs. the short-term economic costs and the long-term environmental benefits of building the same launches directly on the shore of a Great Lake). Much more research on the economic values of natural environments is required before definitive evaluations are possible. In the meantime, New York should pursue coastal recreation development with caution, especially for projects with high potential for long-term/cumulative impacts. Some natural environments along the

Great Lakes (such as wetlands) are almost certainly too important ecologically to be risked for any type of recreation development. Despite perceived short-term advantages of rapid recreation development expansion, long-term/cumulative environmental damage could ultimately ruin many recreation opportunities as well as permanently damage coastal resources. The sad history of Great Lakes fisheries from 1850-1960 (Haynes 1983) is a dramatic precedent and warning of what can happen to coastal resources when sound planning/management and adequate environmental protection are lacking.

It is important that engineers, builders, developers, resource managers, administrators, politicans and citizens be able to consider all of the alternative means of achieving desirable social goals in the coastal zone. To maintain a proper balance, certain types of coastal development must be curtailed, certain habitats must remain untouched and mitigations must be employed routinely. At the same time, limited environmental degradation in some areas may be of net benefit to society. This report with annotated bibliography brings together existing information upon which current development decisions can be based and identifies areas in which further scientific inquiry or social discussion are necessary.

With existing knowledge, improved evaluation tools, better planning and regulatory organization, proper decisions can be made to modify or avoid those projects for which the social/environmental cost is too high. The key remaining questions are whether or not our society and its subunits will 1) agree upon and implement long-term, environmentally sound goals for the coastal zone and 2) spend initially greater time, effort and money to evaluate and mitigate long-term and cumulative impacts, so as to optimize sustainable coastal resource benefits.

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1. Adams, Robert W. and John E. Hubbard. 1979. Monitoring a dredged channel: Braddock Bay, New York. Albany, New York: New York Sea Grant Institute. First Impressions Report (NYSG-RS-80-17). 23pp.

This report documents changes in sediment distribution which occurred after the dredging of a channel between Braddock Bay, New York and Lake Ontario, during August and September 1977. The research presented in this paper was collected after the dredging had been completed. Predredge maps and samples were not taken for comparison with postdredge results.

2. Adee, Bruce H. 1975a. Analysis of floating breakwater mooring forces. Seattle, Washington: University of Washington Sea Grant Program (WASHU-R-75-012). 92pp.

A method for analyzing floating-breakwater effectiveness and mooring forces is presented. The mooring-line analysis is based on static equations and is included as a restoring-force term in motion equations for the breakwater. Results of the theoretical analysis are compared with model experiments and data obtained in the field. The theory consistently under-predicts mooring forces indicating that further refinement of the analysis is required. Evidence of long-period oscillations in the mooring forces is also presented and discussed. (Author's Abstract)

3. Adee, Bruce H. 1975b. Analysis of floating breakwater performance. Seattle, Washington: University of Washington Sea Grant Program (WASHU-R-75-018). 17pp.

A two-dimensional-linear theoretical model has been developed which can predict the performance of floating breakwaters of arbitrary cross-sectional shape, including catamarans. This theory is applied to various breakwaters of different shapes and results are compared with measurements from the model tank and prototype installation in the field. These results indicate that the theoretical model may be very useful an a design and research tool and where additional development of the theoretical model is required. (Author's Abstract)

4. Adee, Bruce H. 1975c. Floating breakwaters: an idea whose time has returned. Seattle, Washington: University of Washington Sea Grant Program (WASHU-R-75-028). 9pp.

A review of recent developments in the construction of floating breakwaters is presented. Construction

techniques and materials are examined and their field performance to date is assessed. Some data on the effectiveness of each of the breakwaters and their cost is included for comparison. (Author's Abstract)

5. Adee, Bruce H. 1976. A review of developments and problems in using floating breakwaters. Seattle, Washington: University of Washington Sea Grant Program (WASHU-R-76-002).

In this review the basic types of floating breakwaters are examined. Data on a number of current installations and their construction costs are included. Materials used in construction are discussed in the light of present applications and problems that have been encountered. The field performance and measured mooring forces are presented for breakwaters that have been instrumented. The conclusion is that current installations are effective in reducing the incident-wave energy. However, their performance is closely tied to the incident-wave frequency. As experience with these structures is accumulated, their use in increasingly severe environments can be expected. (Author's Abstract)

6. Adie, D.W. 1975. Marinas: a working guide to their development and design. Boston, Massachusetts: Cahners Books. 336pp.

This publication deals predominantly with large marina developments (boat storage facilities, recreation buildings, etc.). Building practices are limited to marine coastal areas and large inland waterways. Many of those cited are in England and are supported by an exclusively British legal section. This book is useful for basic engineering descriptions but lacks detail in the discussion of building practices.

7. Allen, K.O. and J.W. Hardy. 1980. Impacts of navigational dredging on fish and wildlife: a literature review. United States Fish and Wildlife Service, Biological Services Program (FWS/OBS-80/07). 81pp.

Literature about the impacts of navigational dredging on fish, aquatic biota, and wildlife are reviewed in this publication. Also included are types of dredging equipment, characteristics of dredged material, evaluation of dredged material pollution potential, and habitat development and enhancement opportunities arising from dredged material disposal. The review contains a brief discussion of the state of knowledge

and provides pertinent literature for additional information. The discussions about impacts and habitat development are divided into "Coastal Waters" (including disposal in estuarine, continental shelf, and deep ocean waters), and "Rivers." A limited discussion of the "Great Lakes" is included as an appendix. (Author's Abstract)

8. American Society of Civil Engineers. 1977. Adequacy of dredging methods and equipment in the United States for maintenance of navigable waters. Journal of the Waterway, Port, Coastal and Ocean Division. Proceedings of the American Society of Civil Engineers. 107(3): 349-373.

This report presents a broad overview of dredging methods and the equipment that is available for channel maintenance in the United States. This paper also evaluates the capability of the dredge fleet to serve the national dredging requirements.

9. Arbuckle, J.G., S.W. Schroeder and T.F.P. Sullivan. 1974. Environmental law for non-lawyers, 2nd edition. Bethesda, Maryland: Government Institutes, Inc. 296pp.

This textbook presents all of the major pieces of Federal legislation that are considered environmental laws in the areas of air, water, noise pollution control, solid waste disposal and land use. These documents are included in the appendices of the text: National Environmental Policy Act, Clean Air Act, Federal Water Pollution Control Act, Noise Control Act of 1972 and the Solid Waste Disposal Act. The requirements and ramifications of these documents relative to industry, government and the public are also considered.

10. Armstrong, John M. and R. Bruce Denuyl. 1977. An investment decision model for shoreland protection and management. Coastal Zone Management Journal. 3(3): 237-253.

An investment decision model for problems associated with shoreline erosion is presented. The model determines the economic benefits that a landowner can realize from available alternative protection structures. Benefits are associated with erosion-induced property value decline for specific reaches of shoreline. This approach enables the decision maker to determine the local economic impact of alternative shoreland management policies. The economic effects of

coastal management policies, such as nonstructural shoreland protection, wetlands regulation and public beaches, are discussed in terms of the model's ability to evaluate and compare the opportunity cost of alternative policies. Computational examples of the model output are presented and discussed. (Author's Abstract).

11. Ascher, David M. 1978. The acquisition of development rights in the coastal zone: an alternative to wetlands regulation p.95-159 in Kaplan, Milton and Robert Reis (eds.). 1978. New York Sea Grant Law & Policy Journal volume 2. New York Sea Grant Program (NYSGI-Z-79-003). Albany, New York.

This article highlights the values of coastal lands, particularly wetlands, and discusses the variety of land use activities that compete for and exploit the natural resources of the coast. The problems that exist in State and local wetland regulations are briefly discussed, as well as traditional land use regulation. Analyses of various less-than-fee approaches to land use control, conservation easements and transferable development rights are presented. In conclusion a number of techniques to provide funding for the aquisition of development rights are reviewed.

12. Ashe, Daniel M. 1983. Fish and wildlife mitigation: description and analysis of estuarine applications. Coastal Zone Management Journal. 10(1/2):1-52.

This article makes a comprehensive survey of the concept of fish and wildlife mitigation, with an emphasis placed upon its use as a tool in estuarine management. Initial portions of this article deal with the establishment of a framework which serves as a standard upon which to evaluate the soundness of potential mitigation efforts. Latter portions apply this conceptual framework to a series of alternative approaches to estuarine mitigation and to policies now emerging within the federal regulatory structure. A major conclusion of this paper is that the lack of formal mitigation policy has given estuarine mitigation the often deserved reputation as being cumbersome and an arbitrary regulatory burden. Applied as a positive management strategy, mitigation can be a powerful tool; however, development of a conceptually sound policy is of the utmost importance. This paper addresses many of the problems involved in developing and implementing such a policy. (Author's Abstract)

13. Batie, Sandra S. and Waldon R. Kerns. 1983. Implications of changing Federal and State roles for managing coastal resources pp.78-84 in Reintjes, John W. (ed.). 1983. Improving multiple use of coastal and marine resources. Bethesda, Maryland: American Fisheries Society.

This paper examines the implications of a shift from Federal to State and local responsibilities for marine resource management. Past Federal management and financial responsibilities toward coastal resource development projects are discussed. The responses of State government toward the changing federal role are highlighted. Current and future roles of Federal and non-Federal governments and the probable impacts a shift in responsibility will have on regulation, financing and conflict resolution issues are also examined. (Modified Authors Abstract).

14. Batie, Sandra S. and Leonard A. Shabman. 1982. Estimating the economic value of wetlands: principles, methods, and limitations. Coastal Zone Management Journal. 10(3):255-278.

This paper describes basic principles which underlie conceptually valid estimates of nonmarket and market values of wetlands and discusses the data needed to make such estimates. The implications for wetlands management are explored for situations where such data are not available. (Modified Authors Abstract)

15. Bean, Michael J. 1978. The Federal role in wetland protection; an overview. pp.103-108 in Fish and Wildlife Service, United States Department of the Interior. 1978. Proceedings of the national wetland protection symposium. Reston, Virginia. June 6-8, 1977. Washington, D.C.: United States Government Printing Office.

Presents the multifaceted role the Federal government has played in the history of wetland policy.

16. Betty, Michael. 1975. Public access to beaches in the United States. pp.65-83 in University of Rhode Island, Master of Marine Affairs Program. 1975. Marine Affairs Journal. Rhode Island Sea Grant Program (RIU-ES-75-001).

Discusses the coastal access problem that has affected the pursuit of recreation in the United States. Describes legal methods such as dedication,

custom, purchase and condemnation as ways of obtaining access to the beach. Predominantly concerned with marine shorelines.

17. Bockrath, Joseph T. 1977. Environmental law for engineers, scientists, and managers. New York: McGraw-Hill Book Co. 359 pp.

This book attempts to present the progression and basic concepts of environmental law to individuals who lack a legal background. Legal cases are presented and the processes concerning the resulting decisions are discussed.

18. Bokuniewicz, H.J. 1979. Stability and fate of dredged material pp.1-23 in Texas A&M University Center for Dredging Studies. 1979. Proceedings of the eleventh dredging seminar. Center for Dredging Studies (CDS) Report No. 219, October 1979.

This paper deals with the formation of deposits of dredged sediments on subaqueous disposal sites. The long-run behavior of the dredged sediment is discussed but is restricted to the disposal of fine-grained sediment from a hopper dredged in shallow water under slow to moderate currents.

19. Bowen, Robert E., Francis W. Hoole and Susan H. Anderson. 1980. Evaluating the impact of coastal zone activities: an illustration of the evaluation research approach. Coastal Zone Management Journal. 7(1): 25-47.

This paper provides an illustration of the use of evaluation research methodology in the coastal zone context by presenting a study of the impact of the California Coastal Zone Conservation Act of 1972 on beach use in the Malibu area in southern California. This evaluation takes place after the program has been implemented and is therefore not effective for preconstruction evaluations. (Modified Author's Abstract).

20. Bowerman, F.R. and K.Y. Chen. 1971. Marina del Rey: a study of environmental variables in a semi-enclosed coastal water. Los Angeles, California: University of Southern California Environmental Engineering Program, Sea Grant College Program (USC-SG-4-71). 59 pp.

