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THE LAND-WATER INTERFACE OF INLAND LAKES AND ITS IMPLICATIONS FOR ECOLOGICAL PLANNING

by
Sari Jane Sommarstrom

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Resource Planning and Conservation)
in The University of Michigan
1976

Doctoral Committee:

Associate Professor Jonathan W. Bulkley, Chairman
Associate Professor Stewart D. Marquis
Professor James T. McFadden
Associate Professor Katharine Warner

DEDICATION

To T. M. J., who lives his life to the fullest and who inspires me to try to do the same.

ACKNOWLEDGEMENTS

I owe a very special thanks to Dr. Jonathan Bulkley for his guidance during my four years of graduate school at the School of Natural Resources. Without his support and encouragement, I doubt I would have ever pursued a doctorate degree. His faith in my ability and concern for my work, especially during this past year of long-distance communication, kept me going even when the end seemed so far away. I believe myself most fortunate to have known a professor of such integrity, good humor, and patience and one who cares about his students.

I cannot name every one who has been of help in writing this dissertation, but a few stand out. Laurel Ames, a staff member of the California Tahoe Regional Planning Agency and long-time observer of planning and politics at Lake Tahoe, was most helpful with sharing ideas, commenting on my proposed scheme of evaluation, and "de-jargoning" my language. Assistance with technical water quality material was gratefully received from Jim Jones of the Lake Tahoe Area Research Coordination Board. The library of the Lake Tahoe Area Council was most useful for researching the history of shorezone events at Lake Tahoe.

Thomas Jopson deserves a life-time supply of ice cream for his merciless but constructive editing of my paper and for kicking me in the rear when I needed it, which was often.

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CHAPTER I

INTRODUCTION

> We must stop acting as though nature were organized into disciplines in the same way that universities are.
>
> -R. Ackoff[1]

"We can respond to nature's laws, even when these are imperfectly understood," proposes Ian McHarg in his landmark book, Design with Nature.[2] Progress in ecological planning has been hampered by our imperfect understanding of nature and of human societies, yet planning decisions cannot wait for a more perfect level of knowledge. In order to accomplish more effective ecological planning, contributions which enable planners and decision-makers to better utilize currently accessible knowledge need to be made to the body of theory in the field and the applicability of these new ideas must be demonstrated. Empirical studies are necessary to evaluate the assumptions and directions of the new theory.

The shorezone of inland lakes, which includes the land and water bordering the shoreline, was chosen for this task because it is a definable area and encompasses many of the problems typical to ecological planning. As the interface between land use and water resource planning, the shorezone represents two areas of specialization within the planning field. Scientific study of the lakeshore, like planning, includes two separate areas of investigation, aquatic and terrestrial. The shorezone is very popular and is subject to

particularly intense human use. As a result of the above three factors, the shorezone presents significant environmental problems and difficult issues for decision-makers to resolve.

Essence of Approach

A theme of interfacing separate areas will pervade this inquiry. In systems terminology, one might call this effort an emphasis on the "linkages" between systems or subsystems.[3] The systems approach, however, connotes a different meaning than what is intended here. Instead of investigating the interrelationships of the relevant subsystems and systems in a holistic framework, this study will examine, directly or indirectly, the threads connecting some of the artificial dichotomies related to ecological planning in the shorezone:

Land use - Water resource planning
Terrestrial - Aquatic ecology
Theoretical - Applied research
Researchers/academicians - Practitioners/planners
Natural - Social sciences
Researchers - Decision-makers
Planners - Decision-makers
Planners - Public
Public - Decision-makers
Researchers - Public

The threads between some of these groups are thin indeed. At a national symposium on land use planning and the environment, it was concluded that the university researcher and the planning practitioner functioned in "two totally separate worlds," having little communication with each other and dependent upon different and conflicting rules of the game.[4] Attempts at interdisciplinary research by biologists, physical scientists, sociologists, and political scientists reveal that a theory of integration among disciplines is almost totally absent. One such group of researchers determined from their mistakes that the most important step in working together is first to conduct studies which will provide information about the interactions between the pertinent subsystems (e.g., aquatic - soil, aquatic - recreation/urbanization).[5] Otherwise, it is very difficult to have a basis for interdisciplinary communication. According to Caldwell, the field of ecology has especially suffered from the traditional split between the social and biological sciences.[6]

A synthesis of ideas is necessary to overcome the preceding problems and to break down the barriers dividing the planning dichotomies, which are certainly not unique to the shorezone situation. In order to appreciate the change of viewpoints in the past as well as the current status of the field, a brief overview of the evolution of ideas will be presented.

Overview of Ecological Planning

The roots of environmental/ecological planning can be traced back to a variety of traditional fields. Natural resource (e.g., forestry, wildlife, agriculture) and public health planning are the primary sources of environmental concepts, according to Hufschmidt.[7] Other disciplines, however, have also contributed much to the development of the field. Physical sciences, such as civil engineering, hydrology, geology, and soil science, have provided a base of understanding upon which to apply ecological principles. The design professionals of landscape architecture and architecture have also been heavily involved in making land use planning decisions. All of these fields progressed separately during the last three decades until the late 1960s--early 1970s, when a turning point arrived, paralleling the rapidly expanding concern for the impact of humans upon the natural environment. That change in perspective was a major breakthrough which created the current concept of ecological planning.

As early as 1944, Graham predicted that man would someday consciously plan the pattern of land use according to sound biological principles and methods.[8] Land management biologists could provide a significant contribution toward land use planning through the prediction of consequences based on their knowledge of natural principles. While focusing upon the management of rural land uses, he believed that conservation might someday become the foundation of a new social philosophy with a much greater scope. An application of Graham's proposal was later made by a Canadian ecologist.[9] This study

determined land capabilities and suitabilities for various natural resource uses based on the combined intrinsic properties of landforms, soils, vegetation, and wildlife. Succeeding studies have expanded upon his application for general ecological planning.

An anthropocentric approach characterized another version of traditional environmental planning. At first concerned only with public health, the field broadened its purposes by the 1960s to include a more general concern for human welfare. Kates defined comprehensive environmental planning as "the conscious organization and manipulation of all aspects of the environment for human ends." Ecologists could not contribute much to this field, he believed, because they felt threatened by human activity and its impact on "their prized plant and animal communities." A human climax to ecological succession must be accepted by ecologists before ecology could prove of value.[10] Less skeptical than Kates, Hufschmidt called for a suitable conceptual framework to tie together human behavior and natural environmental processes. His proposed "rational decision-making model" maximized a hypothetical objective function composed of three general objectives: 1) physical and mental health, 2) aesthetic pleasure, and 3) wealth (national, regional and group income). Although subject to physical, social, political, and biological constraints, such an optimizing model continued to assign higher priority to human values than to environmental values.[11]

A blending of these values to provide practical applications was described by McHarg in 1969 in his "ecological determinism"

approach. Nature provides both opportunities and limitations to human use, and land uses should respond to the intrinsic suitabilities of land. Through ecological inventories, the best location for urbanization and certain other land uses can be determined. These inventories may also include human ecology factors, such as incidence of crime and disease and location of ethnic neighborhoods.[12]

As a result of the legal and political process (e.g., NEPA), the field of ecology was recently forced to become predominantly an applied science. Applied ecologists have been exploring analogies and common themes between natural ecosystems and urban/human systems for several years.[13] All of these ecologists-turned-planners believe that ecological principles must be incorporated into planning decisions, but they urge caution in the scope of a planner's actions. Incremental actions, deemed ecologically sound individually, may cumulatively combine to upset the stability of the ecosystem. The scientists admit, though, that ecology has not yet become enough of a predictive science to provide adequate warning of impending environmental instabilities.

As helpful and well-meaning as these ecologists intend to be, their vague, cautious, and general prescriptions do not provide planning practitioners with the sort of specific or confident advice they need for their daily decisions and work. Much of their work is unintelligible to laymen because of the jargon, complex models, or mathematical equations. Professional controversy over "basic" principles of ecology, such as the relationship of diversity to stability in the

environment, only tends to confuse planners and reduces their level of confidence in ecologists' recommendations and platitudes. While it is still urgent to impart key ecological principles to professionals in applied fields, it is also urgent to continue basic research in ecology in order to advance our limited understanding of nature's laws.[14]

In the meantime, planners are attempting to respond to the need for environmental aids. The American Society of Planning Officials (ASPO) maintains a large research service to help planners. A recent research paper, "Performance Controls for Sensitive Lands," presents some methods of moving from basic ecological principles to public policy decisions to implementation through regulatory mechanisms. Examples are given of actual programs and ordinances which have made some progress towards this end.[15] In another effort, Twiss discusses and critiques nine current approaches to environmental planning. These methods show a wide discrepancy in the application and success of incorporating ecological knowledge into planning practice.[16] Besides the land capability/suitability basis for planning, attempts are also being made to apply the ecological principle of "carrying capacity" to regional and environmental management, but not without considerable difficulty.[17]

Environmental Evaluation Schemes

Several ecological planning and environmental impact methods have been developed in recent years to cope with the need for better

decision-making. These methods may focus on general environmental issues,[18] a specific resource,[19] or certain geographic locations.[20] While all of these techniques have tried to address the needs of planners and decision-makers, they have failed to be effective in practical situations. Their primary fault lies in equating the complexity of the environment with complexity in approach and design. These methods have proven impractical in most circumstances because they require a large amount of data, expertise, and money, which lower levels of government and planning cannot afford. Besides these basic limitations, other weaknesses involve:

a) An awkward or incomprehensible format for users,

b) The frequent requirement for quantification of both tangible and intangible values,

c) Failing to deal realistically with limitations in our current understanding,

d) The assumption that the values of planners or experts reflect those of society,

e) The neglect of the true needs and capabilities of planners, decision-makers, and the general public,

f) A reliance on abstract thinking to understand interrelationships within the environment.

Despite such difficulties, progression is still in the direction of becoming ever more "sophisticated," which tends to be synonymous with "complicated." Sorensen, for instance, feels his stepped matrix approach to coastal zone decisions would be improved through computerization.[21] Although this tendency towards relying on computers for

modeling and information retrieval has its advantages, it moves further away from satisfying the demands of the people which the new methodologies are intended to serve. Ideally, the provision of some sort of model which could handle the pertinent data, values, constraints, and objectives, and could crank out the perfect solution would please a lot of people.[22] Practically, such a solution is not possible.

In our drive for reducing uncertainty and perfecting environmental decision tools, we have lost sight of our purpose in developing new environmental decision tools. This purpose is to make the tools usable and practical for the people who are making critical choices affecting future environmental quality. A large number of these people, if not a majority, are non-professionals who are confused and skeptical about the rash of environmental regulations being pushed upon them by higher levels of government. Since the existing schemes do not appear to work for them, a new and more effective approach is needed.

Objectives of Analysis

The field of ecological planning has made considerable progress in the last ten years despite the relatively primitive state-of-the-art in ecology. Since certain ecological tenets seem to reflect a "common sense" attitude toward nature (e.g., interdependency), it would seem that these concepts could easily be accepted and practiced by the non-ecologist. Planners, decision-makers, and the public

often seem confused, antagonistic, or frustrated by attempts to practice ecological planning, though. An examination of ecological planning and management at the shorezone will provide insights into and propose solutions for this problem by meeting the following objectives:

1) Analyze the existing literature relating to shorezone planning and management, emphasizing the need for integration between the land use and water resource fields;

2) Develop a theoretical scheme of evaluation to more effectively translate the critical considerations of ecological planning for the shorezone to those most involved;

3) Evaluate the shorezone planning process at Lake Tahoe;

4) Demonstrate the applicability of the scheme to practical shorezone issues at Lake Tahoe.

NOTES

[1]R. Ackoff, General Systems (Ann Arbor: University of Michigan Press), 5 (1960):6.

[2]Ian McHarg, Design with Nature (Garden City, New York: Doubleday), p. 97.

[3]C. W. Churchman, The Systems Approach (New York: Delacorte Press, 1968), p. 5.

[4]D. M. McAllister, Ed., Environment: A New Focus for Land Use Planning (Washington, D.C.: National Science Foundation, 1973), p. 10.

[5]James McEvoy, "Multi- and Inter-disciplinary Research--Problems of Initiation, Control, Integration, and Reward," Policy Sciences 3 (1972):201-208.

[6]Lynton Caldwell, "Problems of Applied Ecology: Perceptions, Institutions, Methods, and Operational Tools," BioScience 16 (1966): 527.

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[11]Hufschmidt, loc. cit.

[12]McHarg, passim.

[13]See C. S. Holling and M. Goldberg, "Ecology and Planning," J. Amer. Inst. Planners 37(1971):221-230; K. E. F. Watt, Principles of Environmental Science (New York: McGraw-Hill, 1973), 319 p.; R. S. Dorney, "Role of Ecologists as Consultants in Urban Planning and Design," Human Ecology 1(1973):183-200; W. E. Cooper and R. Vlasin, "Ecological Concepts and Applications to Planning," in McAllister, ed., Environment: A New Focus for Land Use Planning, pp.

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[15]C. Thurow, W. Toner, and D. Erley, Performance Controls for Sensitive Lands: A Practical Guide for Local Administrators, ASPO Planning Service Reports #307, 308 (Chicago: Amer. Soc. Planning Officials, 1975).

[16]Robert Twiss, "Commentary--Nine Approaches to Environmental Planning," in Burchell and Listokin, eds., Future Land Use (New Brunswick, New Jersey: Rutgers University, 1975), pp. 235-242.

[17]A. B. Bishop et al., Carrying Capacity in Regional Environmental Management, U. S. Environmental Protection Agency (Washington, D.C.: Government Printing Office, 1974), 170 p.

[18]Luna Leopold, et al., A Procedure for Evaluating Environmental Impact, U.S. Geological Survey Circular 645 (Washington, D.C.: Government Printing Office, 1971).

[19]N. Dee and N. Drobny, Environmental Assessments for Effective Water Quality Management Planning, Battelle-Columbus Laboratories for the U.S. Environmental Protection Agency (Washington, D.C.: Government Printing Office, 1972), 24 p.

[20]J. Sorensen, "A Framework for Identification and Control of Resource Degradation and Conflict in the Multiple Use of the Coastal Zone." M.S. Thesis, University of California, Berkeley, 1971.

[21]Ibid.

[22]For a description of one modeling attempt, see the discussion on Dillon and Rigler's methodology in Chapter II.

CHAPTER II

SHOREZONE PLANNING AND MANAGEMENT

Reason in itself confounded,
  Saw division grow together;
  To themselves yet either neither;
Simple were so well compounded.

-William Shakespeare

INTRODUCTION

The lakeshore environment is one that has great appeal for multitudes of people. Despite such popular attention, the water's edge of inland lakes has been largely neglected as a focus of concern in the field of ecological planning. Its significance is slowly becoming more appreciated by ecologists, planners, and managers as they come to realize the importance of land-lake interactions in their work. To describe the present situation, a review of the pertinent literature will be made. This review will begin with the current state-of-the-art of the applied field as exemplified by certain shoreland management programs in the country. Related issues to be examined are the economic, aesthetic, public access, and legal aspects of the shorezone. Lastly, the ecological relationships and planning and management approaches involved with the shorezone will be surveyed to describe the significance and importance of the lakeshore environment, to provide insight into the problems, and to indicate needs for further investigation.

The interface of land and lake implies a broader area than that of just the shoreline itself. A wider area of attention, the

shorezone, more accurately indicates the true meaning of the lakeshore/shorezone environment.[1] Although the entire watershed has an impact on the lake, the land and water zones adjacent to the shoreline have the greatest or most immediate impact. Inland areas directly bordering the lake are known as the backshore and have a direct effect on the lake's quality through erosion, vegetation removal, and recreational use. The extent of the backshore varies from lake to lake, but it should include development adjacent to the lake and areas of highest visual impact (e.g., cliffs, bays, shore vegetation). The foreshore involves only the normal area of wave run-up between low and high water levels. The nearshore is the shallowest part of the lake and is the water area with the heaviest recreational use, critical wildlife habitat, and the most visible evidence of water pollution. More discussion of these zones will follow.

Several reasons are behind the immense attraction people have for lakeshores. The shoreline is the preferred location for homes, resorts, recreation, and scenic roads. The view from the shoreline, like that from hill and mountain tops, usually provides the most spectacular scenery in the area. Another appealing feature is the cooling effect of the lake waters and offshore breezes, especially during the hot summer months when people are escaping from the hotter environs of the cities. Originally, settlements were probably located on lakeshores because of the easy accessibility to drinking water, transportation, waste disposal, and food supply.

However, a more implicit reason is the personal need for a feeling of open space. Roderick Nash, in his book Wilderness and the American Mind, claims there is a human tendency to want to be near open areas like meadows, lakeshores, and river banks. "Ancient impulses that we scarcely understand cause us to feel vaguely ill-at-ease in deep woods."[2] An unobstructed view across a lake could also have been important for security for the pioneer in his location of a home. Today it may be the same subconscious desire for security that drives so many people to pay the high price of a lakefront home.