The Marina del Rey boat harbor of southern California was opened to the public in 1962, and since then, no

extensive study had been done on the water quality of its channels. In light of the anticipated rapid population growth around the marina and the ever increasing number of small crafts using the channels, it became important to estimate the quantitative changes in the water quality. This study examines the environmental conditions of the marina, and investigates potential sources of contamination from the surrounding environment.

21. Braden, Patricia L. and Susan R. Rideout. 1980. Consumer investment in shore protection. Ann Arbor, Michigan: University of Michigan Sea Grant Program (MICHU-SG-80-200). 7pp.

This study investigates the demographic characteristics of Michigan shoreline property owners, the physical aspects of their shore property, and factors involved in the acquistion of this land. The behavior of these property owners when confronted with erosion damage is discussed. The shore protection structures chosen and the average investment of individuals is also dealt with.

22. Bradley, Earl H., Jr. and John M. Armstrong. 1972. A description and analysis of coastal zone and shoreland management programs in the United States, Ann Arbor, Michigan: University of Michigan Coastal Zone Management Program (MICHU-T-72-006).

This report provides a survey of the 1972 shoreland mangement programs that were undertaken at the state level. An analysis of certain state programs is provided to determine what types of approaches appear to be appropriate and under what conditions. New York State is mentioned only briefly.

23. Brennan, Sandra F. and Parker E. Calkin. 1984. Analysis of bluff erosion along the southern coastline of Lake Ontario, New York. Albany, New York: New York Sea Grant Institute. 74 pp.

This study investigates the glaciolacustrine sediments and analyzes the erosion of the bluffs along a 212 km. stretch of the southern coastline of Lake Ontario. The physical properties of bluff materials, bluff profile and stratigraphic sections were measured. One year recession rates were also determined. (Modified Author's Abstract).

24. Brower, David J., et.al. 1978. Access to the nation's beaches: and annotated bibliography. Raleigh, North Carolina: University of North Carolina Sea Grant Program (NCU-L-78-001). 58pp.

This bibliography presents selected annotations that deal with planning, public use and regulatory policies that affect the public's use of the shoreline.

25. Brown, Tommy L. and Daniel Decker. 1979. Access to Great Lakes salmonid fishing via private lands: a study of New York's riparian landowners pp. 37-44 in Carls, E.G. (ed.). 1979. Recreation impacts: the Great Lakes ecosystem. Ontario Research Council on Leisure, Monograph 1.

This study examines potential legal arrangements and agency policies that would be most acceptable to shoreline owners along New York's Great Lakes in exchange for fishing access agreements.

26. Brownlie, William R. and Parker E. Calkin. 1981. Effects of jetties: Sodus Bay, New York. Albany, New York: New York Sea Grant Institute. 27 pp.

The authors studied the movement of sediment along the beaches and the effects of wave refraction on beach and bluff erosion of the Lake Ontario coastline around Great Sodus Bay, New York. It was found that jetties in the area may have an effect, but other factors, such as protective efforts along the coast and insufficient records of the shoreline before the jetties were built in 1829, prevent a full explanation of the differential erosion processes there. Thus, the authors were unable to prove that a single factor explains the coastal changes around the Great Sodus Bay. (Modified Author's Abstract).

27. Buddecke, Ronald. 1973. Help yourself-a discussion of the critical erosion problems on the Great Lakes. Shore and Beach. 41(2):15-18.

Without a regulatory body to control the construction of shore protection devices on the Great Lakes they have become the responsibility of private landowners. Often these structures are improperly built and as a result they are inefficient and costly to the landowner. The Army Corps of Engineers proposed six construction guidelines to follow (1) provide adequate toe protection, (2) secure both ends of the structure against flanking, (3) check foundation conditions (4)

use material that is heavy and dense, (5) make sure that the voids between pieces are small so that underlying material is not washed away, and (6) build the structure high enough so that overtopping does not occur. Suggestions to reduce erosion and flooding are also provided.

28. Burgess, William S., Jr. and Fred H. Kulhway. 1983. Coastal structures handbook series: Docks, piers and wharves: a design guide. Albany, New York: New York Sea Grant Institute. First Impressions Report. 320pp.

Docks, piers and wharves are inner harbor structures that provide a link between land and water modes of transportation. This study presents guidelines for the planning, layout and design of these structures while focusing on recreational craft applications.

The planning and layout considerations for docks, piers and wharves are discussed while recognizing that these topics are correctly a subset of overall harbor planning. Design loads and material properties are addressed to provide a basis for structural analysis and design.

Three broad categories of structural type are presented including solid fill, fixed and floating structures. Each structural type is described by component part with design considerations and recommendations based on practical, sound engineering procedures. Design considerations for utilities, special services, and dredging operations are also presented. (Author's Abstract)

29. Camougis, George. 1981. Environmental biology for engineers: a guide to environmental assessment. New York: McGraw-Hill Co. 214 pp.

Clearly presents the vocabulary of environmental biology and discusses environmental biology in relation to both engineering and legislation. The theory and practice of environmental biology is then related to some "real world" situations.

30. Carroll, Allen. 1975. Developer's handbook, Hartford, Connecticut: State of Connecticut, Department of Environmental Protection, Coastal Area Mangement Program. 60 pp.

Provides basic information and advice on land-use planning. Explains through words and diagrams the opportunities and limitations for harmonious development with environmental systems and resources.

Described in easily understood terms are the important functional elements of the natural system; design and construction considerations; Connecticut regulatory controls and programs; and factors for site evaluation.

31. Chaney, Charles A. 1961. Marinas: recommendations for design, construction and maintenance. Chicago, Illinois: National Association of Engine and Boat Manufacturers, Inc.

This volume offers designers and builders a manual of construction methods and materials that may be incorporated into the design and construction of the modern marina. This publication contains chapters on preliminary studies and investigations, construction costs, rentals, maintenance and operations. The greatest portion of this text is devoted to the consideration of planning and construction problems and does not approach the environmental impacts of marina developments.

32. Chen, Kenneth and R.L. Wiegel. 1970. Floating breakwater for reservoir marinas. pp.1645-1665 in Proceedings of the twelth conference on coastal engineering. Washington, D.C.

The concept of multiple use of reservoirs is resulting in the construction of marinas for recreational boating that require breakwaters that will function for large ranges of water levels. Under such circumstances floating breakwaters appear to have more merit than stationary structures. Several new-types of moored floating structures were tested in a wave tank, and several of the devices appear to be effective in that they were reasonable small and could reduce the height of an incoming vave to less than one foot in the lee of the breakwater. (Modified Author's Abstract)

33. Cheung, Francis K.P. and Fred H. Kulhawy. 1982. Coastal structures handbook series: analysis, design and construction of pile foundations in the coastal environment. Albany, New York: New York Sea Grant Institute, First Impressions Report. 277pp.

This study focuses primarily on the design and construction of pile foundations in the coastal regime. The discussions are separated into four parts. In the first part, an assessment is made of the nature and intensities of loads acting on piles. Second,the design principles and methodologies for the various types of loads (compressive, uplift and lateral) are

outlined. Considerations are also given to scour, pile buckling, bent piles and downdrag. Third, the three materials (concrete, steel and wood) commonly used for piles are discussed, concentrating on the potential problems in their use and the appropriate preventive measures. Finally, the methods of installation of piles are described. The emphasis of this study is on conventional design procedures and practical techniques. (Author's Abstract)

34. Chmura, Gail L. and Neil W. Ross. 1978. The environmental impacts of marinas and their boats: a literature review with management considerations. Marine Memorandum 45. Narragansett, Rhode Island. 32pp.

This review summarizes the general aspects of marina and boat-related environmental effects. The discussion focuses on each of these component effects, the management options needed to reduce negative effects of marinas and boats, the future research needs. Much of the literature cited pertains to marine environment.

35. Clark, Brian D., Ronald Bisset and Peter Wathern. 1980. Environmental impact assessment: a bibliography with abstracts. New York: R.R. Bowker Co. 51 pp.

This annotated bibliography contains publications that are relevant to various aspects of environmental impact assessment. The bibliography is divided into five sections, each containing a short introduction and numerous publications relevant to that topic area. The five divisions of the book are (1) aids to impact assessment, (2) critiques and reviews of environmental impact assessment, (3) environmental impact assessment and other planning aspects, (4) environmental impact assessment in selected countries, and (5) information sources.

36. Clark, John R. 1974. Coastal ecosystems: ecological considerations for management of the coastal zone. Washington, D.C.: The Conservation Foundation. 178pp.

This publication reduces the large amount of ecological information into a comprehensive, easy to read format. Contents include: ecological considerations; environmental disturbance; resource evaluation and protection and a chapter on constraints and specific uses of coastal areas. Provides an excellent study of the coastal zone management issue.

37. Clark, John R. 1977. Coastal ecosystem management. New York: John Wiley & Sons. 928pp.

Presents technical knowledge and methodology pertainent to environmental management and planning at the county and municipality level. Contents include : general ecology; management for optimum carrying capacity; classificaiton and survey of natural systems; the management framework; management opportunities at the local level; and guidelines and standards for coastal projects

Concludes with a collection of 41 technical articles which complement the previous chapters in the book, and an appendix of tabular and graphical matter suppling useful technical data.

38. Clemens, Robert H. 1976. Selected environmental criteria for the design of artificial structures on the southeast shore of Lake Erie. South Carolina: Coastal Resources Division Sourth Carolina University, Department of Geology. Technical Report No. 8-CRD.

This study analyzes several important criteria which are often ignored in the design of artificial shoreland protection structures. It assesses the performance of five such structures located on the southeast shoreline of Lake Erie. This study deals primarily with geology, lake level fluctuations and wind wave climates of Lake Erie.

39. Coastal Plains Center for Marine Development Services. 1973. Guidelines for the coastal zone. Wilmington, North Carolina: Coastal Plains Center for Marine Development Services. 16pp.

Presents a classification system which identifies environmental resource categories within preservation areas, conservation areas and development areas. For each resource category there is a brief definition and a list of preferred uses. A definiton and guidelines for specific use activites is also included. Among the twenty uses examined are marinas, mining, dredging, agriculture, ports, recreation, utilities, bulkheads and others.

40. Collier, C.A. 1979. Checklist for building construction on shoreline property. Community Resources Development Information. Alabama Cooperative Extension Service. Auburn, Alabama: Auburn University, Mississippi-Alabama Sea Grant Consortium (MASGC-H-79-001). 6pp.

Provides a series of yes/no questions based on nine separate, easily readable checklists. These checklists have factors which should be considered while constructing or reconstructing buildings in the coastal zone, especially the ocean zone. This publication would be helpful to prospective buyers or current owners of shore property who are concerned about the problems involved in coastal area construction.

41. Crawford, Richard D. and Judith A. Rossiter. 1982. General design considerations in creating artificial wetlands for wildlife pp. 44-47 in University of Minnesota. 1982. Wildlife Values of Gravel Pits Symposium, Crookston, Minnesota. June 24-26, 1982.

Loss of natural wetland resources can be partially offset by the constuction of artificial basins. Design recommendations are made for the construction of relatively small (4 acre) wetlands that will closely resemble a natural basin. Studies of three-five-year old wetlands found that waterfowl and other wetland bird use is comparable to that in natural basins, but plant and animal species diversity and abundance is generally lower in the man-made ponds. These factors may be attributed to the age of the ponds.

42. Crowley, David A., Joel G. MacDonald and Gary P. Settles. 1974. Wetlands- related legislation in the United States. Miami, Florida: University of Miami Sea Grant Program. 56 pp.

Presents a general discussion of the importance of wetlands and then describes various regulatory methods for state wetlands. The appendix lists state wetland legislation and related statutes for coastal states as they existed in 1974.

43. Darnell, Rezneat, W.E. Pequenst, B.M. James, F.J. Benson and R.A. Defenbaugh. 1976. Impact of construction activities in wetlands of the United States. Washington, D.C.: United States Environmental Protection Agency (EPA-600/3-76-045). 393 pp.

The primary types of construction activity which severely impact wetland environments of the United States include: floodplain surfacing and drainage, mining, impoundment, canalization, dredging and channelization, and bank and shoreline construction. Each type of construction activity is accompanied by a host of chemical and physical alterations of the

wetland environment which may extend for miles from the site of construction and may persist for many years. In turn, each type of physical and chemical modification has been shown to induce a derived set of biological effects, many of which are predictable, in general, if not in specific detail. The most environmentally damaging effects of construction activities in wetland areas, in order of importance, are: direct loss of habitat, addition of suspended solids, and modification of water levels and flow regimes. Major construction-related impacts also derived are altered water temperature, pH, nutrient levels, oxygen, carbon dioxide, hydrogen sulfide, and certain pollutants such as heavy metals, radioactive isotopes, and pesticides. (Author's Abstract)

44. Dee, Norbert, Janet K. Baker, Neil L. Drobny, Kenneth M. Duke and David C. Fahringer. 1973. An environmental evaluation system for water resources planning. Water Resources Res. 9(3): 523-535.

Battelle-Columbus Laboratories developed an Environmental Evaluation System (EES) for assessing environmental impacts for water resource development projects proposed by the Bureau of Reclamation. The evaluation system that evolved is based upon a hierarchical arrangement of environmental quality indicators--an arrangement that classifies the major areas of environmental concern into major categories, components, and ultimately into parameters and measurements of environmental quality. Four major categories are evaluated: ecology, environmental pollution, esthetics, and human interest.

In additon to providing information on environmental impacts of specific project proposals, the EES can be used in the planning phase to identify project designs that meet most development objectives while minimizing adverse environmental impacts. (Modified Author's Abstract)

45. Dennis, Freda. 1981. Wetlands law. Mobile, Alabama: University of South Alabama. 18pp.

Provides a brief but useful outline and discussion of the Fede.al Laws which pertain to wetlands (Rivers and Harbors Act, Coastal Zone Management Act, National Enironmental Policy Act, and the National Historical Preservation Act). Following the discussion of the Federal Laws the author concentrates on the issues and laws which affect the coastal area of Alabama.

46. Dippel, Carol J., Sharon K. Meier and Harold J. Stitt. 1980. Integrated impact assessment: a case study. Ann Arbor, Michigan: University of Michigan, School of Natural Resources. 124pp.

This paper provides a definition, an explanation and a rationale for an Integrated Impact Assessment (IIA) process, which attempts to incorporate all forms of analysis into this comprehensive assessment program. The application of the proposed process is through a case study of sand and gravel extraction in Freedom township in Washtennaw County, Michigan. The paper ends by presenting conclusions regarding the application of the process to the case study, and offers comments and recommendations for future research.

47. Ditton, Robert B. and Mark Stephens. 1976. Coastal recreation: a handbook for planners and managers. Washington, D.C.: United States Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.

This paper is intended to provide a basic understanding of recreation supply, demand, impacts and management considerations, and to provide recommendations which can be integrated into a balanced long-term coastal zone management program.

Although this publication does provide a good section on the responsibilities of government agencies, the remainder of the publication is not as useful as the title implies.

48. Domoy, F.M. 1981. Great Lakes recreation/tourism futurescapes. Albany, New York: New York Sea Grant Institute. First Impressions Report. 31pp.

This publication is an attempt to identify future trends of the tourism industry in the Great Lakes region of New York State. The trends can then become the basis for recommendations for future educational programs or new client groups.

49. Ducsik, Dennis. 1974. Shoreline for the public: a handbook of social, economic, and legal considerations regarding public recreational use of the nation's coastal shoreline. 257pp.

This publication examines the growing demand for coastal recreation and the decreasing supply of suitable public recreation areas. A brief summary is made of common law doctrines and statutory proposals

for establishing public rights in wet-sand and dry-sand areas. Concepts surveyed include easements, customary rights, implied dedication, the public trust doctrine, and the statutory approach of the National Open Beaches Bill. The issues of purchase of use and access rights and the acquisition and protection of these rights through regulation are also discussed.

50. Dunham, James W. and Arnold A. Finn. 1974. Small-craft harbors: design, construction, and operation. Fort Belvoir, Virginia: Department of the Army, Coastal Engineering Research Center, Special Report No. 2. 375pp.

Analytical data, design standards and procedures are presented for use in the development of small-craft harbors and launching facilities under a wide variety of conditions applicable to a broad spectrum of geographical locations. Environmental impact and governmental control aspects are discussed. Procedures for determining project feasibility and possible sources of governmental assistance are presented. Harbor operations and administration are reviewed. Several case histories of harbors are included. (Author's Abstract).

51. Ehrlich, Laurie A. and Fred H. Kulhawy. 1982. Coastal structures handbook series: breakwaters, jetties, and groins. Albany, New York: New York Sea Grant Institute. First Impressions Report. 355pp.

Small-scale breakwaters, jetties and groins are constructed to control erosion, and to stabilize beaches and inlets. The functional and structural design of these coastal structures are presented in this study.

Siting of the structures requires a background knowledge of the dynamics of littoral processes. Functional design characteristics include orientation, length, height, spacing and other geometrical components. These topics are discussed in their relation to structure, purpose and operation. The structural configurations highlighted are mound and wall type constructions and low cost shore protection methods.

Rubble mounds are the most common form of breakwaters, jetties and groins. The structural design of mounds is the focus of the second part of this study. Preliminary design considerations include quantification of environmental loads and assessment of geotechnical conditions. The selection of rock for rubble mound construction is an important facet of design. Guidelines for the evaluation of rock durability in the

coastal zone are presented. In the final section, technical design methods are reviewed. The design emphasis is on practical, sound engineering procedures. (Author's Abstract)

52. Ellis, Robert H. 1972. The design of a management information system for coastal resources planning. Hauppauge, New York: Regional Marine Resources Council, Nassau-Suffolk Regional Planning Board.

The objective of this report is to present a design blueprint for development of a coastal zone management information system (MIS). General and specific characteristics, structures and functions of the total system and its components, and examples of the system application are described. The MIS created in this report is for Long Island, but it can be generalized and transferred to be used in other coastal regions.

53. Ellis, R.H., T.A. Haines and J.C. Makarewicz. 1976. Aquatic biological survey, Irondequoit Bay, New York. Final Report to the United States Army Corps of Engineers. Buffalo, New York. 58pp.

This report addresses the biological components of Irondequoit Bay, on Lake Ontario, that would be affected by a proposed dredging operation in that area. The impact that dredging would have on the habitat, phytoplankton, zooplankton, macrobenthos, fish, aquatic macrophytes, reptiles and amphibians is considered. The results of this report indicate that Irondequoit Bay will not suffer from long-term changes in the ecosystem if the dredging of a small boat access channel does occur. Short-term damage in the immediate area of the operation will be unavoidable.

54. Evans, David E. 1980. Problems of beach access: local government remedies. Env. Comment. March 1980. p.4-9.

This report discusses the options available to localities to deal with the public access problem. The comparative strengths and weaknesses of the various methods are discussed and suggestions as to how and when these methods might be effectively employed.

55. Field, Richard, Hugh Masters and Melvin Singer. 1982. An overview of porous pavement research. Water Resources Bulletin. 18(2):265-270.

This paper discusses the economics, advantages, potential applications, status and future research needs of porous pavements. Porous pavements are an available stormwater management technique which can be used on parking lots and low volume roadways in order to reduce both stormwater runoff volume and pollution. In addition, groundwater recharge is enhanced. Also cost reductions result due to the elimination of curbs, drains, and small sized storm sewers. Porous asphalt pavements consist of a relatively thin course of open graded asphalt mix over a deep base of large size crushed stones. Water can be stored in the crushed stone base until it can percolate into the subbase or drain laterally. Other porous concrete mixes are also discussed. (Author's Abstract)

56. Flint, R. Warren. 1979. Responses of freshwater benthos to open-lake dredged spoils disposal in Lake Erie. Journal of Great Lakes Research. 5(3-4):264-275.

This publication evaluates the impact of open-lake dredged spoil disposal on natural benthic macro-invertebrate communities in the nearshore waters of Lake Erie. The disposal of two types of dredged sediments is investigated: sandy-silt and coarse sand. Adjustment to predisposal conditions occurred much faster in the site which received the coarser particles.(Modified Author's Abstract)

57. Forste, Robert H. (ed.). 1970. Proceedings of the New England coastal zone management conference., April 28-29, 1970. Durham, New Hampshire: The New England Center for Continuing Education. 159pp.

Presentation of papers from the 1970 conference of New England regional coastal zone management. This conference hoped to insure that further development of New England coastal areas would proceed in an orderly and reasonable manner. It was intended that future coastal development could be planned with citizen participation in the design process.

58. Freese, Jonathan H. and Fred H. Kulhawy. 1983. Coastal structures handbook series; general planning considerations for small-scale coastal structures. Albany, New York: New York Sea Grant Institute. First Impressions Report. 124pp.

The siting of a small-scale structure in the coastal environment requires the use of a well-defined planning methodology. This study outlines one such

planning process, with emphasis on the development and evaluation of alternatives. Natural coastal processes and the possible effects a given structure may impose on these processes are addressed with regards to coastal beaches, bluffs, and tidal and freshwater wetland areas. Cost and benefit trade-offs are evaluated and a summary of site and construction considerations is provided to prepare the planner for possible trade-off decisions or construction problems which may be faced. The final section of this study provides the basic justification for such regulations, a description of what types of structures or activities will require a permit, and a discussion of permit application procedures for the respective agencies. (Modified Author's Abstract)

59. Fried, Eric. 1981. Evaluation of wetlands for regulatory protection. pp. 403-411 in Richardson, B. (ed.). 1981. Selected proceedings of the midwest conference on wetland values and management. Minnesota: Freshwater Society.

To help implement the 1975 New York Freshwater Wetlands Act and evaluatory classification system was developed. This paper presents the system which utilizes some 40 characters to assign the freshwater wetlands of the state into four evaluatory classes, Class I Wetlands have the highest benefits, Class IV the lowest. The issuing of permits for activities in wetlands is considered according to the standards of each of the four classes. The standards for activities in Class I Wetlands are the most stringent whereas those for activities in Class IV Wetlands are most liberal. (Modified Author's Abstract)

60. Fried, Eric. 1980. Freshwater wetlands regulations. The New York State Conservationist. May-June 1980. pp. 8-9

Discusses the responsibilities and actions that accompany Parts 663 and 664 of Article 24 of the New York State Environmental Conservation Law, the Freshwater Wetlands Act.

61. Galloway, G.E. 1978. Assessing man's impact on wetlands. Raleigh, North Carolina: North Carolina State University Sea Grant Program (NCU-78-013). 115pp.

This document provides background discussions of Federal interest in wetlands and a summary of evaluation techniques used in the government and

private sectors to evaluate the impacts of various activities on the wetland environment. The characteristics of an ideal evaluation system are defined and a Wetland Evaluation Sysytem (WES) is described. The Wetland Evaluation System is applied in abbreviated case studies to construction in the Yazoo Basin in Mississippi and the Neuse River Estuaries of North Carolina. Typical outputs of the WES are provided. (Author's Abstract)

62. Gaughan, Michael K. and Paul D. Komar. 1977. Groin length and the generation of edge waves, pp. 1459-1476 in American Society of Civil Engineers. 1977. Proceedings of the fifteenth coastal engineering conference, volume 2.

In this study a series of wave basin experiments were undertaken for the purpose of better understanding the selection of groin spacing and lengths and how waves react to these structures. Changes in wave strength, beach run up and the rearrangement of sand between the groins, are also investigated.

63. Geis, James W. and Janet L. Kee. 1977. Coastal wetlands along Lake Ontario and St. Lawrence River in Jefferson County, New York. Syracuse, New York: State University of New York, College of Environmental Science and Forestry. 130 pp.

This report considers techniques for the location, description and evaluation of wetland systems. 41 individual wetlands of the Lake Ontario and St. Lawrence River area of New York were evaluated according to vegetation, size, wildlife use potential and biological uniqueness using two regionally appropriate evaluation systems.

64. Genesee/Finger Lakes Regional Planning Board. 1971. The Lake Ontario shoreline: a regional overview of environmental problems. Rochester, New York: Genesee/Finger Lakes Regional Planning Board. 114 pp.