The U.S. Bureau of Outdoor Recreation found that 41% of Americans prefer water areas, such as ocean, ponds, lakes, and streams, to other recreation locations.[3] This desire for water-based recreation is so strong that the demand is high even for lower quality areas like reservoirs and other artificial lakes. The unsightliness of a barren shoreline with emergent tree stumps or the unavailability of prime species of sport fish do not seem to deter the public from flocking to these "unnatural" water bodies, even highly eutrophic ones.

The value of lakeshores, as well as the potential threat to them, was particularly appreciated by two biologists writing sixty years ago:

> Much of the scenic beauty of every land lies in its shorelines; and it should be a part of public policy to keep unimpaired as far as possible the attractiveness of all public waters. . . . The famous distant lakes and streams that attract so many people far from home every summer are not more beautiful or restful than many homeland waters once were, or might again be, were but a little public care

> exercised to keep their waters clean and the beauty of their shores and bordering vegetation unspoiled.[4]

As the quote implies, human use of the shoreland does not have to lead to the impairment of its scenic beauty, to the degradation of the lake's waters, or to other shorezone problems. These other problems include shoreline erosion, lakebed dredging and filling, loss of wildlife habitat, disruption of the aquatic and terrestrial ecosystems, lack of public access, and the overcrowding of shoreline facilities. Such problems are, to a large extent, derived from some of man's laws--sociological, economic, and legal--which are interrelated with and common to environmental problems in general. The human causes of the deterioration of our environmental quality have been discussed extensively in works by Caldwell, Whyte, Henning, Nash and others.[5]

In regards to the quality of the lakeshore environment, some researchers contend that misuse of the water's edge has occurred because of mismanagement or a lack of management and planning. With increasing population pressures on the shorezone, though, they are concerned that time is running out for sound planning and management to be able to stem the tide of man's harmful impacts on the area.[6] One water resource planner believes that the root of most problems with the landscape is human ignorance of nature and that public education must be used extensively to counteract the arrogant assumption that all nature exists only for man's benefit. Unlike man's laws, he

says, nature's laws are immutable, and the shorescape will bear the scars of misuse.[7]

Investigators have approached the study of the shorezone either from a land resource perspective or a water resource perspective, but only recently have begun to combine these two. The backshore is in the realm of terrestrial ecologists, land use planners and land resource managers, while the nearshore area comes under jurisdiction of aquatic ecologists, water resource planners, and water quality managers. Other fields that overlap the land-water realms include hydrology and the management of groundwater, floodplains, river basins, watersheds, and costal zones. Specialists in these fields have lately tried to relate the effects of land use changes on the pertinent water characteristics. For the effect on water quality, the studies range from general discourses to detailed simulation models.[8]

In the past, the management of water was of more general concern than the management of land. The water system, Gilbert White claims, "is the first where man has attempted to cope in a rigorous way with integrated management of linked resources in the same area."[9] The development of the water resources field in several ways is more advanced than the land resources field, mainly because of an earlier need for information. Until recently, water, rather than land, has been the country's limiting resource for most development, and public and government attention was forced to focus on the effective management of water resources. Now the finite supply

of both resources has been recognized and environmental quality has emerged in the forefront of concerns. The recent determination of standards and regulations for water, though, have preceded those for land.[10]

The Federal Water Pollution Control Act (FWPCA) of 1965 and its amendments of 1972 separated land use planning from water pollution control, despite an acknowledgement that the two are directly related.[11] Water quality specialists admit that only recently has planning begun to concentrate on the relationship between land use and waste management.[12] The current "208" program for areawide waste-water management, required under the 1972 Act Amendments, has run into difficulties in describing to the public the connection between land use and water quality.[13] A good number of people do not understand why the regulation of land is necessary to protect water, and they resent attempts by government to regulate land use for that reason alone.

A brief review of the state programs which have applied land and water controls for the shorezone will shed valuable light on this planning area.

BRIEF SURVEY OF STATE SHORELAND PROGRAMS

Several states across the country have attempted to deal with their shorezone problems through specific state legislation, ranging from voluntary shoreland zoning to mandatory comprehensive planning and management programs. Wisconsin was the first to focus on

shoreland protection and other states with numerous recreational lakes have followed: Maine, Michigan, Minnesota, Vermont, and Washington. Each approach is different and results have been mixed. A detailed comparative analysis of these experiences would involve a separate investigation. They will be reviewed here to provide an understanding of the current state-of-the-art and the difficulties being encountered.

Wisconsin

The pressures for development along Wisconsin's lakeshores were noticeably increasing and the water quality of its lakes was rapidly deteriorating when the Water Resources Act was passed by the state legislature in 1966.[14] Specific sections for shoreland protection were included in the legislation to provide preventative measures for certain problems such as septic tank seepage. The first of its kind in the country, the Wisconsin shoreland program had to develop original guidelines and procedures for carrying out the Act's provisions. In the process, the state made a bold step forward in uniting land and water resource planning.

The legislation basically requires all counties to adopt a shoreland protection ordinance to guard against such harmful activities as excessive deforestation, marshland destruction, landfills, and erosive scarring. Special shoreland zoning is recommended as the primary tool to implement this goal. This zoning could require a minimum lot area (e.g., 20,000 sq. ft., and 100 lakefront feet);

a 75-foot building setback for the shoreline; establishment of land use districts (e.g., conservancy, recreation-residential, general purpose); regulation of vegetation removal within a 35-foot wide strip parallel to the water; and no boathouses over public waters.[15] In the absence of detailed land use data and expertise, the counties could adopt a Model Shoreland Protection Ordinance designed by the State Department of Natural Resources (DNR). The DNR, however, adopted the strategy of encouraging the counties to draft and enact their own ordinances in order to achieve better local enforcement of the regulations.[16] The ordinance must still meet approval of the DNR to ensure that it satisfies the Act's intent.

As will be discussed in the Planning and Management section, Wisconsin has done much to lead the way for other states by providing a model ordinance, guidelines, technical studies, and educational materials pertaining to the shorezone. Experience over the past ten years has also shown the difficulties and weaknesses of this approach. Certain deficiencies in the original legislation are serious. The state has no power to insure the enforcement of the state-mandated ordinance, nor to review local variances granted by the county.[17] Locally, the regulating agencies have suffered from inexperience, a lack of technical expertise, fear of driving away large developers, and the absence of competent legal advice.[18] Past land use practices continue to prevail in some areas, despite the best intentions of the state.

Washington

Another significant attempt to regulate the shorezone began in 1971 with the passage of Washington's Shoreline Management Act.[19] Haskell and Price described this legislation as the "first major Washington State effort to integrate land use with water quality and water resource planning."[20] While also applying to the state's coastal zone and streams, the Act specifically defines the planning area of lakes to extend 200 feet landward of the ordinary highwater mark and to include all marshes, bogs, swamps, and floodplains. All lakes over 1000 acres in size are classified as Shorelines of Statewide Significance, where the public interest is paramount and where the following uses have priority: those which

1) Recognize and protect the state-wide interest over local interest;
2) Preserve the natural character of the shoreline;
3) Result in long-term over short-term benefit;
4) Protect the resources and ecology of the shoreline;
5) Increase public access to publicly owned areas of the shoreline;
6) Increase recreational opportunities for the public in the shoreline;
7) Provide for any other element deemed appropriate or necessary.

Like Wisconsin, the planning and implementation steps are carried out at the local level with the state overseeing compliance with general policy. Shoreline districts are recommended to be zoned as urban, suburban, rural, conservancy, or natural and each is to be designated permitted uses. State and local governments are required also to

review their existing land use policies regarding land adjacent to shorelines and revise them, if necessary, to be consistent with the shoreline policies. Citizens' Advisory Committees are used to develop Master Programs for each city and county having shoreline jurisdiction.

Phase I of the program centered around the state development of guidelines, plan review, and administrative procedures while Phase II emphasizes local government implementation.[21] The Snohomish County Shoreline Management Plan was cited by the American Society of Planning Officials as an exemplary effort for protecting a fragile area.[22]

Unlike Wisconsin, Washington has the power to review permit decisions by local government and approve of variances. A statutory period of review by the state follows local approval. If disagreement occurs over a local decision by the applicant or by the state, the issue may be appealed to the State Shoreline Hearings Board. Between June 1971 and October 1974, local governments issued 2,580 permits for various shoreline projects. Of these, 171 were appealed to the Hearings Board and 33 resulted in action by the Board.[23] The Director of the Department of Ecology, the responsible state agency, used these figures to prove that the level of control, contrary to public opinion, still basically rests with local government. He felt that the provisions of the Act were quite complex, frequently misunderstood, and occasionally controversial and that, unfortunately, there existed a "widespread public misconception that it is a 'no-no'

Act in which the 'state' somehow pre-empts individual rights, takes private property, and forbids all growth."[24] As will be seen in the Legal section, the constitutionality of the Act has been upheld in the state supreme court.

Other States

Shorezone regulations for the remaining states tend to be variations of the Wisconsin scheme, with both stronger and weaker provisions. Minnesota's Shoreland Management Act of 1969 pertains only to unincorporated lands within 1000 feet of the normal high water mark.[25] The State Department of Natural Resources sets zoning standards but the county must enact and enforce a shoreland zoning ordinance. A comprehensive plan for the maintenance of shorelines and the control of dredging, filling and waste disposal is also required of each county.

Michigan's Shorelands Protection and Management Act of 1970 is directed solely to the Great Lakes and is aimed mainly at protecting high-risk erosion areas and "environmental areas" from misuse.[26] However, the backshore area is classified by the state according to ten shore types based on erodibility and shore height for the determination of its most compatible use (e.g., preservation, conservation, or general use). Regulations regarding inland Michigan lakes come under the Inland Lakes and Streams Act and the Soil Erosion and Sedimentation Control Act of 1972 for such activities as dredging, sediment control, piers, and harbors.[27] Permits for these activities

and others are required from the State Department of Natural Resources. As opposed to some other states, special zoning of the backshore lands or county plans for lakeshores is not mandated.

For lakes larger than 20 acres, Vermont established the policy in 1970 of requiring municipalities to provide shoreland zoning bylaws within two years.[28] The purpose of these bylaws is to: 1) maintain safe and healthful conditions, 2) prevent and control water pollution, 3) protect spawning grounds, fish and aquatic life, 4) control building sites, placement of structures and land uses, preserve shore cover and natural beauty and provide for multiple use of the waters.

Maine instituted a Shoreland Zoning Law in 1971 for shores of municipal "great ponds" larger than 10 acres, in response to the growing deterioration of its lakes.[29] Twenty-seven lakes at that time had serious water quality problems and more than 100 were endangered. Instead of the 1000-foot backshore designation used by Minnesota and Vermont, the width of the zone was whittled down to 250 feet through political compromise.[30] Otherwise, the zoning criteria are quite similar to that of the other states. Most of Maine's towns and cities missed the two-year deadline to zone their shorelands, and the State was forced to impose a one-year moratorium on shoreland development in about half the municipalities. Since most of Maine's towns are quite small, a definite lack of experience and technical expertise in the development of land use controls has been an impediment. As one report suggested, "in all likelihood, some have no

inclination to improve these skills."[31]

The scope and function of the state shoreland programs should be compared to the shorezone program examined at Lake Tahoe in Chapter IV.

PERTINENT ISSUES

Salient concerns for shorezone planning and management also embrace the pertinent issues of economics, aesthetics, public access, and law. While each one is worthy of in-depth study, only the most relevant items found in the literature are discussed in the succeeding section.

Economics

The economic value of the shorezone stems from both market and non-market sources. Lakeshore property almost always has a higher market value than adjacent parcels inland because of its limited supply and extremely high demand. Real estate appraisors have studied the various factors affecting shoreline value and list the following as being most important:[32]

a) Zoning requirements
b) Sewage regulations (i.e., existing sewage system more valuable than septic tanks)
c) Type of beach available
d) Quality of backshore for construction
e) Terrain of parcel
f) number of trees on backshore
g) Amount of shoreline property available / density / size of lake

h) Quality of lake water (e.g., depth, fertility, clarity)
i) proximity to population centers

Developers may be discouraged from constructing along the shoreline if local ordinances and available services increase the cost of development.[33]

An economic trade-off occurs relative to the amount of developed land along the shore. Up to a certain level of development, the value of the property continues to rise as the supply diminishes, but as the 100% level of development is approached, the value may level off or even decrease.[34] The increase in density and the decrease in open space and aesthetics reach a point where the marginal benefits equal the marginal costs for the property buyer. However, David found that no significant relationships exist between land values and the amount of public land in the lake vicinity or the amount of access. She warns, though, that public agencies should acquire shorelands before substantial windfall gains by the private market are made.[35] After determining a monetary value for the traditionally intangible benefits of wildlife, aesthetics, water supply and flood control for freshwater wetlands, researchers concluded from their economic analysis that over 90% of the wetlands in Massachusetts deserve preservation over development.[36]

Various uses of the shorezone also create "spillover effects" or negative impacts which are unaccountable in the economic system. For instance, those who benefit from despoiling a marsh for a second-home development are not the ones who pay for the consequences.

These externalities are common and occur whenever the activities of one entity affects the welfare of other entities who have no direct control over that activity. Ideally, the costs such activities impose on others should be balanced with the benefits derived from those uses. A limitation on the type, amount, and/or location of the activities will help provide this balance.

In a sense, no one entity owns the shoreline scenery and the public lake waters; as a result, the resource attributes of the shorezone represent a common property resource. The problems associated with common property are well known and pose a real challenge to planners and managers. Internalizing these external costs is one solution which Craine asserts can be accomplished institutionally.[37]

Aesthetics

Aesthetic value has been repeatedly mentioned as an important aspect of lakeshores. Beautiful scenery attracts people to lakes, yet increased human use can also destroy the very qualities which were originally attractive. The ecological planner Philip Lewis describes a representative lake scene:

> The typical shoreline is cluttered with the county highway system and all its traffic, individual driveways, inadequate septic systems dumping effluent into the lake, shoreline ramps and matchstick docks cluttering the shoreline.

Architectural controls, clustering of uses, and improved design patterns are some of his recommendations to help save the problem.[38]

The most difficult problem in managing and planning the aesthetic resources is the controversial nature of the definition of "scenic beauty". We seem to know intuitively when it exists and when it does not but have problems in objectively measuring scenic values. In the past decade, techniques have been devised to describe the aesthetic appeal of the landscape and shorescape by Shafer et al., Leopold, Litton, and others.[39] Most involve rankings of key factors on an evaluative scale of 1 through 5 on the basis of either its scenic appeal or unique characteristics. Litton believes that five aesthetic factors of the shore element of the waterscape are most significant: 1) edge definition (vertical and longshore), 2) spatial expression, 3) edge features, 4) riparian environment, and 5) evidence of human impact. In contrast, Leopold's philosophy about aesthetic value differs from the others by attempting to avoid personal preference or bias. "Landscape that is unique either in a positive or negative way is of more significance than one that is common."[40] These attempts at objectivity are intended to be aids in decision making and/or to suggest potential alternatives to a proposed project.

The "interface of land and water" is also singled out as an important aesthetic parameter in a report evaluating environmental impacts that can result from water quality management plans.[41] Unfortunately, the aesthetic responsibility of planning entities is, at best, only vaguely defined. A recent survey discovered that environmental planning agencies are not using any of the developed

aesthetic assessment techniques.[42] Their planners complain that these methods are either too subjective, time-consuming in data collection, not flexible enough, and/or too expensive. Another type of aid needs to be developed to improve planning for the shorescape.

Public Access

Another critical and controversial aspect of the shorezone is the provision of public access through the backshore to the lake waters. The state is the owner of the lake bed in lakes meeting the federal "test of navigability," and is considered the trustee for the public.[43] The state has the power, if it chooses to exercise this power, to provide public access for recreation. For non-navigable lakes (by federal definition), the state may choose any of three tactics to obtain user privileges for the public:[44]

a) Rely on traditional riparian doctrine (to be in the same legal position as other users of the lake surface, the state should acquire submerged lands as well as a right-of-way for the public)

b) Provide a state test of navigability which is more liberal than the federal test, to assert state ownership of the lake water

c) Declare all lakes navigable under state law to be under servitude of common use by the public for recreation.