This report provides a broad preliminary overview of environmental problems such as sewage and industrial pollution which affect the 90 miles of the Lake Ontario shoreline forming the northern boundary of the Genesee/Finger Lakes region. The complexities of ecological, land use, water use and economic problems which beset the lake, bays, wetlands and creek watersheds and the shoreline communities are discussed. Opportunities for a more productive utilization of the

lakeshore as a natural resource are described. The report reviews pollution sources and water quality conditions; examines the recommendations of published comprehensive planning reports; examines land use and water use conflicts; reviews the state of scientific knowledge of the lakeshore environmental problems. Also included are brief surveys of regulations instituted in two other states to deal with similar shoreline and wetland management problems. The report ends with broad conclusions and recommendations concerning future environmental planning action. (Author's Abstract)

65. Georgia Department of Natural Resources. 1975. Handbook: building in the coastal environment. Atlanta, Georgia: State of Georgia Department of Natural Resources. 118pp.

This handbook is designed as a working tool for government officials, planners, developers, and interested citizens concerned about the future of the Georgia coast. It provides site-specific guidelines to make the development of residential communities compatible with Georgia's coastal resources.

66. Giannio, Steven P. and Hsiang Wang. 1974. Engineering considerations for marinas in tidal marshes. Newark, Delaware: Delaware College of Marine Studies. 105pp.

This document describes the economic, social, and natural values of estuarine settings in which marinas are placed, with an emphasis on coastal marshes. After a brief review of negative environmental impacts of development in those settings, the document examines problems, impacts and potential solutions for locating marinas in a marsh environment. The report is concluded with a composite overview design which would permit a marina to be constructed in a marsh system yet retain or even enhance its environmental value. The design, however, is not tested.

67. Gifford, Charles A. 1978. Use of a floating tire breakwater to induce growth of high marsh and foredune plants along a shoreline. pp. 136-148 in Cole, D.P. (ed.). 1978. Proceedings of the fifth annual conference on restoration of coastal vegetation in Florida. Hillsborough Community College, Tampa, Florida.

A floating tire breakwater used for shoreline erosion control in Santa Rosa Sound induced volunteer growth of several species of high marsh and foredune plants along

the protected shoreline. Accreted detritus apparently contained viable seeds, plant fragments, and nutrients. No planting, fertilizing, or other care was needed.

68. Good, Ralph E. Dennis F. Whigham and Robert L. Simpson. 1978. Freshwater wetlands: ecological processes and management potential. New York: Academic Press. 378pp.

This volume is the result of a conference entitled "Freshwater Marshes: Present Status, Future Needs". The conference attempted to summarize the present knowledge of the general ecological processes as well as the management potential of freshwater wetlands. Papers presented at the conference dealt with freshwater tidal wetlands, littoral wetlands of rivers, streams, lakes, and ponds, praire glacial pothole wetlands, and northern bog wetlands. These papers are included in the four sections of this book: primary production, decompositon, mineral cycling, and management potential.

69. Great Lakes Basin Commission. 1981. Basin plan: wetlands policy plan and environmental impact statement. Ann Arbor, Michigan: Great Lakes Basin Commission.

This report presents the portion of the Great Lakes Basin Plan that covers wetlands management in the Great Lakes basin. This plan, adopted in 1971, is intended for state, local, and federal land use managers and policymakers. The plan is aimed towards determining wetland acreages and functions, understanding these functions, and administring effective regulatory and management programs.

70. Greeson, P.E., J.R. Clark and J.E. Clark (eds.). 1979. Wetland functions and values: the state of our understanding. Minneapolis, Minnesota: American Water Resources Association, Proceedings of the National Symposium of Wetlands. 674pp.

These proceedings seek to examine the status of wetlands knowledge that exists throughout the nation. The following key topics are addressed: wetland conservation and science; management and evaluation of wetlands; wetland food chains; wetland hydrology; wetland habitats; wetland water quality; the wetland heritage; and wetland harvest. Newly enacted wetland regulations as well as their impacts on state and local governments are also discussed. This publication

provides extensive insight into the functions and values attributable to wetlands.

71. Gupta, T. R. 1973. Economic critera for decisions on preservation and alteration of natural resources with special reference to freshwater wetlands in Massachusetts. Ph.D.Dissertation. Cambridge, Massachusets: University of Massachusetts. 206 pp.

This publication describes the present economic and institutional forces such as real estate ownership, taxation, zoning practices and other factors which affect wetland usage in Massachusetts. These factors are used by the author to develop methods of placing a monetary value on wetland benefits. The benefits obtained by individual wetlands are used as criteria to determine if wetland alteration should or should not occur. The data generated by this study is not valid for every community.

72. Gutman, Andrew L. 1979. Low-cost shoreline protection in Massachusetts. pp. 373-387 in Proceedings of the specialty conference on coastal structures 79. Alexandria, Virginia.

Sand-filled fabric bags have been used successfully for low-cost, temporary shoreline protection in many areas of the country. The effective application of these bags was investigated at several sites in Massachusetts. A temporary groin was constructed for investigations prior to a planned large-scale beach nourishment program. The bags were also used as toe protection for a bulkhead and as a low-cost revetment. Finally, there was an extensive investigation of the "perched beach" concept using the bags as sills. (Author's Abstract)

73. Haines, Barbara. 1978. An overview of wetland protection efforts in New York State. pp. 95-98 in Fish and Wildlife Service, United States Department of the Interior. 1977. Proceedings of the national wetland protection symposium. Reston, Virginia, June 6-8, 1977. Washington, D.C.: United States Government Printing Office. 255 pp.

The State of New York has two regulatory programs for the protection of its wetland resource, the Tidal Wetlands Program and the Freshwater Wetlands Program. This paper summarizes some significant aspects of each program and discusses some of the problems encountered in their implementation. The Freshwater Wetlands

Program is the main focus of discussion in this article.

74. Haynes, James M. 1983. Finding salmon & trout in Lake Ontario. Water Spectrum. 15(1): 30-37.

Describes the history of the Great Lakes fishery including an elaboration of the downfall which occurred in the 19th and early 20th century, and the recent progress that has been made to rebuild the fishery. Predominant portion of this article discusses the methods used to determine the location of fish in Lake Ontario. Radio telemetry and vertical gill netting have helped researchers learn the locations, movements, and habitat preferences of salmon and trout in Lake Ontario. These findings are presented.

75. Haynes, James M. and Joseph C. Makarewicz. 1982. Comparison of benthic communities in dredged and undredged areas of the St. Lawrence River, Cape Vincent, NY. Ohio Journal Sci. 82(4):165-170.

Macroinvertebrate communities were compared in dredged and undredged areas of the St. Lawrence River near Cape Vincent, NY, by sampling with a Ponar dredge in three seasons. No significant differences existed in numbers of Gammarus spp. and species of Oligochaeta between dredged and undredged areas. The chironomids Pseudochironomus and Stictochironomus spp. were significantly more abundant at previously dredged sites. Amoung mollusks, Bithynia Tentaculata and Sphaerium corneum were found in significantly greater densities at undredged areas. The differences in total abundance of invertebrates and abundance of individual species in dredged and undredged areas appear to be related to the presence of gyttjatype sediments caused by breakwater construction and dredging operations at least 40 years ago. (Author's Abstract)

76. Heer, John E., Jr. and D. Joseph Hagerty. 1977. Environmental assessments and statements. New York: Van Nostrand Reinhold Company. 367pp.

Provides a comprehensive background of environmental assessments and impact statements, and narrates the history of environmental evaluation from ancient times to the present, including a complete text of the National Environmental Policy Act (NEPA). Impact statements, which are mandated by NEPA, are discussed regarding definition of an impact statement, required contents, criteria for determining when a statement is

needed, various methods for quantitative and qualitative assessment of environmental impact, and steps in the actual preparation of the impact statement. Also provided are case histories of environmental assessment work in various projects.

77. Heikoff, Joseph M. 1977. Coastal resources management: institutions and programs. Ann Arbor, Michigan: Ann Arbor Science Publishers, Inc. 287 pp.

Examines the 1972 Coastal Zone Management Act and the different ways in which three coastal states--Maine, Rhode Island, and Washington--have tried to implement it. Special attention is paid to state agency structures, state supervision of local land use regulation, the integration of resources management in the coastal zone and statewide, and public participation in program development. (Modified Author's Abstract)

78. Heikoff, Joseph M. 1980. Marine and shoreland resources management. Ann Arbor, Michigan: Ann Arbor Science Publishers, Inc. 214 pp.

Introduces some of the major coastal management programs that the state and local governments of New York have been involved in for years, with the objective of illustrating the complexity of the institutional arrangements of coastal resources management. The study is confined mostly to the New York marine coast which includes Nassau and Suffolk counties on Long Island.

79. Heikoff, Joseph M. 1975. Shorelines and beaches in coastal management: a bibliography. Monticello, Illinois: Council of Planning Librarians Exchange (Bibliography 879). 63 pp.

This bibliography contains numerous entries which pertain to coastal zone management, shoreline and beaches, wetlands and estuaries; storms and the shoreline, sedimentation, dredging and mining, recreation, power plants and energy, ports, legislation and legal aspects, and U.S. Army Corps of Engineers projects relative to coastal zone management.

80. Herbich, John B. and Jack Y.K. Lou. 1977. Protection for small craft marinas. Texas: Texas A&M University, Ocean Engineering Program. Texas A&M University Sea Grant Program (TAMU-G-77-002). 4 pp.

This paper discusses, very generally, the protective structures such as fixed and floating breakwaters which are implemented to protect small craft marinas from wave action. It also deals briefly with natural factors that must be considered (erosion, siltation, wave action and circulation) during and after the placement of these coastal structures.

81. Hershman, Marc, Robert Goodwin, Andrew Ruotsala, Maureen McCrea and Yehuda Hayuth. 1978. Under new management: port growth and emerging coastal management programs. Seattle, Washington: University of Washington Sea Grant Program (WASHU-X-78-001). University of Washington Press. 212 pp.

Port development in the United States consumes a large amount of coastal area. It is important therefore that these coastal areas be managed effectively. This publication essentially deals with the federal management programs and generally touches on the relationship these programs have to certain state programs, especially those on the West Coast (especially Washington and California).

82. Hobbs, Carl H. III and Robert J. Byrne. 1981. Shoreline erosion: a problem in environmental management. Coastal Zone Management Journal. 9(1):89-105.

Finding the most satisfactory solution to a shoreline erosion problem, particularly one affecting several owners of private property, is a complex task. In addition to the expected technical-physical analysis of the shore, an economic assessment of the direct and indirect costs of the benefits accrued due to each of several alternative measures or options is required. The efficiency of shore protection is significantly enhanced if entire shoreline reaches are managed with a coordinated strategy rather than with unrelated actions.

83. Holecek, Donald F. and E. Thomas Smiley. 1982. Management guidelines for Michigan's Great Lakes bottomland preserves. Ann Arbor, Michigan: University of Michigan Sea Grant Program (MICHU-SG-82-201). 22pp.

In response to the approval of Michigan Public Act 184 on July 2, 1980, bottomland preserves will be established in the Great Lakes. The guidelines presented here serve to provide suggestions for the management of these facilities and also attempt to deal with the anticipated problems that are likely to be encountered in the operation of the underwater preserves.

84. Holmes, Beatrice Hart. 1980. Federal participation in land use decision making at the waters edge--floodplains and wetlands. Natural Resources Lawyer. 13(2): 351-410.

Describes in some depth the sequence of Federal environmental policies, legislation and regulations in regard to floodplains and wetlands. Each new program and associated jurisdictional limits of the Federal government are also discussed.

85. Hubbell, Walter D. and Fred H. Kulhawy. 1982. Coastal structures handbook series: environmental loads. Albany, New York: New York Sea Grant Institute. First Impressions Report. 217 pp.

Coastal structures are constantly subject to numerous natural and man-made factors which have the potential to significantly alter the analysis, design and construction of a structure. These factors may also affect the life and maintenance costs of the completed structure. Collectively, these factors are defined as environmental loads.

This publication presents numerous environmental loads and discusses interactions between these factors and coastal structures that should be considered during design and construction.

86. Jaakson, Reiner and John A. Geraghty. 1976. Public access to shorelines through use of easements. Recreation Canada. No. 34/2/76. pp. 49-55.

Urban developments, extensive private ownership, and a shortage of public roadways in certain areas have all contributed to the accessibility problem that exists. along the Great Lakes. This article seeks to alleviate these problems through the use of the public access zone concept, which is explained to a limited degree. It is intended that this concept along with others can be assimilated into a multilateral program that will increase the recreational opportunities for the general public.

87. Jackivicz, Thomas P., Jr. and Lawrence N. Kuzminski. 1973. The effect of the interaction of outboard motors with the aquatic environment--a review. Environmental Research. 6:436-454.

The effects of the compounds associated with outboard motor subsurface exhausts on water quality and aquatic biota are reviewed. The problems associated with diminished water quality may include the formation of undesirable tastes and odors and the appearance of oily substances. It has been demonstrated that outboard motor exhaust water can exhibit a toxic effect in sufficiently high concentrations to fathead minnows and bluegills, taints the flesh of various fish, and may affect the reproduction of fish.

A discussion of the current research related to the effects of outboard motors on the aquatic environment is presented. Recommendations are given for future research to broaden the understanding of the interaction of outboard motors and the aquatic environment.

88. Jaworski, Eugene and C. Nicholas Raphael. 1978. Coastal wetlands value study in Michigan. Fish, wildlife, and recreational values of Michigan's coastal wetlands. Twin Cities, Minnesota: United States Fish and Wildlife Service, Region III. 225pp.

This publication presents a survey of the existing literature pertinent to Michigan's coastal wetlands. The values of wetlands to waterfowl, furbearers, nonconsumptive users and the commercial and sport fishery are discussed. The findings of this study reveal that wetland environments provide important ecological and economic values to the general public. These findings are important because Michigan has already lost approximately 70% of its original coastal wetlands.

89. Johanson, Edward E. 1976. The effectiveness of silt curtains (barriers) in controlling turbidity. pp. 183-206 in Dredging: environmental effects & technology, Proceedings of World Dredging Conference, San Pedro, California.

This paper presents the results of a study to determine the effectiveness of silt curtains in controlling the turbidity of dredging operations. Conditions under which curtains are effective along with optimum deployment techniques, and a summary of problems encountered while using turbidity curtains are included. (Modified Author's Abstract)

90. Johnson, Lynn E. and William V. McGuinness, Jr. 1975. Guidelines for material placement in marsh creation. Hartford, Connecticut: Center for the Environment and Man, Inc. (CEM Report 4165-519). 225pp.

This report presents a systematic set of guidelines for creating new marshes from dredged material under a variety of situations and constraints. New marshes are characterized on the basis of the freguency of dredging, confinement requirements and the need for surcharging. Pertinent information on important physical environmental factors, dredging and disposal operational practices, and engineering properties of dredged materials is used to develop guidelines for creating each type of marsh. (Author's Abstract)
Predominantly concerned with marine tidal marshes.

91. Johnston, Sam A., Jr. 1981. Estuarine dredge and fill activities: a review of impacts. Environmental Management. 5(5):427-440.

Dredge and fill activities in estuaries have many environmental effects, most, although not all, deleterious. These effects include reduced light penetration by increased turbidity; altered tidal exchange, mixing, and circulation; reduced nutrient outflow from marshes and swamps; and creation of an environment highly susceptible to recurrent low dissolved oxygen levels. Ways to mitigate the effects of dredge and fill operations include careful pre- and post-construction environmental studies; use of bridging to create roadbeds where coastal wetlands can not be avoided; use of a turbidity curtain and other means to control turbidity; dredging during periods of low benthic populations; and thoughtful disposal of spoil, such as locating spoil sites on the uplands with proper diking.

92. Jurgensen, K.M. 1976. Know your mud, sand and water: a practical guide to coastal development. Raleigh, North Carolina: University of North Carolina Sea Grant Program (NCU-G-76-007). 32pp.

Presents a brief explanation of the natural coastal processes, paired with some general management tools governments and citizens have at their disposal. Useful for estuaries and coastal management in marine areas.

93. Kalter, Robert J. 1971. The economics of water-based recreation: a survey and critique of recent developments. Ithaca, New York: Cornell University. Institute of Water Resources REport 71-8.

This report is a survey and critique of the literature and practices of estimating the use and benefits from outdoor recreation for the purpose of determining the direction of further research efforts by the Corps of Engineers. The report outlines the conceptual and empirical difficulties associated with the various methodologies in use, and suggests promising approaches to improved analysis within the framework of multiple objectives of water resources development. (Author's Abstract)

94. Ketchum, Bostwick H. 1972. The water's edge: critical problems of the coastal zone. Cambridge, Massachusetts: The M.I.T. Press. 393pp.

This report represents the judgements of some sixty professionals who participated in the Coastal Zone Workshop at Woods Hole, Massachusetts. The participants discussed the problems that have been created by man's use of coastal resources. Guidelines and recommendations are presented for actions which can be taken to ameliorate, correct, or improve the present and predicted deterioration of the coastal environment.

95. Knutson, P.L. 1977. Planting guidelines for marsh development and bank stabilization. Coastal Engineering Technical Aid No. 77-3. Fort Belvoir, Virginia: Coastal Engineering Research Center. 21pp.

This report provides guidelines for the establishment of vegetation for marsh development and bank stabilization in coastal areas. Discusses plant selection, seed application rates, plant spacings, fertilization requirements and estimates of the amount of labor involved in a planting project. Direct advice is given for planting projects in marine environments.

96. Koehn, Enno and James A. Rispoli. 1982. Protecting the environment during construction. Journal of Construction Div ASCE. 108(2):233-246.

Present practice indicates that nonpoint pollution sources will be most effectively controlled by a combination of fitting the development to the particular site, reducing, if possible, the grading and

exposure of bare soils, and by applying control measures at the proper times. Methods to reduce the amount of erosion and the resulting pollution due to the tranportation of sediments are presented and an expression designed to measure soil loss is outlined. Examples and construction cases are presented. The importance of air quality and control of miscellaneous wastes such as pesticides and fertilizers is emphasized. The control of storm water during construction and the life of the facilities being built are also discussed.

97. Kusler, Jon A. 1970. Regulations to reduce conflicts between recreation water uses. Research Report 65. Madison, Wisconsin: University of Wisconsin, Department of Natural Resources.

This report examines the use of police power regulations enacted at local levels to minimize conflicts between recreational uses of lakes and streams. It explores the problem of surface water conflicts, regulatory techniques to minimize conflicts, and the legal requirements for alternative regulatory approaches. It discusses legal and policy arguments concerning the state or local government level necessary for adoption of specific surface water zoning regulations. Recommendations for specific alternative approaches for state, local, or conjunctive regulation of waters to resolve conflicts in Wisconsin. (Modified Author's Abstract)

98. Kusler, Jon A. 1978. Strengthening state wetland regulations. United States Department of the Interior, Fish and Wildlife Service. Washington, D.C.: United States Government Printing Office. 147pp.

This report was prepared to assist States in developing and strengthening wetland protection programs that would receive approval under Sections 208 and 404 of the 1977 amendments to the Clean Water Act. Two versions of a draft statute are provided, and are to be used as a basis for new wetland protection efforts. Various regulatory programs from coastal states are provided for comparisons; however, only minimal policies are discussed concerning inland wetlands.

99. Kussy, Edward V.A. 1982. Wetland and floodplain protection and the federal-aid highway program. Northwestern School of Law of Lewis and Clark College Environmental Law. 13(1):161-264

This article documents the current relationships between the Federal-Aid Highway Program (FAHP) and the federal laws, regulations, and policies that provide for the protection and regulation of activities in wetlands and floodplains. Additionally, since the FAHP is an old program and since many of the laws discussed here have been enacted or significantly expanded in scope since the mid-1960's, this article illustrates how an established program has accommodated new environmental safeguards.

100. Laird, Beverly L. and Martha A. Patton. 1974. Annotated bibliography of documents related to estuarine and marine sanctuaries. Special Report No. 49 in Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science. Gloucester Point, Virginia. 47pp.

This bibliography includes 217 entries and is intended to review the background of estuarine sanctuaries and the development of conceptual and policy alternatives for the implementation of legislation that authorizes the establishment of marine sanctuaries.

101. Larson, Joseph S. 1976. Models for assessment of freshwater wetlands. Massachusetts: University of Massachusetts Water Resources Research Center Report 32. 91pp.

Four sub-models for relative and economic evaluation of freshwater wetlands are presented within a single, three phase eliminative model. Phase I identifies wetlands which should be protected at all costs. Phase II applies wildlife, visual-cultural and groundwater sub-models to those wetlands which do not meet the criteria for outstanding wetlands. Phase III develops the economic values of the wetlands evaluated in Phase II.

102. Leopold, L.B., F.E. Clarke, B.B. Hanshaw, J.R. Balsley. 1971. A procedure for evaluating environmental impact. U.S.G.S. Circular No. 645.

Presents a procedure to assist in developing uniform environmental impact statements. The system is based on a matrix which is general enough to be used as a reference checklist or as an abstract of the text of the environmental assessment. The proposed manner of

using the matrix is aimed at separating factual information on magnitude of each type of impact from the more subjective evaluation of the importance of impact. An example of an impact assessment using matrix analysis is presented. (Modified Authors Abstract).

103. Lyon, John Grimson. 1980. Data sources for analyses of Great Lakes wetlands. pp. 516-528 in American society of photogrammetry, 46th Annual Conference, March 9-14, 1980, St. Louis.

This paper presents a comparison of data sources for assessing quantity and variety of coastal zone wetlands. The information supplying capabilities of aerial photography, LANDSAT imagery and SEASAT radar data was evaluated. This was accomplished by mapping wetlands in relation to Great Lakes water levels. The value of each source is examined in a framework of data gathering and analysis for purposes of coastal zone management. (Author's Abstract)

104. Mann, Richard A. and Mike Miles. 1979. State land use planning: the current status and demographic rationale. Journal of the American Planning Association. 45(1):48-62.

Recent history has shown an increase in land planning activities at the state level. This study identifies the critical issues involved in state level planning and surveys the status of such planning in the fifty states. Interstate variations are discussed in terms of demographic differences and possible future trends are suggested.

105. Marcellus, Kenneth L., George M. Dawes and Gene M. Silberhorn. 1973. Local management of wetlands--environmental considerations. Special Report No. 35 in Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science. Gloucester Point, Virginia.

This publication defines wetlands according to Virginia environmental laws. It discusses wetlands in general terms and outlines the nature and purposes of shoreline developments and structures, indicating some of their effects and describing some means of mitigating adverse effects. Permit processes and the roles of other agencies in the management system of Virginia are reviewed.

106. Marr, Paul D. 1976. Governmental jurisdiction of the New York coastal zone: an analysis of coastal programs summary. Albany, New York: New York Sea Grant Institute. 36pp.

This booklet summarizes governmental responsibilities in the coastal zone of New York State. One of the major problems facing those interested in coastal affairs is understanding the complex web of agencies and programs involved. For both of New York State's coastlines--along the Atlantic and along the Great Lakes--this publication outlines the work of every relevant agency: international, interstate and state, and regional. (Author's Abstract)

107. Marr, Paul D. and Eugene K. Schuler, Jr. 1976. Governmental jurisdiction of the New York coastal zone: an analysis of coastal programs. Albany, New York: New York Sea Grant Institute. 116pp.

This report clarifies the great number of agencies and programs for both the marine and Great Lakes coastal zones of New York State. It introduces and summarizes the work of every agency with responsibility for coastal activities: international, federal, interstate, New York State, and regional organizations/ boards/commissions/authorities. Matrices, maps, appendices, and a bibliography illustrate and augment the text. (Modified Author's Abstract).

108. Massachusetts Institute of Technology (MIT) Marine Industry Collegium. 1977. Computer models for environmental engineering and research in near-coastal environments. Cambridge, Massachusetts: Marine Advisory Services, Massachusetts Institute of Technology (MIT) Sea Grant Program (MIT-Ti-77-003). 31pp.