Various policies have been developed by the states to provide access for the public. In Hawaii, state law requires that 75 feet shoreward of high water at Waikiki Beach be designated for public use.[45] For its reservoirs, the Tenessee Valley Authority (TVA) anticipated public pressure so the agency retained ownership of a thin strip of land adjacent to the water.[46] Originally, the TVA

reserved a 250-foot strip around the reservoirs for public access where tracts were sold, but difficulties arose in prohibiting permanent structures in this public zone. Since TVA was oriented toward maximum development of shoreline land, the public rights were later limited to an area between maximum shoreline coutour and the water's edge. Wisconsin law allows the state to exact public access rights at regular intervals as a condition to the privilege of building a lakeshore subdivision.[47] Through the use of eminent domain, all states could require riparian owners to give the public access to their shoreline and without compensation, though few states have been willing to exercise this prerogative. An incentive is provided by New Jersey by giving tax exempt status to non-navigable private lakes made available to the public.[48]

The legal considerations regarding public access are presently being given much attention in the planning effort for the coastal zone[49] and in the courts. The California Supreme Court in 1970 decided two landmark cases, Gion v. City of Santa Cruz and Dietz v. King, which favored liberal interpretation of the State Constitution's provisions for public access to navigable waters.[50] As a result, a beach could be dedicated to the public if proof exists of at least five years of continuous public use at any time in the history of the land. This "dedication by implication" decision will also be applicable to California's inland lakes, and sets a precedent for other states.

The provision of public access to lakeshores has generally not been a prime consideration in shorezone planning and management until recently. Battles will still have to be fought in court, and management techniques will still have to be developed to ensure optimum public use. In addition, precautions should be taken to avoid the over-use of lakeshores which could arise from unlimited access. One survey of shoreline residents revealed that most did not object to public access as long as strict controls were provided.[51]

Legal

In addition to the complicated questions of the right of public access, there are many legal implications of planning and managing the shorezone on the basis of different criteria than other areas. Both water and land use law doctrines are involved, but it is English common law, partly derived from Blackstone's Commentaries, that is the foundation of most of our present assumptions about shorezone "rights."[52] This historical doctrine declared the sovereign rights of the state, on behalf of the people, in all navigable waters. It also stated that, although the state held these waters in trust for the people, it could make grants of waterfront land and could permit riparian owners to exercise their franchise to develop the waterfront.

However, it is often interpreted that these ancient policies continue to be implied in our present laws. For instance, the "right to wharfage" which riparian owners sometimes consider their "Constitutional" right, is not explicitly mentioned in the U.S. Constitution.

It is only an historical precedent brought over from England. The courts, though, are quite wary of breaking away from this tradition and many states avoid claiming the nearshore and foreshore areas for public use only.[53] Confusion also arises from conflicting claims in property title boundaries. Some supposedly extend to the low water mark of navigable lakes, while the state claims title to the high water mark.[54] East of the Mississippi, riparian law is the rule for water rights and it entitles shoreline property owners to the use of the adjoining water. Appropriation law, dominant west of the Mississippi, allocates water use according to historical claims rather than location.

Zoning of the backshore lands for conservation purposes has been upheld in the courts as well as restrictive use covenants in private deeds.[55] Since 1954, when Justice William O. Douglas wrote the U.S. Supreme Court's majority opinion in Berman v. Parker, the protection of aesthetic values in a community became a valid component of the public welfare.[56] A recent decision on a shorezone case by the New York Supreme Court reaffirmed "aesthetics as a legitimate concept within the general police powers."[57] This McCormick v. Lawrence decision upheld the Adirondack Park Agency's denial of permission for private developers to construct boathouses on Oseetah Lake. Judge Shea's opinion elaborated on the reasons behind this decision:

> It can be seen that the view from the main channel (of Oseetah Lake), which passes close by the Petitioner's property, still retains a scenic view of the trees and shoreline unspoiled by

> over-development . . . that the addition of a cluster of boathouses on a project of this size and in this location would tend to destroy the natural beauty of this area, and that the Agency's decision cannot be deemed arbitrary or capricious.

Other state supreme courts have upheld state shoreland management legislation and procedures. In Just v. Marinette County, the Wisconsin Supreme Court supported the county and state position of using the concept of geographically specific shoreland regulations and special permit techniques for a wetland area to implement the Wisconsin Shoreland Management Act:[58]

> An owner of land has no absolute and unlimited right to change the essential natural character of his land so as to use it for a purpose for which it was unsuited in its natural state and injures the rights of others.

This ruling also clearly acknowledges that compensation is not necessary to the owner when critical natural features serving public interests are at stake. Similarly, the Washington State Supreme Court in 1974 confirmed the constitutionality of the Washington Shoreland Management Act and its restrictions on shoreline development in Department of Ecology v. Ballard Elks Lodge #827.[59] Since the Act "does not purport to totally prohibit such development," but, instead, "stresses the need that such future development be carefully planned, managed and coordinated in keeping with the public interest."

Water and land resource laws are still evolving and are growing less dependent on traditional assumptions and attitudes toward accepted practices. Water law expert Professor Joseph Sax believes changes are very much needed to develop a system of legal rights

which is "based on the articulation and application of modern resource management principles."[60] On the basis of the above shorezone cases, it appears that some progress is being made towards this new system.

Examination of the current status of ecological research and planning and management for the shorezone will provide insight into the significance, problems, and needs of the lakeshore environment.

ECOLOGICAL RELATIONSHIPS

As mentioned previously, the ecological study of the shorezone is usually divided into its terrestrial and aquatic components by researchers. In turn, terrestrial ecosystems are subdivided into biomes on the basis of dominant vegetation type, and aquatic ecosystems are separated into marine and freshwater types by the degree of salinity. Only recently have the two ecosystems been studied for their interactions. One of the major difficulties in developing general principles about the dynamics of land-water systems, claim the ecologists, is that each lake and drainage basin has its own special structural and functional traits.[61] Consequently, theory appropriate for one lake basin may not be applicable to another. Certain common principles, however, are applicable to all lakes.

The body of ecological theory available for understanding ecosystems is still in its infancy, and that of the linkages between terrestrial and aquatic ecosystems only just conceived.[62] Researchers vary in their opinions about the ability of ecology to become a predictive science and eventually guide management decisions, but

they do agree on one point. The limiting factor for the quality of applied research will always be the amount and quality of pure research, and much basic information is still lacking.

Limnologists classify the nearshore region of lakes as the "littoral" region, or the "interface zone between the land of the drainage basin and the open water of lakes."[63] Its depth extends to the limit of habitat available to autotrophic plants and varies considerably from lake to lake, depending on the geomorphology of the lake basin and the rates of historical sedimentation. For example, the edge of the litoral shelf is only 1.5 meters deep in Lunzer Untersee (a European lake), but it is 100 meters deep in Lake Tahoe.[64] The littoral flora, which include macrophytes, periphyton, and phytoplankton, can contribute significantly to the productivity of lakes, particularly in small, shallow lakes where the zone represents a large proportion of the total area.[65] As the lake area richest in animal life, the region also represents critical habitat for the feeding, breeding, and shelter of many land and aquatic vertebrates and invertebrates. Wetlands are probably the most-studied littoral habitat, known for their great diversity of species and significant ecological value.[66]

A further classification of the littoral region is the eulittoral zone (or foreshore), which lies between the low and high annual levels of the lake waters and includes the land area affected by wave action. It is in this zone that the most concentrated ecological interactions occur between land and lake. As the border between

two ecosystems, the eulittoral is a perfect example of an ecotone, representing the "edge effect" of having an increased diversity of species and density of organisms over that of adjacent habitats. Besides the endemic land and aquatic biota, the eulittoral provides special niches for additional species adapted only for this zone. Unfortunately, they have received little study. Researcher Ewa Pieczynska has focused her ecological studies on the eulittoral region of Polish lakes and has developed several conclusions:[67]

1) Organic matter in the eulittoral is utilized by macro- and micro-consumers inhabiting the zone and also in lake and land neighboring areas (after output of the matter from wave action into the lake or by organisms periodically penetrating the zone).

2) The eulittoral aids in the conversion of several kinds of organic matter of land and lake origin, most of which is difficult to decompose. Due to the intense decomposition processes of the eulittoral, the matter is available for use in the nutrient cycle much quicker there than it would have been in typical land and water habitats.

3) The fluctuation of the lake level significantly affects the environmental conditions and biological processes in the intermediate zone (i.e., decomposition and production conditions, stability of benthic communities).

4) Interactions between the drainage basin and the littoral zone vary in different ecosystems and also in certain areas of a single ecosystem and in various seasons of the year. Each lake's shorezone system has a number of functioning "subsystems" which are variously connected with the surrounding areas (i.e., swampy areas with periodical pools).

These findings about the eulittoral region are helpful toward understanding its function and especially the values needing protection.

It is important to recognize the primary sources of imported (allochthonous) materials in lakes: 1) inflow from streams,

2) inflow from sub-surface springs, 3) atmospheric percipitation, 4) products of surface erosion, 6) leaf litter fall, 7) domestic wastes, and 8) industrial wastes.[68] Little data exists, however, on the amount, form, and destiny of this matter once it arrives in the lake body, asserts Pieczynska. New data is now being collected in the U.S. on some of these sources, particularly in conjunction with implementation of the 1972 FWPCA Amendments.[69]

Some correlations between the land and lake systems in regard to nutrient levels of the water have been determined. It is a common generalization that the longer and more irregular the shoreline is in relation to the lake surface area, the higher the productivity will be. Obviously, the larger amount of direct contact of the land with the water provides a greater source of imported materials and a greater area of production by shore plants. Another general theory applicable to particular small lakes is that several productivity parameters (e.g., primary production, phytoplankton biomass, chlorophyll concentration, and nitrogen and phosphorus content), are directly related to the total watershed area and inversely to the lake volume. Quantitatively, this relationship can be described as $(A_d + A_o)/v$, where A_d is the terrestrial drainage area, A_o is the lake surface area, and v is the lake volume.[70]

Other factors affecting littoral zone productivity are:

1) Fertility of the drainage basin
2) Lake depth and slope:
    a) A shallow lake with sloping shores of mud and sand would tend to be more productive than a deep one of

equal size with steep, rocky slopes.

b) Productivity is related to the extent of light penetration and the type of substrate available for plants on lake bottom and on shore.

3) Temperature: lakes of warmer climates tend to be more productive than those of colder ones.

4) Age: in general, lakes naturally progress with age from a low nutrient status ("oligotrophic"), through a middle state ("mesotrophic"), to a highly productive condition ("eutrophic"). The process may be accelerated through excess nutrient input from human activities ("cultural eutrophication").

Until recently, the examination of the linkages between aquatic and terrestrial ecosystems has been largely neglected by ecologists. Two new studies in particular have concentrated on the theoretical understanding of these interactions, one by Likens and Bormann, and the other by Loucks.[72] They both focus on the broader context of the drainage basin as opposed to the shorezone area itself, but their insights into the ecological interactions occuring between land and water within the watershed are still quite important for shorezone planning and management.

A diagrammatic model of the functional linkages between terrestrial and aquatic ecosystems as perceived by Likens and Bormann is depicted in Figure 1. Connecting the two systems are meteorologic, geologic, and biologic vectors which transport nutrients or energy along the illustrated pathways. These components may be defined as follows:

a) Meteorological: primarily air movement, which transports water and dissolved substances in rain and snow, particulate matter, or gases.

b) Geological: the gravitational movement of dissolved and suspended matter in surface and subsurface drainage, and mass movement of colluvial materials.

c) Biological: the animals migrating across ecosystem boundaries.

Rivers and streams are identified as the primary links between terrestrial and standing water systems, though they are also separate ecosystems in themselves. Eutrophication, both natural and man-made, is very much dependent upon the geologic input of nutrients or energy (as organic matter) from terrestrial ecosystems. To illustrate this point, data is presented in the study from areas in both undisturbed and disturbed forest ecosystems to show the interrelationship of the condition of the lands and the gross output in the drainage water of key nutrients. Point source effluents such as urban sewage wastes provided most of the human-caused phosphorus input to lakes, while the diffuse sources of agricultural and deforestation runoff provided most of the inorganic nitrogen.

Several conclusions were made by the authors for the management of aquatic ecosystems for which the "terrestrial-output/aquatic-input" link is crucial:

1) The undisturbed, mature terrestrial ecosystem is quite efficient in minimizing the input of nutrients into basin waters and should be maintained as much as possible.

2) Ecologists can only approximate the effect of a particular action on the ecosystem; they cannot yet predict due to the variable nature of ecosystems.

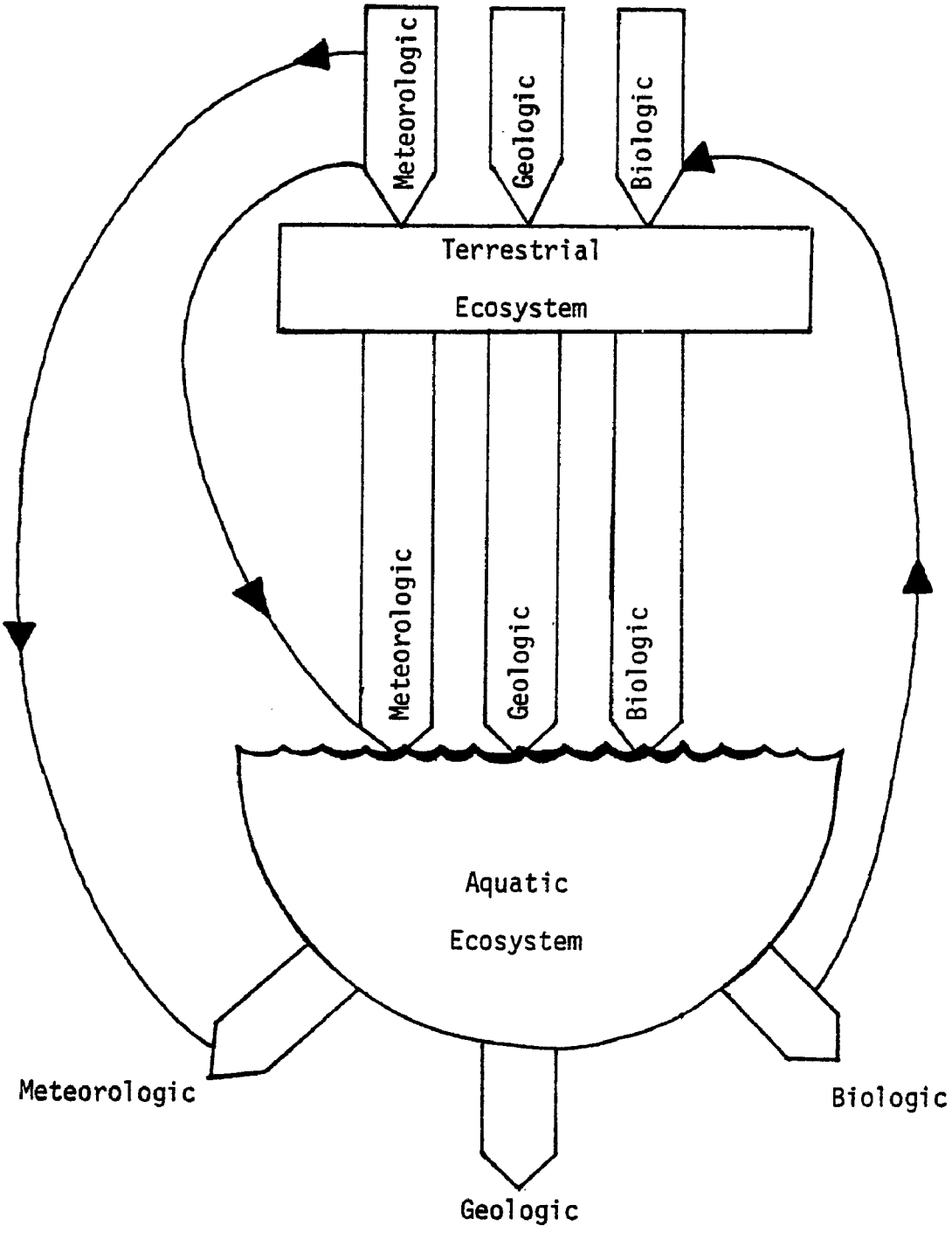


FIGURE 1

FUNCTIONAL LINKAGES BETWEEN TERRESTRIAL AND AQUATIC ECOSYSTEMS

(After Likens & Bormann, 1974)

3) "The key to wise management of aquatic ecosystems is wise management of watersheds or landscapes."

While reticent to discuss the subject of "wise management," the study does seek to identify the key land-water interactions of which planners and managers should be aware and concerned.

In contrast to the former approach, a U.S./International Biological Program (IBP) study under Loucks designed a systems model of the terrestrial and aquatic components of an entire drainage basin. Such research at the scale of the landscape-watershed system had been strongly encouraged by the National Academy of Sciences.[73] The IBP group's image of the significant land-water interactions is somewhat different from Likens and Bormann's study, as shown in Figure 2. The purposes of this second model are to:

1) Provide a framework for a quantitative study based on the biogeochemical cycling between the land and water systems,
2) Help identify control strategies which will ameliorate human impacts.

To follow the dynamics of nutrients, a "transported material systems" model involving nitrogen, phosphorus, carbon, and energy is coupled with a "carrier system" model of atmosphere, water, soil and biomass.

To date, specific conclusions for management cannot be made as a result of this modeling experience. The mathematical description of some of the more complex components of the model is still lacking and the total model has yet to be tested for predictability in the lake studied. The model has helped, though, to set priorities for

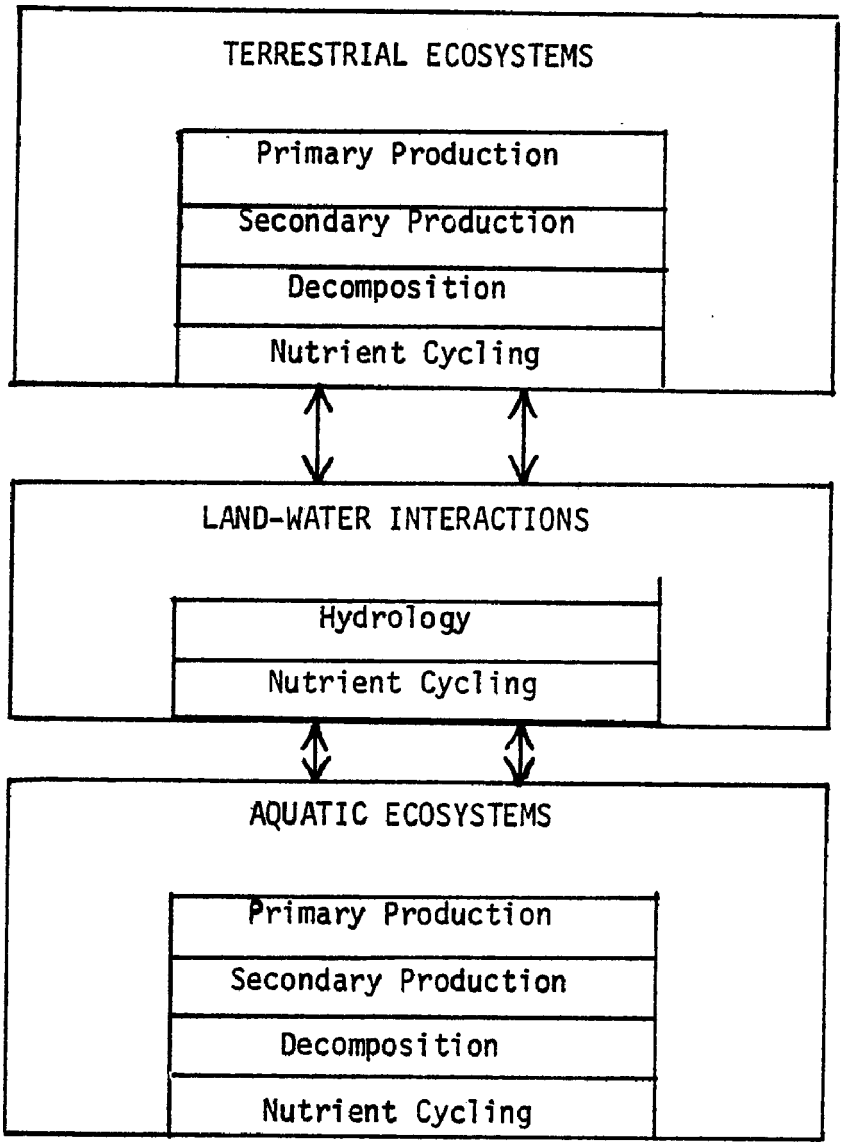


FIGURE 2

LAND-WATER INTERACTIONS

(After Loucks, 1975)

ecosystem research by identifying the particular interactions which are least understood, such as the nutrient-hydrologic interactions at the interface.

As can be seen, the ecological relationships of the shorezone have only begun to be studied. The present quality and quantity of our ecological knowledge is limited, yet decisions will not and cannot wait until all the necessary facts are gathered and new theories are tested.

PLANNING AND MANAGEMENT

It is important to first clarify the distinction between "planning" and "management" as their definitions are only implicit in the literature and often not clearly separated. One often makes a distinction between planners and managers, but the scope of their responsibilities is not always very distinct. MacNeill views management as a "process that begins with goal-setting and extends through the functions of information systems, research, planning, development, regulation, and financing."[74] Planning is only one aspect of management in this case and involves developing plans designed to implement previously established goals and objectives. On the other hand, some practitioners feel planning and management are two distinct functions. One report categorizes planning as a function preceding construction of a project, while management is responsible only after the project is completed.[75] Another describes the two words as separate

strategies or techniques to aid in decision making.[76] Planning encompasses the use of comprehensive plans and analysis in approaching environmental problems while management deals with the day-to-day decisions which make these plans operational.

A variation of the latter definition will be used here for the sake of organization and not just for the sake of perpetuating this artificial dichotomy. While the two processes certainly overlap in reality, and planners and managers may perform the same duties, the basis for distinction will be the type of approach used. Those approaches which are predominantly conceptual, analytical, and/or theoretical will be classified as "planning" (e.g., problem-definition, objective-setting, short- and long-term strategies, analysis of impacts, etc.). Management approaches will include those that provide the application of the planning strategies (e.g., regulation, mitigating actions, enforcement, and public education).

Planning

The shore area most studied for planning purposes is not lakeshores, but the coastline bordering the continents, including seas, and the Great Lakes. The two areas share many of the same types of values, problems, pressures and constraints, since they are both edges between land and water, zones limited in area, and the location of highly concentrated use. Inland lakeshores differ mainly in the relative scale and scope of these issues. Many of the planning ideas presented at the 1972 Coastal Zone Workshop at Woods Hole are

also applicable to the shorezone of lakes.[77] Following the development of an understanding of the coastal zone as a system, the Workshop recommended using this knowledge to create a dynamic plan for its "best use." Responsibility for policy formulation would be at the federal level, for planning at the state level, and for implementation at the local level. These recommendations were basically incorporated into the Coastal Zone Management Act of 1972.[78] Shorezone legislation patterned after this approach is one possible alternative to improve lakeshore planning.

At the state level, the California Coastal Zone Conservation Commission advised regulation within 1000 yards of the mean high tide line and adjacent resource areas which are necessary to protect the coastal concerns.[79] Shoreline planning in the San Francisco Bay Play, however, sets few criteria for shoreline use except for priority use areas (e.g., waterfront industrial, wildlife, and recreation).[80] In other areas in the Bay, any use is allowed as long as the "maximum feasible" public access is allowed. Clearer guidelines, criteria, and procedures are needed to improve this haphazard situation.

In Europe, the coastline and lakeshore problems are very similar to those in the U.S., with the main weaknesses being in the quality of public education and available technical information.[81] For instance, Norway passed a "Temporary Act" prohibiting development within 100 meters of its coastal shoreline during the period of June 1965-July 1970 to allow preparation of a coastal plan.

Governmental approval is required in Austria for lakeshore development. The criteria include density, aesthetics, height, and land use aspects of any development within 500 meters of the waterfront of its lakes.[82]

Artificial lakes, such as reservoirs and real-estate lakes, may demand different planning procedures. For lands bordering the Tennessee Valley Authority (TVA) reservoirs, a covenant is required to be signed by shoreland buyers to prevent uses which might degrade water quality "to an extent that would be incompatible with the public interest."[83] However, TVA policy is oriented toward the development of its reservoir shorelines. Criley feels that new concepts of land use standards are needed for TVA reservoir shoreline development rather than the simple acceptance of traditional patterns.[84] The county, he claims, would be the best adapted to plan for the shore using its regional planning powers, zoning plan and ordinances, and subdivision regulations.

The U.S. Geological Survey (USGS) warned in 1972 that several important California recreational reservoirs were endangered of becoming overly enriched because of extensive shoreline development.[85] More intensive study and "comprehensive planning" were recommended to prevent their deterioration, yet to date no shoreland plans have materialized from the responsible planning authorities. In the planning of real-estate lakes, the USGS recommends careful consideration of uses of the shoreline in order to prevent ecological disruption, aesthetic blight, and impairment of its recreational value.

An undeveloped buffer strip about 25-50 feet wide around the lake and along contributing streams is advised as one solution to the problem of bank erosion.

One enlightened and practical approach to shoreland planning for inland lakes was developed in Michigan by Applied Environmental Research (AER).[86] Recognizing that the condition of the watershed is a key to the quality of the lake, their suggested program focuses on cause-effect relationships within the watershed. After adequate information on the lake and watershed is gathered, the drainage basin and the shoreline would be analyzed to define critical areas needing priority attention for planning and management. Shorelands are considered distinct from the sub-basins within the total basin because of their different shape, total area, water movement, and intensity of development. Five predominant types of shorelands are identified on the basis of typography and drainage, each representing a different level of use capability. Wetlands provide the most problems and least number of opportunities for development and are categorized along with small berms as "third order shorelands." Second order sites include bluffs and large berms and possess limited tolerance for development, while lake slopes, terraces and high berm sites are the most capable of development and are first order. By examining the number of first order areas occupied, the degree of capacity reached can be ascertained. Ideally, only these sites and carefully planned second order sites should be built upon, and not the third order locations. Planning for the watershed and shorelands

would involve:

1) Formation of goals for the desired lake environment,
2) Design of a plan with operational guidelines,
3) Implementation of the plan, and
4) Periodical evaluation of the plan.

Besides physical qualities, the aesthetic quality of the shoreland can be protected or even enhanced through special landscape design considerations.

Despite the many strengths of the above planning scheme, it still does not plan for the shorezone in an ecological context, nor does it address some of the critical issues. Land is evaluated only as physical and aesthetic potential for development, with protection of water quality being a primary objective for planning. The biological element and maintenance of the natural ecosystems (e.g., native vegetation, wildlife, aquatic communities) are almost totally ignored. Wetlands are considered as possessing only the greatest physical limitation to development instead of being valuable ecological sites needing protection from development for their own sake. Other weaknesses involve the generalizations made. "Development" of land is treated as a homogeneous use whereas in reality it encompasses a variety of types and intensity of uses (e.g., recreation, commercial, residential, agricultural), and magnitudes of impact. Foreshore and nearshore areas are also excluded from special concern, yet these zones were shown to be of ecological significance earlier in this chapter. The AER method, though, should still be commended for its focus on the shoreland and its

inexpensive and non-technical approach to planning and management.

Another method for determining the capacity of a lakeshore for development was designed totally on the basis of lake trophic status.[87] Dillon and Rigler devised a mathematical technique involving quantifiable relationships between nutrient inputs and water quality parameters to predict the water quality impact of an increase in residence within 1000 feet of the shoreline (assuming septic tank use). The total permissible number of cottage units can be calculated if limits are set on the "permissible" summer average chlorophyll "a" concentration or Secchi disc transparency. Many of the same criticisms of the former approach are also applicable to this one. While the authors believe their method is suitable to any lake, the number of questionable assumptions, the amount of required data, and the complex mathematical calculations make this technique almost completely impractical for most land and water resource planners, and especially local administrators. It appears to be no more than an interesting academic exercise in number manipulation to produce a "correct" answer, rather than a realistic tool.

Management

Management can only be effective if it is preceded by high-quality planning. If the design, criteria, and procedures of shore-zone planning are inadequate, then the various management techniques for lake rehabilitation, plan enforcement, recreation, and public education will not be able to help implement a plan or correct past

mistakes. A further complication is that lake managers have found that each lake has its own "personality" and general guidelines are not necessarily appropriate for all lakes.[88] Each lake must have its own particular management program.

Often shorezone management has utilized short-term solutions aimed at symptoms and not the causes of a problem, as in the use of dredging, chemical treatment, and mechanical harvesting to remove aquatic nuisances. These are at best only stopgap measures to remove the symptom until the cause (e.g., nutrient source) is controlled.

Concern for long-term renewal approaches is growing. Disagreement may exist, though, regarding the sources of nutrients, the methods of control, and the benefits to be gained. One study suggested that successful rehabilitation may require the "integrated implementation of several techniques due to numerous interacting biotic and abiotic variables within an ecosystem." This study also found that only 3% of the 443 lake rehabilitation programs surveyed had used land use controls as a management technique. The absence of quantitative documentation of the effects of these controls was cited as the major reason for not attacking the land use problem source directly.[89] It has been shown by Edmunson and Schindler in separate studies that some lakes can recover after abatement of nutrient additions and revert to an earlier trophic state.[90] Besides structural measures which intercept nutrients and sediments before they reach the water, land treatment measures are also being used.

A key factor in control of sediment is the prevention of soil erosion through the stabilization of the land surface. Minimal site disturbance during construction and revegetation afterwards and on other disturbed sites are effective practices to control nutrient influx from soil and reduce management costs.[91]

Management also involves people problems, which require human solutions. Implementation and regulation can be seriously impeded if lakeshore users and property owners do not change past practices such as lawn fertilizing, littering, and leaf burning.[92] In a recent survey of lake property owners in Wisconsin, 62% considered "solitude and beauty" to be their main benefit of owning lake property. However, their perception of what lake management activities were needed at their lake shows a lack of understanding of problem sources. The highest ranked activity by 81% of the owners was "stocking of fish" while pollution control ranked lower; "inspecting private septic tanks"--66%; "monitoring sources of pollution"--64%; "pumping and servicing septic tanks"--63%; "planning development"--42%; "stopping shoreline erosion"--34%. The survey also showed that lake property owner organizations can be quite effective in carrying out important lake and shoreland management functions.[93] Property owners must become aware, though, of the differences between treating the symptoms and the causes. One educational tool being used in Wisconsin is the development of films designed for viewing by developers, lake property owners, local officials, and other lake

users. The films illustrate some common shoreland problems and describe the reasons behind shoreland protection.

The carrying capacity approach to regulating the number of shore users is another management technique. Overcrowding and conflicting uses in the shorezone can cause ecological and aesthetic harm, so shoreland management should aim at achieving the "optimum multiple use of lake water," suggests one researcher. He also recommended keeping one-third of the open water and adjacent shoreline in an undisturbed state where visitors are restricted to certain footpaths and plant and animal life "can continue to fulfill their functions as elements indispensable to tourist attraction." The maintenance and development of diversity in the environment should be a major objective for recreational management of the shoreline, and recreational facilities should only be allowed if ecological research determines the extent of impact and such impact can be minimized.[94] Regulation of numbers can also be accomplished through a permit system for use of public lakes or through lake zoning of permitted uses according to space or time.[95]

Institutional problems arising from conflicts or confusion about agency jurisdictions, responsibilities, and regulatory powers in the shorezone can impede effective management. For example, structures within the waters of navigable lakes are regulated by the U.S. Army Corps of Engineers and also by state and local agencies. Without coordination of permit criteria and procedures, the implementation of even the strictest plan for controlling these structures

may fall far short of the objective. The cumulative impacts of shore development may especially be overlooked unless the responsible institutions unite their efforts and concerns.[96]

SUMMARY

Ecological planning and management efforts for the shorezone of lakes are experiencing the growth pains typical of a new field of endeavor. Many people have recently realized that shorelands deserve special attention in land use planning and that the nearshore waters are a barometer for overall lake water quality. The interrelationship of land and water issues, however, are only slowly becoming understood and appreciated by ecologists, planners, and managers.

The emphasis on shorelands or shoreline as opposed to the shorezone is quite apparent in reviewing the literature. The broader context of including both the nearshore and backshore zones of the lake as the area of attention is not yet an explicit consideration. Although more ecological study is certainly needed, planning and managing entities are having difficulty in translating even the current level of ecological knowledge known about the shorezone into effective actions. The local decision-makers responsible for providing the necessary regulations to protect the shorezone are not able to comprehend the implications of their actions for the area's future quality.

While water quality regulations have been very difficult to enforce and understand, the development of decent land use controls has been even more difficlut. The combination of these two resource concerns at the land-lake interface produces an especially complicated situation which has definitely impeded progress. A new approach to viewing shorezone problems is needed now to break through this complex barrier. Chapter III will present a new approach to accomplish this task.

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CHAPTER III

A SHOREZONE SCHEME

Where is the wisdom
We have lost in knowledge?
Where is the knowledge
We have lost in information?

-T. S. Eliot

INTRODUCTION

Despite good intentions and sound legislation, the state shoreland programs are not solving lakeshore problems as rapidly as had been hoped. A breakdown has occurred in the translation of ecological and environmental ideals and concerns into decisive action and positive results. Common excuses for the programs being unworkable have been the lack of expertise, money and time. Mandated shoreland ordinances were also forced upon the local governments to develop and enforce without a basic local understanding of the significance of the shore area. Lacking this knowledge and possibly resenting the legal threat to comply, they met only the letter of the law and ignored its spirit. Even the best regulations are fated to lie fallow under these circumstances.

The absence of successful results for most shorezone planning and management attempts is symptomatic of a larger problem: the gap between many scientists/professionals and laymen is widening in the field of resource and environmental planning. In the drive for collecting vast quantities of environmental data, perfecting theories

and decision tools, and developing stringent protective regulations, many of these professionals have lost sight of the purpose of much of this work. That purpose involves their successful application to the environmental problems and decisions being faced daily by people across the country. Many of these people have the desire but not the knowledge to control or correct these problems and until they do, the gap between theory and application will continue to grow wider. The basic assumptions inherent in environmental planning are not even being understood, much less accepted, by the practitioners who develop and carry out the plans for much of our land and water resources.