Presents a collection of computer models developed by MIT Sea Grant, to predict the impact of engineering activities in the coastal environment. Four models are discussed (CAFE-1, CAFE-2, DISPER-1 and DISPER-2); each has been designed for use in near-coastal environments and is dependent upon hydrodynamic circulation. These can be used to predict the flow of sediments after dredging or the movement of thermal plumes and industrial outflows. This publication provides a brief description of each of the models and discusses their strengths and weaknesses.

109. McCauley, James E., Robert A. Parr, and Danil R. Hancock. 1977. Benthic infauna and maintenance dredging: a case study. Water Research. 11(2):233-243.

Monitoring studies of a small maintenance dredging operation in Coos Bay, Oregon, showed that significant decreases of benthic infaunal abundance occurred immediately after dredging and extended at least 100 m. from the site of actual dredging. The infauna re-adjusted to pre-dredge conditions within 28 days in the dredged area and within 14 days in the adjacent areas. At the spoil site a similar decrease was followed by a 2-week recovery period. The authors suggest that an area subjected to maintenance dredging is also subjected to frequent disturbances from ship movements and other harbor activities and that the infauna are well adapted to this. Thus, maintenance dredging is a relatively normal event and should not be expected to have catastrophic effects.

110. McEvoy, James III and Thomas Dietz (eds.). 1977. Handbook for environmental planning: the social consequences of environmental change. New York: John Wiley & Sons, Inc. 323pp.

This publication discusses the social impacts that need to be considered during environmental planning. The topics chosen for discussion in relation to social impacts are law, demography, land use, economics, transportation, sociocultural effects and the display and integration of information. Chapter outlines and topical indices are contained which serve as overviews to the contents of each chapter and provide specific locations of impact checklists and data sources.

111. McHarg, Ian L. 1969. Design with nature. New York: Natural History Press. 197pp.

This book is based on the premise that man must work with nature. It describes a series of situations in which the ecological approach was used, including preservation of the New Jersey shore, an open space plan for Metropolitan Philadelphia, a study of Staten Island, a landscape plan for Washington, D.C., and a study of health and pathology in Philadelphia. This book is a major contribution to the area of planning theory and practice.

112. Mitre Corporation. 1975 Guidelines for the environmental impact assessment on small structures and related activities in coastal bodies of water. for the U.S. Army Corps of Engineers, New York District. McLean, Virginia: The Mitre Corporation.

Presents information to assist in the identification and analysis of impacts related to permit applications for riprap; bulkheads, groins; mooring piles; dolphins and ramps; dredging; outfalls, submerged pipes and lines; and aerial crossings. For each of the above headings there is a detailed definition, description of main uses, analysis of construction methods, and a hypothetical composite case study describing typical impacts. Tables and information permit a general analysis of the magnitude of impacts based on the size of the project. A detailed description of environmental factors (air and water quality, noise, ecology, flooding, etc.) precedes the impact assessment segments and several useful appendices on erosion, runoff, water and air quality and navigation conclude this report.

113. Morrison, W. David, Jr. 1979. The impacts of development of wetlands on water quality. Detroit, Michigan: Southeast Michigan Council of Governments. 111 pp.

This report evaluates the functional role of wetlands in terms of their beneficial impacts upon water quality. Wetland characteristics and ecosystems are described in detail.

114. Morton, James W. 1977. Ecological effects of dredging and dredge spoil disposal: a literature review. United States Fish and Wildlife Paper 94. United States Fish and Wildlife Service.

Provides a comprehensive review of the literature on the physical, chemical and biological effects of dredging and spoil disposal in estuaries and identifies alternative spoil disposal methods. Specific objectives were to identify the most critical problems relating to dredging and spoil disposal and to summarize the progress made to date in solving these problems. Using literature search facilities, bibliographies, and communications with experts throughout the United States, about 520 scientific and technical articles on dredging and disposal, as well as information extracted from selected articles are included in this review. (Modified Author's Abstract)

115. Mulvihill, E.L., C. A. Francisco, J.B. Glad, K.B. Kaster and R.E. Wilson. 1980. Biological impacts of minor shoreline structures on the coastal environment: state of the art review, volume I. United States Fish and Wildlife Service, Biological Services Program (FWS/OBS-77/51). 156 pp.

This review summarizes and evaluates the information found in literature for each type of shoreline structure. Descriptions of the structures and their physical and biological impacts are presented in an organized and useful format. Additional studies that are relevant to the subject are identified, and selected case histories depicting impacts of structures are presented as part of the review.

116. Mulvihill, E.L., C.A. Francisco, J.B. Glad, K.B. Kaster and R.E. Wilson. 1980. Biological impacts of minor shoreline structures on the coastal environment: state of the art review, volume II. United States fish and Wildlife Service, Biological Services Program (FWS/OBS-77/51). 306 pp.

This volume contains a computer printout of the data base which was used to prepare Volume I, Biological impacts of minor shoreline structures on the coastal environment: state of the art review. The refernces are listed by author and keyword. An extensive annotated bibliography is provided.

117. Myhrum, Christopher B. 1979. Federal protection of wetlands through legal process. Boston College Environmental Affairs Law Review. 7(4): 567-627.

This article discusses the importance of wetlands in the ecosystem, as well as the pressures imposed upon them. The wetland definition is followed by a generalized overview of the Federal presence in water pollution control. Reviews of Federal programs and their elements that are significant to wetlands protection are discussed.

118. Neafsey, Joseph A. 1974. Developing criteria for the evaluation of wetlands. Ithaca, New York: New York State College of Agriculture and Life Sciences, Cornell University. 47 pp.

This report considers the effectiveness of various wetland classification systems, and includes an explanation of the wetlands inventory maps of New York

that are presently being prepared by the New York State Department of Environmental Conservation. A summary of the various applications of aerial remote sensing devices, and a partial estimate of the primary productivity of the various inland freshwater wetlands identified in the classification system used for the development of the wetland maps are discussed. An appendix is provided containing a bibliography and a 1955 acreage estimate of New York State wetlands.

119. New York Nassau-Suffolk Regional Planning Board. 1976. Integration of regional land use planning and coastal zone science: a guidebook for planners. New York Nassau-Suffolk Regional Planning Board.

This report describes methods developed by the Nassau-Suffolk Regional Planning Board for use by planners, which integrate traditional land use planning techniques with scientific knowledge into a framework for assessing the environmental impacts of land use decisions in the coastal zone. The concentration of this publication is mainly on sewage and water quality problems that exist on Long Island.

120. New York State. Department of Environmental Conservation. 1975. Natural resource inventory: a guide to the process. Albany, New York: New York State Department of Environmental Conservation. 70 pp.

This guide was developed to help standardize the efforts of conservation commissions across New York State as they conduct natural resource inventories. The rationale for doing an inventory, getting organized to begin, and procedures to conduct the inventory are outlined along with a description of the physical product and the steps necessary to complete the product. A comprehensive discussion of the information factors which should be included in the inventory and a guide to the sources of that data are presented. An extensive bibliography is also included. (Modified Author's Abstract)

121. New York State. Department of Environmental Conservation and the Office of Parks, Recreation and Historic Preservation. 1982. Strategic plan for economic development through expansion of waterway access to the Great Lakes. Albany, New York: New York State Department of Environmental Conservation and the Office of Parks, Recreation and Historic Preservation. 43 pp.

The inadequacy of public access facilities serving New York's Great Lakes waterways has prevented lakeshore communities and the state from receiving full economic benefits from the recreational resources of the lakes. To eliminate the access problem and to stimulate economic growth, the New York State Department of Environmental Conservation and the Office of Parks, Recreation and Historic Preservation have jointly prepared this plan for the development of major boat and shoreline access facilities. This plan will help to provide safe, adequate, convenient and well-distributed public access to the Great Lakes resources. Thirty-seven high priority sites were selected for immediate action and near-future implementation. These sites are located on Lake Erie, Lake Ontario and the Niagara and St. Lawrence Rivers and are identified and described in this publication. Completion of these priority projects will provide an additional 105 simultaneous boat launchings and approximately 2800 car and boat trailer parking spaces (5600 single vehicle spaces).

122. New York State, Department of State. 1978. Coastal management handbook. Albany, New York: New York State Coastal Zone Management Program. 32 pp.

This handbook is designed to describe the activities of the New York State Coastal Zone Management Program. Discusses the reasons that support the implementation of this program and the expected outcomes if this program is properly managed.

123. Niven, Katherine. 1978. Beach access: an historical overview pp. 161-199 in Kaplan, Milton and Robert I. Reis (eds.). 1978. New York Sea Grant Law and Policy Journal volume II. Albany, New York: New York Sea Grant Institute (NYSGI-Z-79-004).

This article provides an historical background on the problems that surround access and private ownership of the beach. Access laws are traced from English Common Law up to the Coastal Zone Management Act, 1972. Proposed Federal legislation that deals with beach preservation is also discussed.

124. Nixon, Dennis. 1978. Public access to the shoreline: the Rhode Island example. Coastal Zone Management Journal 4(12):65-81.

Competition for the use of our nation's shoreline has produced a thorough analysis of means to accommodate the increased demands of the public for access to the shore. The issue of the public access in Rhode Island is considered at three levels. First, Rhode Island cases involving common law doctrines, such as the public trust, dedication, and so forth, are examined for their relevance. Second, the effect of the federal government in Rhode Island through the Coastal Zone Management Act and its amendments is studied. Finally, two types of state management programs are considered--a Commission for the Discovery of the Rights of Way and the Coastal Resources Management Council.

125. Nixon, S.W., C.A. Ovaitt, S.L. Northby. 1973. Ecology of small boat marinas. Kingston, Rhode Island: University of Rhode Island Sea Grant Program, Marine Technical Report Series No. 5. 20 pp.

Compares basic environmental parameters (nutrients, productivity, biotic diversity, etc.) between two similar neighboring coves in a New England estuary. One area had been developed into a marina and the other area remained in a natural marsh condition. Analyzing the results, the report concludes that marinas can be compatible with and may even enhance the productivity of natural coastal environments.

126. Ontario Ministry of Natural Resources. 1981. Great Lakes shore management guide. Ontario, Canada: Ministry of Natural Resources. 21 pp.

This guide consists of an overview, four appendices and a working example which demonstrates the application of the methodologies to a section of the Canadian shoreline. The overview contains a general discussion of the approaches and factors that should be considered in developing a shore management plan, as well as a framework for organizing the various component studies. Appendices on land-use planning, shore processes, economic evaluation and environmental evaluation provide methodologies for the development and evaluation of shore management plans. (Modified Author's Astract)

127. Ontario Ministry of Natural Resources. 1981. Great Lakes shore processes and shore protection. Ontario, Canada: Ministry of Natural Resources. 77 pp.

This publication outlines, in general terms, basic concepts of shore processes and provides general information on shore protection. Presents an outline of data requirements and sources of information, general guidelines for shore protection, typical drawings of various types of shore protection and a case study. References for detailed design methods for a wide range of applications are given in the shore management bibliography. (Modified Author's Abstract)

128. Parish, Gary E. and J. Michael Morgan. 1982. History, practice and emerging problems of wetlands regulation: reconsidering Section 404 of the Clean Water Act. Land and Water Law Review. 17(1):43-84

In this article the authors explore the problems with the Section 404/wetlands permit program as currently administered by the Corps of Engineers. The authors critique the existing program and provide a guide for the practitioner dealing with its uncertainties. The article also examines the extent to which Section 404/wetlands regulations deviate from enabling legislation and the Constitution, and offers suggestions for reform. (Author's Abstract)

129. Pope, R.M. and James Gosselink. 1973. A tool for use in making land management decisions involving tidal marshland. Coastal Zone Management Journal. 1(1):65-74.

This paper outlines a technique to place a cash value on the ecological values of a tidal marsh. The calculated values for the individual components of the system approach a total "life support" value which is based on the primary productivity of the marsh. Using this value, an analysis is made of the cost of highway construction through coastal marshes which takes into consideration the marshland destroyed.

This system is applicable to other coastal developments such as parking lots and recreation facilities constructed in coastal marshes. (Modified Author's Abstract)

130. Poulin, Kathleen A. 1984. A review and evaluation of regulatory, design and environmental impact considerations for Great Lakes recreation development. M.S. Thesis. SUNY College at Brockport, New York. 130p.

This work reviews common techniques and practices for coastal development, their environmental impacts and mitigations and laws and regulations relevant to coastal

development on the Great Lakes. Included are 175 selected annotations for references on shoreline structures, construction practices, environmental impacts and mitigations and laws and regulations pertinent to coastal development.

131. Pratt, Diana B. 1979. Acquisition of public access sites to the Great Lakes Ann Arbor, Michigan: University of Michigan Sea Grant Program (MICHU-SG-79-214). 57 pp.

Presents various methods used to acquire coastal land for the purpose of public access sites. Consideration is also made concerning access sites for a variety of public uses involving the acquisition of limited and full rights inherent in the land. A variety of costs and payment alternatives are presented involving both public and private sources of funds. The tax consequences are also discussed.

132. Pratt, Diana V. 1981. The legal rights of the public in the foreshores of the Great Lakes. Ann Arbor, Michigan: University of Michigan Sea Grant Program (MICHU-SG-81-209). 24 pp.

Summarizes the legal principles that govern the ownership and use of the foreshores of the Great Lakes. This is a good publication to obtain a general understanding of "water-shore law".

133. Race, Margaret Seluk and Donna R. Cristie. 1982. Coastal zone development: mitigation, marsh creation, and decision-making. Environmental Management. 6(4):317-328.

Marsh creation is currently receiving wide attention in the United States as an important tool for mitigating the impacts of development in coastal wetlands. The perception that there is no net loss in valuable coastal wetlands when development is mitigated by the creation of man-made marshes can have a significant impact on the permitting and decision-making processes. The effective result may be the trading of natural marshes for man-made marshes. Techniques for marsh creation were developed by the U.S. Army Corps of Engineers to enhance and stabilize dredge spoil materials. Most research sponsored by the Corps has been directed at determining whether these goals have been accomplished. A survey of the research indicates that there is insufficient evidence to conclude that man-made marshes function like natural marshes or provide the same important values of natural marshes. It is necessary, therefore, for decision-makers to understand the limitations of present

knowledge about man-made marshes, realistically evaluate the trade-offs involved and place mitigation in its proper role in the permitting process. If this is achieved then conditions that clearly meet state qualifications could be imposed on developments.

134. Reid, Ron. 1979. Shrinking wetlands: what you can do. Ontario Naturalist. 19(2): 38-42.

Describes the difficulties involved in attempting to protect the wetlands of Ontario from continued loss. Ideas for citizen involvement, future wetlands programs and legislation are discussed. Only general comparisions to U.S. wetland programs are included.

135. Reitz, Arnold W., Jr.. 1974. Environmental planning: law of land & resources. Washington, D.C.: North American International Co.

This publication presents the history of wetlands legislation, giving a brief analysis of these laws and some individual state programs. The emphasis is upon basic developmental planning strategies that minimize environmental impacts. These discussions however, are not highly supported by environmental studies, but rather are influenced by legislative history.

136. Reppert, R.J., Wayne Sigleo, Eugene Stakhiv, Larry Messman and Caldwell D. Meyers. 1979. Wetland values: concepts and methods for wetland evaluation. Fort Belvoir, Virginia: United States Army Corps of Engineers, Institute for Water Resources. 109 pp.

This report presents concepts and methods for the evaluation of wetlands. These evaluations are based on the analysis of their physical, biological and human use characteristics. The report discusses these functional characteristics and identifies specifc criteria for determining the efficiency with which the respective functions are performed.

Two wetland evaluation methods are described. One is a nonqualitative method in which wetland areas are evaluated based on the deductive analysis of their individual functional characteristics. The other is a semi-quantitative method in which the relative values of two or more site alternatives are established through the mathematical rating and summation of their functional relationships. The evaluation rating is accomplished by using high (3), moderate (2), and low (1), value estimates. (Modified Author's Abstract)

137. Rossiter, Judith A. and Richard D. Crawford. 1981. Evaluation of constructed ponds as a means of replacing natural wetland habitat affected by highway projects in North Dakota. Washington, D.C.: United States Department of Transportation. 171 pp.

This study evaluates the use of constructed wetlands by waterfowl and other marsh birds. The types and abundance of aquatic plants and macroinvertebrates that are present in constructed wetlands are investigated and the parameters that compose artifical wetlands are compared with those of natural basin wetlands.

138. Sachs, Joel H. 1979. Environmental law and practice. New York: Practicing Law Institute. 544 pp.

This handbook is a reference manual for environmental legislation. Contains easily understandable and useful interpretations of environmental laws and discusses how these laws are implemented and practiced.

139. Saczynski, Thomas M. and Fred H. Kulhawy. 1982. Coastal structures handbook series: bulkheads. Albany, New York Sea Grant Institute. First Impressions Report. 325 pp.

This work is intended to describe the complexities of soil properties, soil-structure behavior and fabrication procedures to provide a rational and simplified design approach for bulkheads and to discuss other pertinent design and construction aspects.

Based upon the evidence found in the literature, a particular design method was selected and a computer was coded. The program was modified so that parametric studies could be conducted and the results could be incorporated into simplified design charts. The reliablity of the chosen design method and resulting design curves was tested by probabilistic methods.

Other design considerations, such as external loading, cost effectiveness, and component design and dimensioning, are elaborated upon. Construction procedures and their impact upon wall performance are also discussed (Author's Abstract)

140. Schnick, Rosalie A., John M. Morton, Jeffrey C. Mochalski and Jonathan T. Beall. 1982. Mitigation and enhancement techniques for the Upper Mississippi River system and other large river systems. Washington, D.C.: United States Fish and Wildlife Service. 714pp.

Extensive information is provided on techniques that can reduce or eliminate the negative impact of man's activities (particularly those related to navigation) on large river systems, with special reference to the Upper Mississipi River. These techniques should help resource managers who are concerned with such river systems to establish solid environmental programs. (Author's Abstract)

141. Schubel, J.R., W.M. Wise and J. Schoof (eds.). 1979. Questions about dredging and dredged material disposal in Long Island Sound. Albany, New York: New York Sea Grant Institute. 136pp.

This booklet provides an overview of the history of dredging and dredged material disposal in the Long Island Sound. Assessments of how these activities have affected the Sound and its aquatic environment, an examination of alternative disposal methods, and a general discussion of research priorities in the area of dredge and disposal of dredged spoil are included.

142. Schwartz, Martin P. and Michael P. Voiland. 1979. Projected economic impact and boat launching needs of a mature salmonid sportfishery for the Western New York Lake Ontario shoreline. Albany, New York: New York Sea Grant Institute. 35pp.

This report systematically generates localized projections of boat launching needs and economic expenditures to assist planners and decision makers of local lake communities in Niagara, Orleans, Monroe, and Wayne Counties, New York. Localized projections of boat launch needs were generated by the growing body of salmonid sportfishery research and marine facility inventories, along with contacts with various statewide and local officials. (Modified Author's Abstract)

143. Seelye, J.G., Robert J. Hesselberg and Michael J. Mac. 1982. Accumulation by fish of contaminants from dredged sediments. Environmental Science and Technology. 16:459-464. Correction 16:886.

The process of dredging and disposing of dredged materials causes a resuspension of these materials and an increase in bioavailability of associated contaminants. A series of experiments were conducted to examine the potential accumulation by fish of contaminants from suspended sediments. These results demonstrated not only the potential for uptake of contaminants by fish as a result of dredging but also the potential utility for fish bioassays in evaluating proposed dredging operations.

144. Shabman, Leonard A. and Sandra S. Batie. 1978. Economic value of natural coastal wetlands: a critique. Coastal Zone Management Journal. 4(3):231-247.

Recent estimates by Gosselink, E. Odum, and R. Pope of the economic value of natural wetlands have had considerable impact on analyses and discussions of public policies concerning natural wetlands management. However, these economic value estimates are neither conceptually nor empirically correct. First, these workers failed to recognize the nature of the process by which economic values are determined and made an illegitimate combination of the principles of systems ecology and economic theory. Second, where Gosselink, et al. attempted to apply proper economic principles, their calculations resulted in economic value estimates that are most likely in error. (Modified Authors Abstract

145. Shabman, Leonard A. and Sandra S. Batie. 1981. Basic economic concepts important for wetlands evaluation. pp.431-443 in Richardson, B. (ed). 1981. Selected proceedings of the midwest conference on wetland values and management. Minneapolis, Minnesota: Freshwater Society.

This paper provides a general introduction to the concepts of wetland economic values and the tools which are available to measure these values in developed or natural wetlands. A brief review of some of the methods of evaluation (use of market prices, land price analysis, travel cost, and the contingent valuation method) are presented.

146. Sherk, J. Albert, Jr. 1971. The effects of suspended and deposited sediments on estuarine organisms--literature summary and research needs. Solomons, Maryland: University of Maryland, Natural Resources Institute (Contribution No. 443).

Provides an exceptional review of the available literature on the impacts of dredging and construction in the estuarine environment. The effects of sedimentation on biological systems and on filter-feeding organisms are extensively reviewed.

147. Shuey, Allen G. and Lawrence J. Swanson, Jr. 1979. Creation of freshwater marshes in West Central Florida. pp.57-86 in Cole, D.P. (ed.). 1979. Proceedings of the 6th annual conference on the restoration and creation of wetlands, Hillsborough Community College, Tampa, Florida.

Three approaches for establishing freshwater marsh vegetation were tested. The approaches were natural colonization, selective planting, and mulching with organic material from natural marshes. The three methods were evaluated ten months after establishment by comparing species composition and water quality to natural marshes. Preliminary results indicate that freshwater marshes can be established by either the selective planting or mulching technique. Mulching results in a larger number of species and a higher ground cover in a shorter period of time.

148. Sly, P.G. 1977. A report on studies of the effects of dredging and disposal in the Great Lakes with emphasis on Canadian waters. Canadian Fisheries & Environmental Scientific Series Report 77. 46pp

Dredging in the Great Lakes is undertaken mostly to maintain navigation, although sand and gravel are exploited to a limited extent. Various studies have been made to assess the influence of dredging practices on water quality. This report focuses primarily on studies in the Canadian portion of the Great Lakes, which in most cases have been undertaken in conjunction with regular dredging operations. (Modified Author's Abstract)

149. Smardon, Richard C. (ed.). 1983. The future of wetlands: assessing visual-cultural values. Totowa, New Jersey: Allanheld, Osmun & Co. Publishers. 226pp.

Contains an introduction to policy and visual-cultural assessment of wetlands in the United States and Britain, followed by an overview of techniques to assess the visual, recreational, and educational values of wetlands. People's perceptions of visual-cultural aspects of wetlands are examined as well as methods for describing the physical attributes of wetlands.
Two chapters on wetland evaluation methods are also discussed. A framework to aid in choosing the proper techniques or group of techniques necessary in different contexts is suggested.

150. Smith, Hanley K. 1978. Habitat creation with dredged material. World Dredging & Marine Construction. 14(8):14-19.

This paper evaluates the results of the U.S. Army Corps of Engineers, Habitat Development Project (HDP), which was designed to evaluate the potential of using dredged material in the creation of wetland (tidal marsh), inland, and terrestrial habitats. The development of man-made habitats on disposed dredged material appears to offer a significant potential for the creation of highly productive communities while at the same time providing for the disposal of large quantities of spoil.

151. Somersan, Ayse and Michael Neuman. 1977. Impacts of recreation in the coastal area: demand and supply of recreation in Wisconsin's coastal counties. Wisconsin: State of Wisconsin Coastal Zone Management Program. 94pp.

This study reviews and projects the demand for selected summer recreation activities and presents a summary of the supply of facilities in the coastal counties and communities in Wisconsin. (Modified Author's Abstract)

152. Sorensen, Jens C. 1971. A framework for identification and control of resource degradation and conflict in the multiple use of the coastal zone. Berkeley, California: University of California at Berkeley, Department of Landscape Architecture, College of Environmental Design. 31pp.

This report analyzes the conflicts over occupancy of the coastal zone and proposes an "impact system framework" through which conflicts can be resolved. Includes several large matrices to be used in the analysis process.

153. Sorensen, Jens C. and Marie Demers. 1973. Coastal zone bibliography: citations to documents on planning resources management and impact assessment. LaJolla, California: University of California at LaJolla, Institute of Marine Resources.