Acknowledgement of these increasing separations has come from several researchers. Ditton and Goodale noted that the very technical and esoteric treatment of water quality information which is typical of hundreds of articles and technical reports causes these findings to be by-passed by the non-specialist population.[1] This literature cannot be easily interpreted in terms relevant to their everyday experience and so the results become meaningless to them. In a study of the strained relationship between planning experts and local planning boards in one rural community, it was concluded that the lay members of the boards reacted to the obvious gap of knowledge by rejecting the expert advice and reaffirming the role of their traditional rural institutions.[2] As a result, no improvement was made in the quality of planning decisions. Sensing early the difficulty of making ecology an applied science, Caldwell in 1966 recommended "the creation of

tools for making ecological concepts operational in non-professional hands," in addition to encouraging a "massive change in the popular perception of the human environmental condition."[3] In a recent evaluation of Section 208 Areawide Management Planning Agencies, one of the recurring problems noted was the use of too much technical terminology in communicating with the public. The explanations of water quality issues and the proposed solutions were not clearly understood as a result.[4]

Helping laymen to understand the environmental implications of their actions calls for a simpler approach, not a more complex one. Although the current trend is toward more sophisticated methodologies, such schemes have not been usable by lower levels of government and non-professionals. The primary purpose of the scheme proposed here is to make a significant contribution toward improving the translation of ecological considerations for the shorezone into appropriate planning and management decisions and actions for laymen--decision-makers, staff, and the public.

In order to keep the scheme to a manageable size, the scope was purposely narrowed to the shorezone of rural recreational lakes which are facing the pressures of second home development and intensive recreational use. This situation is a very common one all over the country and, in a sense, strikes at the heart of the difficulties involved with shorezone planning and management. The responsible local authorities are unprepared for the onslaught of new demands and cannot grasp the implications of their decisions quickly enough.

They need a simple framework which will help explain the situation as directly and accurately as possible. An appropriate scenario, then, for relating the essence of the proposed scheme of evaluation is:

> A rural county with several relatively undeveloped lakes is facing increased pressure to develop the shorelines. Since the land is unincorporated, the responsibility for making decisions about the future planning of these lakeshores lies with the County Board of Supervisors. This Board is composed of local businessmen, farmers, and ranchers, similar to the make-up of the county's population. The county staff is small and understaffed, with the only professional employee being a civil engineer in charge of public works projects. Regulation of land and water use stems from the county government's powers over zoning, subdivision control, and sanitation control.

The development of the scheme was based on several principal assumptions which should be made explicit:

1) Local administrators responsible for lakeshore planning in rural areas have many decisions to make in a short amount of time and they cannot waste their efforts on deciphering complex decision aids, extraneous information, or learning unnecessary jargon and technical terms. However, they will need to understand the problems involved, the relevant ecological considerations, and possible mitigating procedures.

> To be any good, a scientist has to think of one thing, deeply and obsessively, for a long time. An administrator has to think of a great many things, widely, in their interconnections, for a short time.
>
> -C. P. Snow[5]

> As [shoreland] ordinances are adopted, administrators will need some technical know-how and background, presently lacking.
>
> -J. H. Beuscher[6]

2) Most lake areas cannot afford the sophisticated planning techniques employed by special areas like Lake Tahoe and Lake Michigan, much less a professional or technical staff to develop or interpret such techniques. A simple methodology is required to meet their needs.

> It is my experience that it is rather more difficult to recapture directness and simplicity than to advance in the direction of ever more sophistication and complexity. Any third-rate engineer or researcher can increase complexity, but it takes a certain flair of real insight to make things simple again.
>
> -E. F. Schumacher[7]

3) A planning and management scheme based on ecological principals is inherently conservative in nature, seeking to preserve and encourage the complexity and resiliency of natural ecosystems.

> An ecological framework for planning suggests new principles based more on a recognition of our ignorance than the presumption of our knowledge about the systems in which we try to intervene.
>
> -C. S. Holling and M. A. Goldberg[8]

4) While the state-of-the-art in ecological planning is yet in its infancy, and ecological theory continues to change, there are still many concepts and "common sense" approaches which are applicable to shorezone planning but are not being utilized.

> We have to live today by what truth we can get today and be ready tomorrow to call it falsehood.
>
> -William James[9]

On the basis of these assumptions, the following criteria were chosen as guidelines. The proposed scheme must be:

a) Understandable to non-professionals and non-scientists

b) A simple format, easy to use, and inexpensive

c) General enough to be applicable to most inland lakes, yet specific enough to be useful

d) Qualitative rather than quantitative

e) Of educational value to help people understand the importance of certain measures and controls

f) Based on ecological, biological and physical capabilities of the natural system

g) Appropriate for focusing decision-makers to areas needing their attention and judgment (e.g., long-term objectives, appropriate uses, public needs, jurisdictional responsibilities

h) A guide to the basic information essential for sound environmental decision-making

i) An aid to identifying possible cumulative impacts, since incremental decisions can lead to a larger impact than their sum.

The format chosen is a series of "Where-why-what-who" questions answered through a combination of checklists and verbal descriptions or "word models." The use of matrices, decision trees, and network diagrams was avoided because these formats are not easily understandable to the audience being addressed, and they needlessly limit the amount of information necessary to explain the important interrelationships involved. A checklist helps to get the analytic process started, may prevent certain categories of impact from being ignored, and is a quick, convenient aid for people at the staff level to use.

The selection of basic information deemed essential for sound shorezone planning and management (Table 4) was compiled partly from practical experience with staff shorezone analysis at Lake Tahoe. Although we will always be dealing with imperfect information and

knowledge, an abundance of unnecessary or impractical information will not improve the situation and could do more harm than good. If overloaded with too much material, the local administrators may become so frustrated that needed information ends up being ignored and traditional planning practices will once again prevail. Also, the addition of more information does not necessarily reduce the level of uncertainty involved in the decision-making. In a sense, as Benveniste[10] describes it, a level of "optimal ignorance" is sought for the decision-makers. The basic information required (and critical concerns) were found to be relatively the same regardless of the type of lake involved. Therefore, no lake classifications were proposed.

The questions which will be addressed to the responsible people in the scenario are quite similar to those that Gilbert White suggests be asked of every water management strategy.[11] For understanding how decisions are made, one should ask, "Who makes what choices?" His other two questions concern the consequences of a particular choice: "What is the effect on the public welfare?" and, "What is the effect upon the natural environment?" Although these last two are linked, they are kept separate because their effects are difficult to trace. White is the first to admit that no fully adequate answers exist for any one of these questions, as yet, because of the imperfect state of our analytical methods. They are still highly pertinent questions, though, and deserve special attention.

The scheme will begin answering the key questions by explaining and defining the importance of the shorezone. Following this brief introduction, the ecological considerations will be covered by

describing the natural system and common use-cause-effect relationships. Planning considerations for decision-makers, staff, and the general public are then discussed. Mitigating procedures and agency responsibilities are examined under Management Considerations. The general sources used for the following sections are cited in the notes.

SHOREZONE PLANNING AND MANAGEMENT SCHEME

A good journalist captures the essence of a story by answering the basic who-why-what-where questions of the situation in as short a space as possible. The essence of shorezone planning and management can also be captured concisely by using the same approach:

1) What and where is the shorezone?

2) Why should the shorezone deserve special attention?

3) What are the natural or ecological characteristics of the shorezone?

4) What planning considerations need to be made?

5) What are the management considerations, and who should make them?

The shorezone encompasses a broader area than that of just the shoreline alone. Both the immediately adjacent lands and lake waters are also included within its boundaries, as depicted in Figure 3. For discussion purposes, it is convenient to divide the shorezone into three easily identifiable areas:

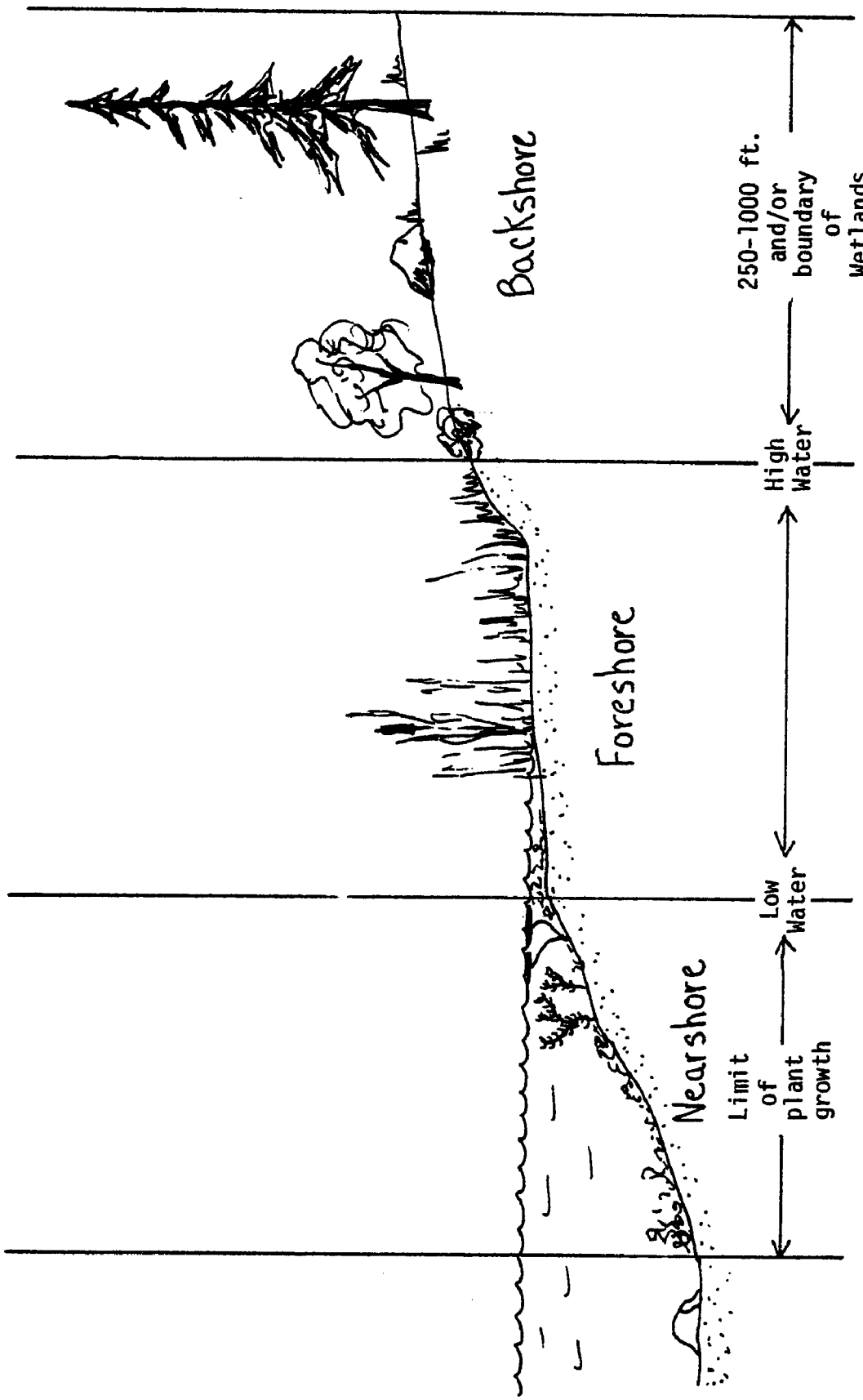


FIGURE 3

THE SHOREZONE OF INLAND LAKES

a) Foreshore ("shoreline")--the area contained between the high and low water levels and the neighboring areas which are splashed or exposed during normal wave action. This zone has the most intensive interactions between the land and the lake.

b) Nearshore ("shallow waters")--the shallower lake waters extending from the low water level down to the greatest depth of plant growth or light penetration; the area showing the most water quality deterioration, such as algal blooms.

c) Backshore ("shorelands")--the inland area above the limits of normal wave action which includes at a minimum the boundary of the beaches, marshes, floodplains and eroding slopes. Its limit is often defined as extending landward for 250 to 1000 feet horizontally from the high water line.

The lakeshore area deserves special attention in planning and management for several reasons. First of all, its immense attraction creates a high concentration of recreational activities. It is a favorite site for all types of recreation--swimming, boating, fishing, picnicking--as well as for homes, cottages, resorts, tourist attractions, and scenic roads. While this great attraction may create a boon to the local economy, the desired uses of the lakeshore may also be in conflict with one another. If all or most of the shoreline becomes privately owned, for example, then the public's use and enjoyment of the water's edge will be restricted and the few available public areas will be overcrowded. If the shoreline becomes densely populated with structures, then the scenic beauty of the lake which originally attracted everyone will be spoiled and tourists may no longer enjoy coming to the area. As a result, the tourist economy may suffer. These conflicts can be lessened or avoided if suitable considerations are first taken by the responsible authorities.

Human use of the shorezone may also create related environmental problems, such as shoreline erosion, water pollution, loss of important wildlife habitat, and weed-choked waters, if not carefully controlled. These problems and others can be traced back to the improper planning and management of the shorezone as will be shown in the succeeding section. They do not have to be the inevitable by-product of man's use of the lakeshore.

By focusing attention on the shorezone, some of the greatest problems can be affected. The entire watershed of the lake impacts on the quality of the lake waters, but it is the backshore lands which have the most immediate effect and are the most readily controllable. A good indicator of the overall water quality of a lake is the quality of the nearshore waters. It is the shallow portions of the lake that are first altered by pollution and which provide the first visible evidence of its presence; algae-covered piers and rocks and changes in water color are typical indicators.

A knowledge of the ecological concerns related to the shorezone will provide valuable insights into the implications of local decisions for the area.

ECOLOGICAL CONSIDERATIONS

The Natural System

The shorezone involves the natural characteristics of both the land and water areas which it encompasses. These natural characteristics present opportunities, constraints, and prohibitions for human

use at the lakeshore and, if recognized by careful planning and management, will allow for optimum use and protection. If ignored, the fragile shorezone environment will not be adequately protected and long-term damage will likely result. Special qualities of the shorezone that need to be discussed are:

1) Flows between land and water
2) Capacity for human interference
3) The aging of lakes
4) The food-web of the shorezone

1) The shorezone is just one portion of the entire watershed or drainage system and as such, it is greatly affected by actions within this larger zone. Flows between land and water occur throughout the watershed and cause soils, nutrients, and other materials to eventually end up in the lake. Figure 4 illustrates some of the major types of flows. Incoming streams can contribute a large amount of material to the lake and often act as the primary link between land and lake areas. Other flows involve water runoff over the land surface (resulting from rain and snowmelt), and subsurface or groundwater runoff where water penetrates the ground and later seeps into streams and lakes. Surface runoff is associated with erosion while subsurface runoff is related to septic tank seepage. Within the lake, water and loose materials (e.g., sand, soil, pebbles) move in defined patterns around the shore known as nearshore currents or littoral drift. Wind and currents also cause water to flow into land through wave action. Waves and nearshore currents in combination can greatly alter the appearance and shape of the shoreline by causing

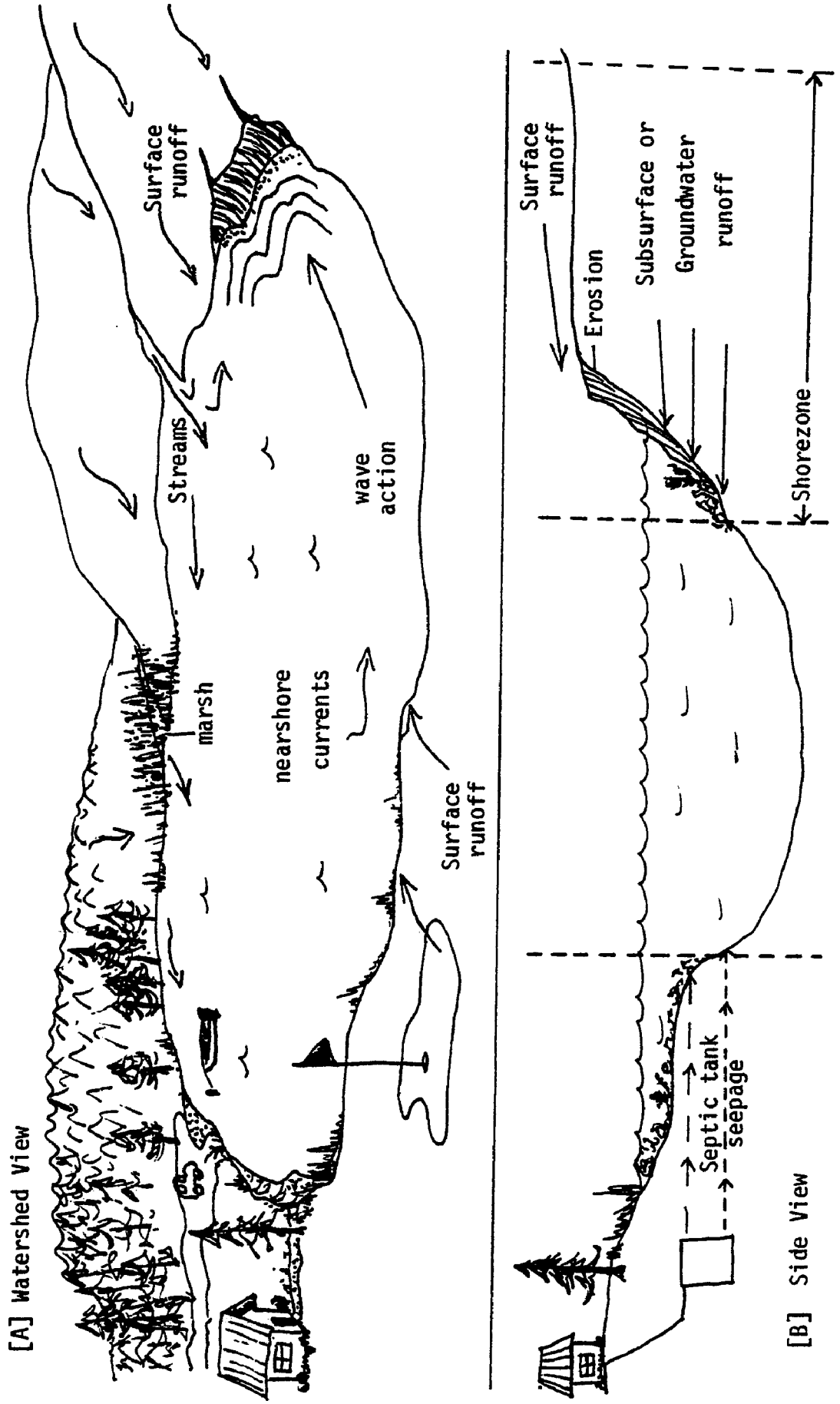


FIGURE 4

FLOWS BETWEEN LAND AND WATER

erosion and deposition.

2) Lakeshores have an inherent capacity for accommodating human activities. Some lakes are more capable of development and intensive use than others, depending on particular characteristics. These characteristics involve, among other things, slope, soil capabilities, vegetation, and fragile habitats and will be discussed in a later section. If the use capability is exceeded, then many difficult problems will arise for the local authorities to contend with (e.g. cliff erosion, beach removal, water pollution). To avoid such problems, an awareness of the strengths and weaknesses of the shorezone for human use is important before making choices about appropriate uses.

3) Lakes naturally progress through several stages in their lifespan. A young lake is generally very low in nutrient content and fertility and, as a result, is quite clear, and has little plant growth. With increasing age, the lake begins to fill up with sediment (physical aging) and/or additional nutrients (chemical aging). More aquatic plants are stimulated to grow, providing additional food and habitat for fish. After a certain point, the increasing nutrient level and plant production cause intolerant types of fish to die out, and encourage types of fish tolerant of such conditions. The final stage in a lake's physical aging is the complete filling in of the lake and the formation of a meadow. Without interference by man, the natural process takes many thousands to millions of years to

complete. With unwise interference by man, the future life of a lake can become drastically shortened to only a few decades.

4) The shore area is the richest part of the lake for animal life. Although waterfowl and fish are the most apparent animals, they represent a very small proportion of the total number of organisms living in lakes. They are also very dependent on the existence of numerous other organisms within the shorezone for their food and survival. This dependency is part of a natural network of organisms known as food chains, and collectively, as the food web. Figure 5A represents a simplified version of a food web for the shorezone. Plants capture the sun's energy and transfer it into usable energy for other organisms. Both the microscopically small plants and the very large plants are important food sources for the animal life on the land and in the lake. The energy from these plants can either be absorbed directly by larger aquatic animals, such as fish and waterfowl, or by microscopic animals not much larger than the plants they feed upon. In turn, these small organisms can be eaten by progressively larger animals. This food chain may terminate, though not necessarily so, with consumption by humans. Although these food dependencies vary, the elimination of one type of organism from the web can upset the whole system. Some organisms may suddenly become superabundant while others may disappear entirely. To avoid the creation of pests and the extinction of desirable organisms, the natural food web should be maintained as intact as possible.

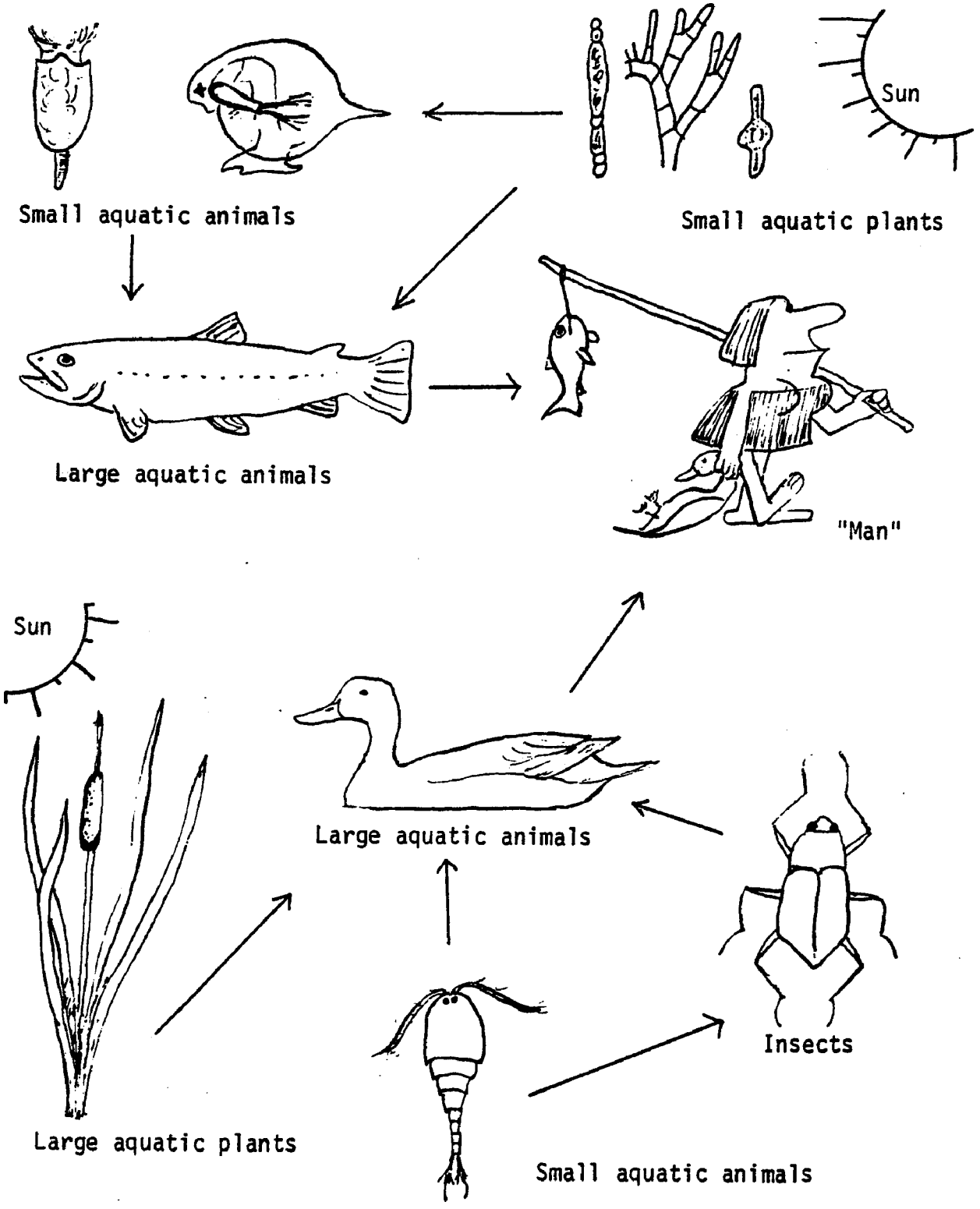


FIGURE 5A

A SIMPLIFIED FOOD WEB OF THE SHOREZONE

Cause-Effect Relationships

As just discussed, the natural system contains both opportunities and limitations for human interference. By understanding the problems which may result because of these inherent constraints, then many of the negative impacts can be avoided. The implications of local decisions regarding the lakeshore area can also become more apparent.

The following tables can be used to trace out the environmental problems which may result from some common uses of the shorezone. They are divided into three sections in order to provide a breakdown of cause-effect relationships. Table 1 relates the Uses or activities commonly occurring in the shore region (left column) to the Potential Problems and Causes which may result (right column). In Table 2, the Causes listed before are connected to certain Initial Effects or symptoms. With time and the absence of remedial measures, these early effects can expand to become the Later Effects listed in Table 3. It is both these Initial and Later Effects that provide the symptoms of a shorezone which has not had adequate planning and management.

In order to prevent or correct these environmental problems, local administrators should look to the causes and not just the effects for the solution. For instance, the time, money and effort involved in removing nuisance plants from the lake will be wasted unless the cause of this excess plant growth is also removed. Tracing backwards from this symptom, it can be determined from Table 2 that

possible causes of the problem are: soil disturbance, reduced circulation of water, land vegetation removal or damage, sewage wastes, dredging/filling, fertilizer use, and increased surface runoff. These causes can then be traced back further to the uses associated with the problems. After an investigation of the relative significance of these causes at the lake, then priorities can be set to correct the worst contributors to the nuisance growth problem. Possible corrective actions will be discussed in a later section dealing with remedial and protective measures.

Another approach to take would be to evaluate projects at the review stage according to Tables 1 to 3. The proposed shorezone use could be traced forward to determine potential cause-effect relationships. If the proposed use is desirable but the potential effects are not, then attention can be focused on the problem/cause for the prevention of the undesirable effects.

TABLE 1

USES OF THE SHOREZONE AND POTENTIAL PROBLEMS/CAUSES

Uses of the Shorezone	Potential Problems and Causes
1. Construction of nearshore and foreshore facilities (e.g. piers, jetties, bulkheads)	-Disturbance of lake bottom -Dredging and/or filling -Excess noise
2. Construction of backshore facilities (e.g. roads, residences	-Soil disturbance -Vegetation removal or damage -Land filling and draining -Excess noise
3. Boating	-Oil and gas spillage into water -Sewage wastes -Excess noise
4. Marinas	-Oil and gass spillage into water -Sewage wastes -Reduced circulation of water (if enclosed structure) -Dredging for maintenance -Interference with shoreline current (if impermeable structure)
5. Piers	-Interference with shoreline current (if impermeable structure) -High density of structures in lake
6. Residences	-Sewage wastes/septic tank seepage -Fertilizer use -Increased surface runoff from additional ground coverage -High density of structures on land
7. Campgrounds, beaches and other intensive recreational use	-Sewage wastes/septic tank seepage -Unrestricted access to shoreline

Uses of the Shorezone	Potential Problems and Causes
(Campgrounds, etc.)	-Excess noise -Soil disturbance
8. Reservoir	-Artificially large annual variations in water levels
9. Roads, parking lots, and other paved surfaces	-Increased runoff from additional impervious ground coverage -Vegetation damage or removal
10. Shoreline structures (e.g. jetties, breakwaters, bulkheads)	-Interference with shoreline current

TABLE 2

INITIAL PROBLEMS/CAUSES AND INITIAL EFFECTS (SYMPTOMS)

Potential Problems and Causes	Initial Effects (Symptoms)
a. Sewage wastes/septic tank seepage	-Impaired water quality -Contamination of water for drinking and water sports
b. Oil and gas spillage	-Impaired water quality -Damage to aquatic animal and plant life
c. Dredging/filling of lake	-Disturbance of lake bottom -Damage to aquatic habitat -Siltation and turbidity
d. Fertilizer use	-Excess nutrients in water
e. Increased surface runoff/ impervious ground coverage	-Increased erosion hazard -Change in land drainage -Increased input of soil, nutrients, grease and oil into lake water
f. Soil disturbance	-Increased erosion hazard
g. Reduced circulation of water	-Concentration of nutrients, or excess nutrients
h. Land vegetation removal of damage	-Increased erosion hazard -Increased surface runoff -Reduction in animal habitat -Loss of scenic beauty
i. Interference with shoreline current	-Increased erosion hazard -Sedimentation in unwanted areas
j. Unrestricted access to shoreline	-Vegetation damage -Increased erosion hazard -Damage to animal life -Overcrowded recreational areas
k. Disturbance of lake bottom	-Siltation and turbidity -Sedimentation -Increased erosion hazard (e.g. mass movement) -Damage to plant and animal habitat and life.

Potential Problems and Causes	Initial Effects (Symptoms)
l. Land filling and draining	-Reduction in animal habitat -Damage to aquatic animal and plant life -Change in natural drainage
m. Artificially large variations in water levels	-Increased erosion hazard -Damage to aquatic animal and plant life -Loss of scenic beauty
n. High density of structures on land	-Reduced public access to shoreline -Loss of scenic beauty -Reduction of lake surface for recreational use -Increased navigational hazard
o. Excess noise	-Disturbance of animal life -Disturbance of solitude for recreationists

TABLE 3

INITIAL EFFECTS (SYMPTOMS) AND LATER EFFECTS (SYMPTOMS)

Initial Effects (Symptoms)	Later Effects (Symptoms)
i. Impaired water quality	-Reduction in type and number of aquatic animals -Diminished quality of sport fishing -Decrease in recreational use of lake -Decrease in lakeshore property values -Damage to local economy -Loss of scenic beauty
ii. Contamination of water	-Closure of lake to recreational use -Increased health hazard -Loss of water supply source
iii. Sedimentation	-Increased filling of lake with sediment and rapid lake aging -Damage to aquatic plant and animal life by burying with sediment -Excess nutrients from sediment
iv. Siltation and turbidity	-Reduced water clarity -Impaired water quality -Increased growth of pollution-tolerant plants and animals -Damage to aquatic habitat and life
v. Erosion	-Increased sedimentation -Impaired water quality -Damage to existing property -Reduced chance for revegetation from loss of soil -Loss of scenic beauty
vi. Excess nutrients	-Increased growth of aquatic plants and pollution-tolerant plants -Impaired water quality

Initial Effects (Symptoms)	Later Effects (Symptoms)
vii. Increased aquatic plant growth	-Overabundance of nuisance plants, weeds and algal blooms -Increase in rotting vegetation and foul-smelling odor -Reduction in quality of fish and/or increase in number of fish kills -Change of water color to green -Impaired water quality
viii. Reduction or damage or disturbance of plant and animal habitat and life	-Alteration of food web and instability of populations; creation of pests -Some organisms become rare or endangered -Diminished quality of game animals -Loss of scenic beauty
ix. Loss of scenic beauty	-Decrease in recreation use of lake -Decrease in lakeshore property values -Damage to local economy
x. Reduced public access to shoreline	-Overcrowding of existing public areas -Decrease in recreational use of lake -Exclusive use of lakeshore by property owners
xi. Reduction of lake surface	-Overcrowding of recreational uses in remaining areas of lake
xii. Increased navigational hazard	-Impaired boat fishing along shore -Danger to boat use along shore
xiii. Disturbance of solitude	-Reduced enjoyment of lakeshore
xiv. Change in natural drainage	-Flooding of altered sites -Increased surface runoff -Decrease in ground water supply

PLANNING CONSIDERATIONS

A poorly planned lakeshore will very likely have many of the problems mentioned in the last section, problems which could have been avoided quite easily. With a reasonable background in the natural characteristics and ecological considerations important to the shorezone, and a good dose of common sense, people at the local level can do a sound job of planning for their lakeshores. Good planning also goes hand in hand with good management.

The kinds of planning decisions and concerns will vary according to the responsibilities of the people involved.

a) Technicians or Staff:

The concerns of this group will be focused on gathering the necessary information, dealing with project applications, designing plans, and making recommendations to the County Supervisors or other responsible decision-makers. Recommending management techniques and enforcing local regulations may also be the staff's responsibility. They will need to deal with more detail that the other levels.

b) Decision-makers

At this level, the people involved will need to evaluate the total picture or puzzle as well as the smaller pieces. The setting of objectives, the statement of the problem, the approval of projects, and the development of a plan for the shorezone may all eventually need action. Judgment may be based on a combination of

staff recommendation and environmental, social and philosophical concerns.

c) Public

The public will need to watchdog the decision-makers to ensure that they are meeting the public's needs and weighing values and concerns appropriately. They will need to be informed of the shorezone issues so they can adequately comment on and participate in the development of regulations for the shorezone.