This computer automated bibliography contains 1167 references that are relevant to the environmental and socioeconomic impacts of coastal development and resource use. Predominantly oriented toward the California coastal zone.

154. Sorensen, Robert M. 1978. Basic coastal engineering. New York: John Wiley & Sons. 227pp.

This is an introductory text on basic wave mechanics and other coastal processes fundamental to coastal engineering. Its aim is to provide a background from which the reader can pursue a more advanced study of the various theoretical and applied aspects of coastal hydromechanics and coastal engineering design.

The topics covered include:(1) derivation and application of the two-dimensional linear wave theory; (2) three-dimensional aspects of wave motion including refraction, diffraction, and reflection; (3) long period water fluctuations, particularly the tides, tsunamis, basin oscillations, and storm surges; (4) wind wave generation, measurement, analysis, and prediction; (5) wave-structure interaction with an emphasis on piles, cables, floating structures, seawalls, and rubble mound structures; (6) littoral zone processes and their interaction with coastal structures; and (7) diffusion in coastal waters, particularly as related to marine outfall design.

Readers are assumed to have a basic understanding of fluid mechanics and mathematics as presented at the undergraduate engineering level.

155. Sorensen, Robert M. and William N. Seelig. 1977. Hydrodynamics of Great Lakes inlet-harbors systems. pp.1646-1665 in American Society of Civil Engineers. 1977. Proceedings of the fifteenth coastal engineering conference, volume II, Honolulu, Hawaii.

This paper summarizes the hydrodynamic behavior of the inlets and harbors of the Great Lakes, and presents the techniques that were used to predict the hydraulics of these systems. The field data collection program is outlined and the results of the data collection are presented in order to demonstrate the hydraulic response of harbors and inlets, as well as a demonstration of the predictive ability of the analytical techniques.

156. South Carolina Wildlife & Marine Resources Department. Marine Resources Division. 1974. Guidelines for evaluating coastal wetland developments. Charleston, South Carolina: South Carolina Wildlife & Marine Resources Department.

This publication lists and describes the general guidelines to be followed by the South Carolina Marine Resources Division for evaluating applications submitted to the United States Army Corps of Engineers for a permit to alter the tidal wetlands of South Carolina.

157. Stepien, Walter P., Jr. and Segundo J. Fernandez. 1977. Wetlands related legislation in the United States. Miami, Florida: University of Miami Sea Grant Program (MIAU-T-77-004). 78pp.

Provides an overview of wetlands legislation throughout the United States. Includes a general discussion of the history of wetland protection and compares present state programs. The appendix lists state wetland legislation and related statutes in existence in 1977.

158. Stickney, Robert R. and Daniel Perlmutter. 1975. Impact of intracoastal waterway maintenance dredging on a mud bottom benthos community. Biological Conservation. 7(3):211-226.

The effects of hydraulic dredging on the benthic infauna of a mud bottom area were investigated in Georgia in the Atlantic Intracoastal Waterway. Complete displacement of the benthic community was caused by dredging; however, the community began to recover within a month following the cessation of dredging. Within two months the diversity and species composition of the dredged channel were similar to that of a control area and little change in sediment composition resulted. (Modified Author's Abstract)

159. Thibodeau, Francis R. and Bart D. Ostro. 1981. An economic analysis of wetland protection. Journal of Environmental Management. 12:19-30.

Historically, wetlands within metropolitan areas have been filled almost indiscriminately and used for residential or commercial development. As a result, some states have enacted legislation based on either regulation or compensatory taking to preserve these open spaces and to protect public health and welfare. This paper serves to quanify some of the economic benefits of wetlands in the Charles River Basin. This paper also presents some of the legal issues surrounding wetland preservation and suggests the role that economic analysis can play in these land use decisions.

160. Tilton, Donald L. 1981. The environmental impacts associated with developments in wetlands. pp.357-362 in Richardson, B. (ed.). 1981. Selected proceedings of the Midwest conference on wetland values and management. Minneapolis, Minnesota: Freshwater Society.

The environmetal impacts associated with the utilization of wetland ecosystems for stormwater management, wastewater treatment, or other purposes is not widely understood. This paper suggests a conceptual framework which is useful for the preparation of wetland environmental impact assessments, and presents examples of impacts associated with altering the energy budget, nutrient budget, or hydrologic budget of various wetland ecosystems. (Author's Abstact)

161. United States Army Corps of Engineers. 1981. Low cost shore protection. Philadelphia, Pennsylvania: Rogers, Golden & Halpern, Inc. 36pp.

This publication briefly discusses the natural processes that affect shoreline property and the factors involved in erosion and erosion control. The types of low cost erosion control structures available to property owners are presented. These are described in terms of the shoreforms and situations where they can be used successfully, how they protect the shore, the general design features and necessary construction materials and the advantages and disadvantages of each structure.

Provides good descriptions, drawings and pictures that would be very helpful to individuals, groups or communities considering shoreline protection.

162. United States Department of the Army, Coastal Engineering Research Center. 1975. Guidelines for monitoring shore protection structures in the Great Lakes. Fort Belvoir, Virginia: United States Department of the Army, Coastal Engineering Research Center. 38pp.

The extent of wave damage to shores is difficult to predict; it is advisable to observe the behavior of the shore to determine if some protective action is required. After installation of a shore protection structure it is important to continue monitoring shore behavior; and also to inspect for structural changes to determine if the structure is functioning as designed. Optimum and minimum plans for recording shoreline

changes and monitoring groins, seawalls, revetments, and offshore breakwaters are given. Simple shore erosion computations and a data analysis program are presented. (Author's Abstract)

163. United States Congress, Office of Technology Assessment. 1984. Wetlands; their use and regulation. Washington, D.C.: United States Government Printing Office (OTA-O-206). 208pp

Reviews the existing scientific literature to provide information on the ecological functions of wetlands, trends in wetlands use, and the effect of Federal and State programs on wetlands. Much of the regulatory sections deal with the Corps' 404 program, the major pathway for Federal regulation of some activities in the wetlands.

164. United States Department of the Interior, Bureau of Reclamation. 1974. Environmental guidebook for construction. Washington, D.C.: United States Government Printing Office.

This guidebook is designed to help construction people understand how their work relates to the environment. Presents ideas and suggestions to the individual worker and his supervisor about environmental practices they can apply while performing everyday duties. (Modified Author's Abstract)

165. United States Department of the Interior, Fish and Wildlife Service. 1978. Proceedings of the National Wetland Protection Symposium. Reston, Virginia. June 6-8, 1977. Washington, D.C.: United States Government Printing Office. 255pp.

This publication is a collection of the papers presented at the National Wetland Protection Symposium. Research, data gathering, and the establishment of institutions for protection are broadly discussed in relation to wetlands.

166. United States Environmental Protection Agency, Office of Water Programs Operations. 1973. Comparative costs of erosion and sediment control-construction activities. Washington, D.C.: United States Environmental Protection Agency, Office of Water Program Operations (EPA.430/9.73.016). 205pp.

This study extends the work and data of previous reports and provides information on: (1) the cost of retaining sediments on construction sites per cubic yard or material retained; (2) the cost of correcting damages resulting from erosion and sediment deposition in the site and in downstream areas per cubic yard of material removed.

167. United States Environmental Protection Agency, Office of Water Programs Operations. 1971. Control of erosion and sediment deposition from construction of highways and land development. Washington, D.C.: United States Government Printing Office. 50pp.

This publication presents a general review of existing published and unpublished literature on erosion and sedimentation. The control measures used, and those proposed by concerned agencies, along with the administrative approaches to erosion control are discussed and are accented with diagrams and pictures.

168. United States Office of Coastal Zone Management, Department of Commerce. 1976. Coastal facility guidelines: methodology for development with environmental case studies on marinas and power plants. Washington, D.C.: United States Office of Coastal Zone Management, Department of Commerce. 140pp.

This report is designed to provide state coastal zone management (CZM) agencies with information and recommendations for developing guidelines for coastal facility developments. To deal with the need for a relatively simple yet effective approach for coastal facilities, this working paper first outlines a general analytical methodology which can be modified and adapted to fit individual facility development situations. This methodology is then specifically applied to environmental aspects of marinas and power plants.

169. Versteeg, J.H. and John J. Earley. 1982. Erosion control at a delicate highway construction site. Public Works. 113:82-83.

Discusses construction activities used to upgrade a major highway in Oregon and the measures that were implemented to control stream turbidity during and after construction. The practices outlined (although not detailed) in this report include avoiding heavy

equipment contact with the stream, implementation of temporary dikes to separate construction activities from the flowing stream, placement of straw bales in slope gullies to act as sediment filters, and the use of seed and straw mulch on the slopes to hold soil in place and prevent the formation of rivulets and gullies.

170. Weinberg, Robert E. 1976. Coastal zone management involving the boundary waters of New York and Ontario. pp.255-334 in State University of New York at Buffalo Sea Grant Program. 1976. Sea Grant Law Journal, 1. Albany, New York: New York Sea Grant Institute.

This article addresses the need to consider the international implications of New York's coastal zone management projects on Ontario coastal areas. Legalities and treaties that pertain to New York and Canadian boundary waters are discussed. A conceptual framework required to structure a management program for the boundary waters is presented and is expanded to a legal framework capable of achieving a comprehensive and effective management program in the boundary waters of New York and Ontario.

This article does not discuss the impacts of recreation developments, rather it concentrates on pollution and surface water boundary problems.

171. Weyl, Peter K. 1982. Simple information systems for coastal zone management. Coastal Zone Management Journal. 9(2):155-182.

This paper presents information about the contents and outputs of computer information systems that would make them most helpful to coastal managers and decision makers.

172. Wilkinson, Paul F. 1978. Environmental impact of outdoor recreation and tourism: a bibliography. Monticello, Illinois: Vance. 90pp.

The study of the environmental impact of recreation concerns the assessment and analysis of broad classes of impacts caused by the construction and maintenance of a recreation site or service. These impacts have been broken down into four areas; economic, ecological/ physical, social, and psychological. These impact areas are studied in relation to fun parks, inland recreation areas and camping impacts. Very few references are made for water-based recreation activities.

173. Windom, Herbert L. 1976. Environmental aspects of dredging in the coastal zone. CRC Critical Reviews in Environmental Control. 6(2):91-110.

Provides a brief description of the various types of dredges used and the different disposal practices which correspond with each. Water quality and biological impacts of dredging are discussed in a general format and do not include details as to how these impacts directly affect the physiology of aquatic organisms.

174. Wohlwill, Joachim F. 1982. The visual impact of development in coastal zone areas. Coastal Zone Management Journal. 9(3/4):225-248.

The focus of this paper is theoretical, as well as methodological. It reviews previous studies of visual impact and reports research by the author on people's evaluation of the appropriateness of different man-made facilities in different coastal area contexts and other environments. (Modified Author's Abstract)

175. Wood, Lance D. and John R. Hill, Jr. 1978. Wetlands protection: the regulatory role of the U.S. Corps of Engineers. Coastal Zone Management Journal. 4(4):371-408.

The U.S. Army Corps of Engineers administers the only nationwide regulatory program that controls development activities in U.S wetlands. This article examines the statutory authorities, jurisdictional limitations, and evolution of the current Corps regulations, which express a strong policy to protect wetlands, estuaries, and tidal waters from unnecessary dredging, filling, or other alteration. The article explains the organization and procedures of the U.S. Army Corps of Engineers and examines in detail several precedential permit cases which have developed and implemented the Corps "wetland policy." The article also evaluates current and potential policies underlying the regulatory efforts of the Corps of Engineers.

176. Zieman, J.C. 1976. The ecological effects of physical damage from motor boats on turtle grass beds in Southern Florida. Aquatic Botany. 2:127-139.

Observation has shown that beds of turtle grass, Thalassia testudinum, although highly productive, do not recover rapidly following physical disturbance of the rhizome system. In shallow waters the most common form of rhizome disturbance is from the propellers of motor boats.

In turtle grass beds which are otherwise thriving, tracks resulting from propellers have been observed to persist from two to five years. The proportion of fine sediment components is reduced in comparison to the surrounding grass bed.

Damage of this type is most likely to occur in the shallow passes between islands and keys. These areas are also the slowest to recover due to the rapid tidal currents present in the shallow passes.

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