Basic Information

Contrary to popular opinion, vast amounts of information and data will not necessarily improve the quality of decisions. In fact, a large difference exists between the ideal amount of information and the basic amount of information actually needed at the local level for making informed decisions. With limited funds and time with which to collect and interpret available data and information, local administrators may find it even more necessary to focus upon a basic background level. In actuality, almost all of the essential information has probably already been gathered by local, state and/or federal agencies and once gathered together, can be continually used for reference.

Although technical data like water quality characteristics can be helpful to have, their interpretation usually requires specialists and thus such detailed data is not really essential to have at the local level. It is more useful to know important trends and problem

areas than the specific figures for each chemical and physical measurement.

Table 4 presents a basic information checklist for items considered most relevant to shorezone matters and which will help reduce uncertainty about the decisions to be made. Items that were excluded from this list were considered to be extraneous and not worthwhile for serious attention locally. While this information is appropriate for shorezone issues at the program or project level, site specific information for projects may also be needed for the items marked (*). Common sources for locating the information are listed in the right column.

Following Table 4 is a brief description of each of the items listed to indicate their significance.

TABLE 4

BASIC INFORMATION FOR SHOREZONE PLANNING

Physical	Source
Lake:	
-Dimensions (morphology)	USGS; State Water Res.
Shoreline length	
Maximum length and width	
Maximum depth and average depth	
Volume	
Surface area	
-Watershed size (drainage area)	USGS; State Water Res.
-Flow-through (retention time)	" "
-Water levels (high, low: annual, historical)	Corps; State Water Res.
-Depth to plant growth (littoral zone)	USGS; State Water Res.
-Clarity (near-shore vs. lake body)	" "
-Temperature ranges	" "
-Suspended sediment level	" "
*Direction of nearshore currents (littoral drift)	Corps; "
Land:	
-Eroding shoreline areas	SCS
*Soil tolerance for use	SCS
*Slope of backshore and nearshore	USGS
*Runoff sources and amount	USGS; Corps, State Water Res.

Chemical	
Lake:	
-Level of fertility (nutrient status)	State Water Quality
-Coliform bacteria level	State/local Public Health
-Other	
Land:	
-Source(s) of nutrients	State Water Quality
-Sewage treatment level and capacity	"
*Location and status of septic tanks/sewerlines	"

Biological	Source
Lake:	
*Fish habitat and spawning areas	State Fish & Game
-Wetlands and other critical habitats	"
-Aquatic animal status	"
*Rare and endangered plants and animals	"
-Aquatic vegetation status	State Water Quality
Land:	
*Wildlife status and location	State Fish & Game
*Rare and endangered plants and animals	"
*Vegetation status of backshore	SCS

Planning	
Lake:	
-Lake uses and location	County Recreation
*Shoreline structures--location and number	Corps; County Bldg. Dept.
-Navigability of lake	Corps, State Att. Gen.
Land:	
*Land use	County Planning
*Zoning	" "
-Land ownership (public and private)	County Assessor
-Shoreline lots (developed and undeveloped)	" "
-Public areas (location, size, access)	County Planning
-Noise problems (sources and locations	
-Special scenic features	

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* Site or project specific information needed also

Abbreviations: USGS--U.S. Geological Survey; State Water Res--State Water Resources Department; Corps--U.S. Army Corps of Engineers SCS--Soil Conservation Service; State Att. Gen.--State Attorney General's Office

Physical: Lake. As background information, it is important to have some basic physical facts and figures collected. Knowing the dimensions or morphology of the lake is helpful for understanding the potential for water quality problems. Characteristics which have a strong correlation with high lake fertility are: shallow depth, long and irregular shoreline in relation to surface area, and the fertility and size of the drainage basin or watershed. Flow-through or retention time is the amount of time it would take to replace the volume of the lake with inflowing water and is a critical factor in predicting the reversibility of water quality.

The remaining items are necessary for informed shorezone planning. From the annual and historical water levels one can determine the boundaries of the foreshore zone as well as the potential for extreme low and high water problems. The far boundary of the nearshore can be determined from the littoral zone or the greatest depth at which plants are rooted. For the purposes of noting problem areas and comparing water quality trends, figures on water clarity, temperature ranges, and the amount of suspended sediment at various points around the nearshore and at lake center are helpful.

The direction of nearshore currents or littoral drift indicates the movement of materials along the shore as the result of wave and current action. It is important to know its predominant direction in order to predict the potential impact of shoreline structures which may block this drift. Impermeable structures, such as jetties and marinas made of rock or sheetpiling, will impede the movement of

materials, causing sediments to deposit updrift of the barrier. If a significant amount of material is blocked, erosion will very likely occur downdrift from the site since natural deposition is prevented. The process of shoreline erosion and deposition through littoral drift is natural and interference with the drift will probably cause unwanted effects. As a result, the direction of nearshore currents should be noted for every shoreline project involving the foreshore and nearshore zones.

Physical: Land. Eroding shoreline areas should be noted for defining problem areas which need protective or remedial measures. For determining the ability of the land to withstand certain uses and disturbances, data is needed concerning the soil tolerance (or capability) of the backshore and the slope characteristics of both the backshore and nearshore. This information is necessary for the general shorezone at the overall planning stage and for the specific site at the project review stage. Water runoff from land to lake involves three types: surface (e.g., from bare or disturbed slopes, dirt roads, paved areas); subsurface (e.g., groundwater flow and septic tank seepage); and storm drainage (e.g., stormwater drainage systems). Having knowledge of the problem runoff sources and their relative level of impact can help determine priorities for needed protective and remedial measures.

Chemical: Lake. To be able to monitor the changes in lake water quality, the current level of fertility or nutrient status of the lake must be determined. Many technical indicators are available

(e.g., nutrient concentration, chlorophyll content, dissolved oxygen) for classifying lakes into low, medium, and high levels of enrichment. Also, lake residents can help collect some of this data themselves under the guidance of a water quality agency. Coliform bacteria level is a public health indicator for the safety of water for drinking and swimming. A high level indicates sewage contamination of the water and the presence of disease-causing organisms. Other data may be necessary depending on the particular water quality problems of the lake involved.

Chemical: Land. Knowing the sources of nutrients for aquatic plant growth, such as sewage wastes, sediment, fertilizers and runoff, is a first step toward developing effective plans for their control. Information concerning the present level of sewage treatment and the capacity of existing treatment plants points out current and future water quality problems. A low level of treatment (e.g., faulty septic tanks; primary treatment) may reveal sewage to be a major water quality problem source and that special measures must be taken for this problem in planning for the shorezone. The capacity of the sewage treatment plant may be a significant factor in limiting the growth and type of uses which the shorezone can sustain. The location and status of septic tanks and/or sewer lines indicates potential and existing problems also, for some areas may have old, leaking septic tanks or faulty sewer lines.

Biological: Lake. Since fishing is an important activity at most lakeshores, a familiarity with the nearshore locations of known

prime fish habitat and spawning areas can help provide for their protection and ensure good fishing. Wetlands and other critical habitats are also essential areas needing protection in order to sustain the existing food chain. Keeping track of the aquatic animal status, such as fish, waterfowl, crayfish, and smaller animals, as well as the status and location of rare and endangered species, will show the effects of planning and management efforts. If their status was originally good, a marked decrease in the number and/or types implies that these efforts have not been adequate. The aquatic vegetation status, which ranges from extensive weed and algae growth to no algal blooms at all, is evidence of the level of available nutrients in the lake waters: the more nutrients, the more plant growth. The nearshore waters are generally the most fertile part of the lake, and will turn green with an overabundance of plant growth.

Biological: Land. As with the lake, the status and location of wildlife and rare and endangered plants and animals are valuable for analyzing trends and for planning decisions. Shoreland vegetation status may reveal problem areas (e.g., bare and eroding slopes) or protective areas (e.g., undisturbed natural sites) requiring special attention.

Planning: Lake. To recognize existing lake uses, their location, and possible conflicts, an initial inventory is necessary. A survey of the location and number of shoreline structures (e.g., piers, boathouses, buoys, marinas) will aid in deciding future requests of similar structures. Determining the legal navigability

of the lake is very important. A lake meeting the federal or state definition of navigability will require a greater protection of the public interest and will have different agency jurisdictions and responsibilities involved than with a non-navigable lake. Non-navigable lakes include very shallow lakes, ponds and many artificial bodies of water such as real-estate lakes.

Planning: Land. While the land use and zoning classifications are usually noted in shorezone planning decisions, other items are also valuable to know. An inventory of the ownership (both public and private) and number of shoreline lots (developed and undeveloped) is helpful for evaluating the potential for further development. The location, size and access to public areas partly indicates the extent to which the public interest is being served. Noting special scenic features and noise problem sources and locations will contribute to the aesthetic evaluation of the shorezone.

Critical Considerations

Another checklist which might prove helpful is one called Critical Concerns (Table 5). After gathering the basic information listed in Table 4 and recognizing the possible use-cause-effect relationships described in Tables 1-3, the environmental concerns listed here can be used as an evaluation guideline. A particular project, plan or program which is being reviewed should be evaluated against these concerns. Under physical impact, for instance, it can be noted whether the proposal might benefit, harm or increase the seven items listed.

Some items might not be relevant to the proposal and can be ignored. If it looks like a proposed project might cause erosion because of its location on a steep, erodable site, and that the water quality might be harmed as a result, then these concerns should be noted in an evaluation report before making a recommendation or decision on the matter. An explanation is provided following Table 5 of why each of these environmental concerns is deemed important.

The total or cumulative effect of shorezone decisions should also be taken into account. The cumulative impact of successive decisions will lead to a larger impact that that predicted for each individual decision. For example, the approval of one new house along the shoreline or one new pier alone will probably not significantly impair the quality of the lake waters or harm the area's scenic beauty. In combination with existing or future projects nearby, such as a new parking lot and marina, the total effect on aesthetics and water quality could be quite detrimental.

Concerns which are more social and philosophical in nature should not be neglected either. The questions and points listed under Social/Philosophical Concerns are issues which are very closely related to the environmental concerns just discussed, but are non-scientific, value types of decisions requiring resolution by the decision-makers. Personal, ethical and institutional values will be necessary to answer these items for none have any distinct right or wrong answers. The shorezone scheme will not attempt to answer or resolve these items for that is beyond its scope.

These concerns are listed because they are issues which either frequently come up in shorezone discussions or should be brought up for resolution. If not debated and resolved, these social issues may end up tormenting the decision-makers for a long time. The debate on public versus private rights and needs at the shore deserves airing in public meetings in order to hear both sides of the issue and to arrive at a satisfactory decision. Appropriate uses of the shorezone and the appropriate means of accomodating these uses are also not easy decisions but are necessary ones. Lastly, local administrators should make explicit what they consider to be an accurate statement of the problems they are facing in the shorezone, and their short-and long-range objectives for the area. Keeping the problem statement and objectives in mind, and periodically revising them, will help make their decisions easier regarding both social and environmental concerns.

TABLE 5

CRITICAL CONCERNS FOR SHOREZONE PLANNING

ENVIRONMENTAL

Physical:	Location
Soil Erodibility and Slope	-all zones
Erosion	-backshore, foreshore
Sedimentation	-foreshore, nearshore
Runoff	-backshore
Nearshore Currents	-foreshore, nearshore
Water Quality	-foreshore, nearshore
Sewage	-all zones
Biological:	
Prime Habitat (e.g., marshes, spawning areas)	-all zones
Land Vegetation	-backshore, foreshore
Wildlife (game and non-game animals)	-all zones
Bottom-living Organisms (e.g., snails, crayfish)	-nearshore
Other Aquatic Animals (e.g., fish, insects)	-nearshore, foreshore
Aquatic Vegetation	-foreshore, nearshore
Aesthetic:	
Scenic Beauty	-all zones
Open Space	-all zones
Noise Level	-all zones
Recreation:	
Public Access	-all zones
Navigability	-nearshore, foreshore
Cumulative Impact:	
Physical, Biological, Aesthetic and Recreational	

SOCIAL/PHILOSOPHICAL CONCERNS

"Public Interest"

-What is the "public interest"?
-What should be the extent of public access to the lake?
-What degree of aesthetic control should local government attempt?
-Who pays the costs and who benefits?

Private Rights and Privileges of Shoreline Owners

-Is it a right or a privilege for riparian owners to have private facilities in or over the lake water?
-What are appropriate restrictions on shoreline structures?

Appropriate Uses

-Public versus private needs
-Individual versus community shoreline facilities
-Priorities of uses

Appropriate Means

-Backshore zoning for use and density
-Downzoning of existing zones for use and density?
-Acquisition of critical areas

Planning

-Statement of problem
-Short-range objectives
-Long-range objectives (more than 10 years)

CRITICAL CONCERNS

Physical: Soil Erodibility and Slope

The characteristics of the soil type and the slope of the land (both backshore and nearshore) combine to describe the physical capability or tolerance of the shorezone for development. The probability of an erosion problem tends to be related to this capability and the extent of site disturbance. Usually a whole spectrum of capabilities can be seen, ranging from high (e.g. stable soils on a flat slope) to low (e.g. eroding soils crumbling from a steep cliff.) While these extremes provide obvious opportunities or difficulties for use, problems can be best avoided on all lands if care is taken to discourage or minimize land disturbance along the shore.

Physical: Erosion

Erosion by wind and water is a natural process which can be greatly accelerated by certain human activities. Disturbance of the backshore and nearshore soils and the removal of vegetation create an additional potential for erosion beyond the natural level. The resulting loss of soil and land instability can be difficult and expensive to control and the damage is often irreversible. Shoreline erosion may eventually threaten the stability of existing structures and property, requiring emergency measures. Certain shoreline protective measures (e.g., bulkheads) can even increase shoreline erosion on adjacent lands, further compounding the problem. Since the eroding materials are eventually carried into the lake, erosion

is also directly related to the source of other physical concerns: sedimentation, littoral drift, and water quality.

Physical: Sedimentation

Eroded materials, either from incoming streams or shoreline sources, eventually reach the lake and become deposited on the lake bottom or remain suspended in the water. This process of sedimentation leads to the filling in of the lake and the shortening of its lifespan. Sediment particles also carry plant nutrients which can stimulate increased growth of nuisance plants.

Physical: Runoff

Water runoff brings such polluting materials as soil, nutrients, grease and oils into the lake from developed and disturbed sites and stormwater drainage systems. The quantity of water flowing over the surface of the land during and after storms or floods is increased by the removal of vegetation and the covering of land with impermeable surfaces (e.g., pavement, buildings). Disturbed sites resulting from construction and road cuts and fills will contribute additional soil and nutrients to surface runoff. Runoff can be the greatest source of pollution in some lakes, especially if sewage wastes are under control.

Physical: Littoral Drift

As explained in the "Basic Information" section, littoral drift helps to keep the shoreline materials in balance. Any major alteration to its movement will very likely create an imbalance in the

foreshore and nearshore zones, with new areas of erosion and sediment deposit occuring.

Physical: Water Quality

Clean, clear waters are one of the greatest assets for recreational lakes. If the quality of the water is allowed to deteriorate, the nearshore waters will be the first to become choked with nuisance plant growth and become depleted of much of its fish and wildlife. Even the drinking water supply may become contaminated and harmful for human consumption. As a result, the recreational use of the lake, property values, and the local economy will all suffer also. The protection of water quality stems from controlling the causes and sources of pollution from erosion, runoff, and human and animal wastes.

Physical: Sewage

Sewage sources, whether raw sewage, septic tank seepage, leaking sewage lines, or inadequate sewage treatment, are the commonest cause of water quality problems. Sewage contamination contributes disease-causing organisms which can create a serious health hazard, forcing the closure of beaches. Additional plant nutrients from sewage wastes will stimulate the growth of nuisance plants. Sewage systems located in the backshore zone have the highest probability of polluting the lake waters unless stringent precautions are taken.

Biological: Prime Habitat

Biologically rich and valuable areas within the shorezone include marshes, mouths of streams, and fish spawning areas. These sites and

others are prime habitat for the diverse types of plants and animals which are necessary for a healthy natural enviornment. If damaged or destroyed from development, land filling, dredging or other actions, the impact can be irreversible for the fish and wildlife of the lake. Marsh areas also serve to trap sediment and remove nutrients from incoming streams.

Biological: Land Vegetation

Backshore vegetation serves many functions. It stabilizes the soil, provides habitat for wildlife, takes up soil nutrients which otherwise might pollute the lake, minimizes surface runoff, prevents shore erosion, and provides a scenic background for the lakeshore. Once removed, the problems outlined in Tables 2 and 3 will likely result and the area may be difficult to revegetate.

Biological: Wildlife

Wildlife is defined here to include all land animals: game and non-game, vertebrates and invertebrates, common and endangered. They are all essential to a healthy natural environment, an environment upon which humans are also very dependent. Destruction of wildlife habitat is a primary cause of vanishing species and dwindling numbers of plants and animals. The removal of one species, like the osprey or muskrat, can upset the entire food chain and may result in the loss of other species. Similarly, the addition of non-native species can also have a negative impact on other animals.

Biological: Bottom-living Animals

Organisms which live in or on the bottoms of lakes include such common animals as snails, clams, crayfish, worms, insect larvae, and fish eggs. While all of these species may not appear to be critically important, they are intimately involved in the food web of the lake environment. The game fish which attract anglers and support an economically valuable sport are very dependent on the healthy existence of other forms of aquatic life, both plants and animals. Since these bottom organisms are slow-moving or immobile, they are very susceptible to changes in their environment. Activities such as dredging, filling and pier-building can alter bottom habitats and thereby kill these animals. Sediments suspended in the water, which often come from backshore erosion, can settle on the bottom of the nearshore zone and bury the organisms or the plants they feed upon.

Biological: Other Aquatic Animals

Besides the bottom-living organisms, there are numerous other aquatic animals. Ranging in size from tiny water fleas to trophy-size fish and waterfowl, these organisms also include such land-water animals as muskrats, beaver, turtles, and frogs. Interference with their food chain, adverse water quality conditions, and loss of breeding, spawning, and protective areas will reduce their number and variety.

Biological: Aquatic Vegetation

Aquatic plants can be both beneficial and bothersome. Beneficial plants are those which provide habitat and food for animal life. For

instance, cattails are eaten by geese and muskrats and attract marsh birds, song birds, and wildfowl. The yellow water lily provides seeds for waterfowl, leaves, stems, and flowers for deer, and shade and shelter for fish. When becoming excessively abundant, plants become pests like weeds in the garden. Algal blooms and dense aquatic vegetation are symptoms of excess nutrients entering the lake water and of a serious water quality problem. This nuisance vegetation can also deplete the oxygen in the water and thereby cause fish kills.

Aesthetic: Scenic Beauty

One of the main attractions of rural lakes is the unique beauty of their shorelines. The appeal of the shorescape relates to several qualities: clean lake water, unspoiled shoreline flora, unobstructed views, and a feeling of restfulness. Changes in the shorescape which significantly harms these qualities will ruin the area's most valuable asset.

Aesthetic: Open Space

Escaping from crowded cities, people come to rural lakes to enjoy the spaciousness of the outdoors. A high density of structures along the lakeshore will destroy this enjoyment. If sufficient open space areas are set aside, overcrowding and dense development can be avoided.

Aesthetic: Noise Level

The level of noise allowed in the shorezone should be of concern since visitors are often seeking a quiet, peaceful vacation at the lake.

Also, waterfowl are very sensitive to uncommon noise, especially during breeding season. To keep the tourist as well as the wildlife from leaving or avoiding the area, regulation of noise sources such as motor boats and construction equipment would be helpful.

Recreation: Public Access

Various degrees of public access are guaranteed in state constitutions for navigable lakes, but much access to the shoreline is lost through the erection of fences and buildings and the private acquisition of lakeshore property. When the number of public beaches and parks is inadequate they will become overcrowded and the public's enjoyment of the lake will be impaired. Provision for adequate public access when making land and lake use decisions will help protect the public's right to access.

Recreation: Navigability

While piers and buoys are usually designed to aid in navigation, they also can impede pleasure boating and fish trawling along the shore when their location number and size are not effectively controlled.

MANAGEMENT CONSIDERATIONS

Protective and Remedial Measures

As mentioned earlier, human use of the lakeshore need not lead inevitably to the destruction of its prized qualities of scenic beauty, solitude, clean water, and wildlife. Certain measures can be taken to prevent ("protective") or reduce ("remedial") the potential problems and effects listed in Tables 1,2 and 3. It is essential to treat the

causes as much as possible and not just the symptoms, or problems will continue to proliferate. Once problems become serious, fewer choices are available for treatment and sometimes little or nothing can be done to solve them. Preventative actions are the best tools and are preferable to abatement measures for reasons of cost, probability of success, and variety of alternatives.

The natural attributes of the shorezone should be protected as much as possible, for once disturbed, they may not be possible to replace and remedial actions may be continually necessary. For instance, the native plant growth along the shore (both in the foreshore and backshore) serves to hold the soil in place and to take up potentially polluting nutrients from the soil. If removed, erosion will most likely result and the nutrients in the soil will then stimulate unwanted aquatic plant growth. Stabilization of the bare shore and removal of the excess nutrients in the lake can be quite difficult and expensive, if not impossible. Leaving a buffer strip around the shoreline where plants are not to be removed and the soil is not to be disturbed would prevent such a problem from occurring.

The following pages list some common and workable protective and remedial measures for treating the causes of the major problems or effects found in the shorezone. Note that there is some overlap in the recommended measures. This overlap exists because the problem causes are interrelated.

Erosion / Sedimentation / Siltation and Turbidity / Runoff

Protective:

-Provide buffer zone (e.g., 35-75 ft.) in backshore where no vegetation is removed, to minimize surface runoff and shore erosion

-Restrictive footpaths provided for access to lake

-No new development on low physical capability shorelands, especially if shoreline protective structures would be necessary

-Minimize disturbance of natural beaches

-Require structures in the nearshore to be permeable for littoral drift materials

-Require sediment traps (temporary debris basins) during construction

Remedial:

-Revegetate backshore, preferably with native plants to avoid need for fertilizing and special care

-Require strict erosion control procedures during construction and grading

-Artificially replenish beaches

-Reduce maximum lake level or average lake level to slow down shoreline erosion.

-Construct protective shoreline structures (e.g., bulkhead, revetment)--Note: increased erosion on adjacent shoreline may result.

Water Quality / Sewage / Runoff / Nutrients

Protective:

-See "Erosion" control methods

-Setback from shoreline (e.g., 75 ft.) for septic tanks or sewage lines

-Separate storm drainage system from sewage disposal system

-Minimize the area of impervious (paved or solid) surfaces in the backshore to reduce the amount of water runoff to the lake

-Ensure that waste disposal facilities operate satisfactorily

-Require pump-out facilities at all marinas for boat wastes

Remedial:

-See "Erosion" section

-Upgrade existing sewage treatment level

-Minimize or prohibit dredging and filling

-Improve existing storm drainage facilities (e.g., retention of stormwater on-site to be percolated into the soil)

-Require oil traps at parking lots near lake

-Limit use of fertilizers in backshore

Aquatic Nuisance Plants / Nutrients

Protective:

-See "Erosion" and "Water Quality"

-Avoid creating stagnant pools of water

-Make marinas permeable enough to allow adequate water circulation through the structure

-Protect natural level of aquatic plants to provide valuable habitat

Remedial:

-See "Water Quality" and "Aquatic Nuisance Plants" sections

-Improve the quality and/or quantity of aquatic and land habitat

-Provide for a diversity of landscapes for more wildlife (e.g., open meadow, dense forest, open forest)

Scenic Beauty

Protective:

-See previous sections

-Restrict development along undeveloped shorelines

-Designate areas for open space

-Limit building height in the backshore to be compatible with landscape

-Limit density of shorezone structures

-Encourage cluster development over separate buildings for open space

-Encourage shared-use facilities (e.g., community piers)

-Set back all structures in the backshore, especially in high scenic impact areas

Remedial:

-See previous sections

-Design structures to blend in with the natural background

-Encourage revegetation around existing development

-Reduce the number and density of shoreline structures, such as broken piers, boathouses, excess buoys

Public Access

Protective:

-Set shoreline property as high priority for public acquisition

Remedial:

-Reduce the number and density of shoreline structures in lake

-Obtain right-of-way agreements through private property

Management Responsibilities

It is helpful to keep track of all the shorezone regulatory agencies and their powers, for they can be of service in providing background information, management advice, and enforcement when local governments lack the administrative or legal capability. Although the agencies attempt to provide regulation of uses through their permit review procedure, they often are overloaded or understaffed and will at times act on the basis of local recommendations. Local government can therefore influence regional, state, and federal decisions concerning the shorezone if it has the desire.

Another good reason to sort out management responsibilities is to identify those subjects and concerns which lack sufficient regulatory controls. These areas of concern may need new or stronger legislation or a local ordinance in order to be effectively controlled.

Table 6 lists the common shorezone regulatory subjects with space for the federal, state, and local agencies having jurisdiction. Since the federal agencies' responsibilities are basically the same in every state, they have been included in the list. However, variations will occur for different lakes and federal responsibilities will be less for non-navigable lakes.

TABLE 6

SHOREZONE MANAGEMENT RESPONSIBILITIES

Regulatory Subject	Agencies		
	Federal	State	Local
Lake Bed			
Flood Control/water level	Corps/BuRec		
Navigation	Corps/USCG		
Lake Structures	Corps		
Water Supply	EPA/BuRec		
Water Quality	EPA/Corps		
Sewage Treatment	EPA		
Erosion	EPA/SCS		
Dredge and Fill	Corps		
Construction/Grading	EPA		
Storm Drainage	EPA		
Fish and Wildlife	FWS		
Vegetation (land)			
Vegetation (aquatic)	EPA		
Unique Habitat/Wetlands	FWS/Corps		
Aesthetics			
Recreation	BOR		
Public Access			
Land Use			
Zoning			

Abbreviations: Corps--U.S. Army Corps of Engineers; BuRec--Bureau of Reclamation; USCG--U.S. Coast Guard; EPA--Environmental Protection Agency; SCS--Soil Conservation Service; FWS==Fish and Wildlife Service; BOR--Bureau of Outdoor Recreation

CONCLUSIONS

The preceding shorezone scheme is an attempt at combining basic environmental concerns with a common sense approach for the planning and management of the shorezone. Attention to solving the communication gap between laymen and professionals or scientists is long overdue and this is one approach that can be used to meet this need. Some special features of the scheme stand out. The scheme is: directed to what laymen need; informative about the shorezone's significance; focused on the shorezone and not just the shorelands; sensitive to the language used; and useful on both the macro- and micro-levels of decision-making.

A certain amount of accuracy in describing the complexity of the natural shorezone system is, of necessity, sacrificed through this approach. The appropriate qualifications and subtle implications which scientists would mention are not included in order to keep the scheme intelligible and workable. Thus, a trade-off was made between complexity and ignorance. A more sophisticated, scientific approach could include the dynamic response of the natural shorezone system to human interference. By incorporating the characteristics of sensitivity and resiliency, such an approach could ideally describe the capacity of the system to absorb impacts and recommended more specific management actions. Instead, the proposed scheme assumed a conservative approach to management by basically recommending a general minimization of impact on the system.

The problems of the shorezone cannot be neatly packaged into a tidy model which will then produce a simple, "correct" answer. This scheme does not attempt to be a neat package but attempts to sort out the key issues and concerns for local government. Future work will be necessary to make the scheme more workable and applicable to more lakeshore areas by broadening the scope to more than just rural recreational lakes. The inclusion of beneficial effects from certain shorezone uses or actions also would improve the scheme.

Before applying this scheme to some real-world examples, an in-depth study of shorezone planning at Lake Tahoe will be described.

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CHAPTER IV

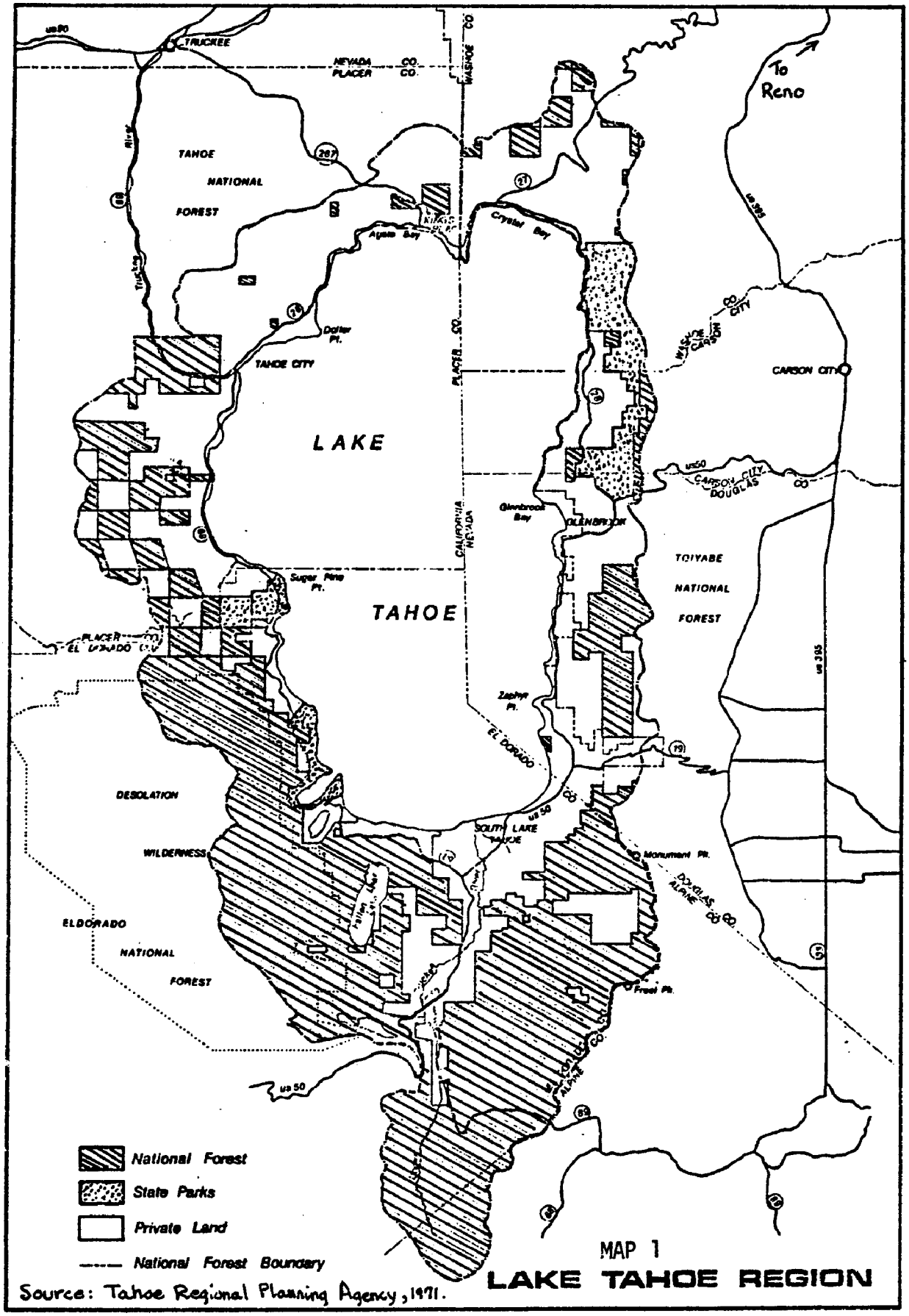
THE LAKE TAHOE CASE STUDY

> A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land.
>
> Aldo Leopold

BACKGROUND: Purpose

World-renowned for its beauty, Lake Tahoe, like many other scenic lakes, is facing the loss of its precious qualities. Environmentally disruptive activities--road-building, recreational home development, and commercial expansion--continue despite the danger to the delicate lake. The shorezone is particularly delicate and is already showing some signs of stress. As a result, this shorezone area has recently become the focus of attention of researchers, planners, and decision-makers. Other lakes of less renown, but similarly threatened, can gain much from Lake Tahoe's experience.

Located high in the Sierra Nevada mountains on the California-Nevada border, the Tahoe Basin deserves its special reputation. Only two other lakes in the world surpass the lake in clarity.[1] Other unusual features, though, have contributed to its problems. Governmental jurisdiction is divided between two states, five counties, two regional planning agencies, and several public land management agencies, as shown in Map 1 and Table 7. The economy is greatly influenced by the gaming industry on the Nevada side, a



MAP 1

LAKE TAHOE REGION

Source: Tahoe Regional Planning Agency, 1971.

TABLE 7

LAKE TAHOE BASIN FACTS AND FIGURES

Lake Tahoe:*

Altitude	6229 feet (1898 meters)
Lake area	191 sq. miles (499 km^2)
Volume	122 mil. acre ft. (156 km^3)
Depth	1645 ft. (501 m.) max.; 1033 ft. ave.
Shoreline	71 miles (113 km.)
Secchi disk depth	116 ft. (35 m.)
Retention time	700 years approx.
Temperature range	40° to 68° F (4.4° to 20.0° C)
Limiting nutrients	nitrate-nitrogen, iron
Primary productivity rate	0.5 to 2.6 mg $C/m^3/day$
Nutrient level	5 to 10μg/l for NO_3-N, Tot-P
Littoral zone depth	100 meters (18.7% of surface area)
Watershed	315 sq. miles (800 km^2)

Basin Land Ownership:**

Federal (public)	107,826 acres	(57% total)		
State (public)	9,600 acres	(5% total)		
Counties	Total	(acres)	Private	(acres)
El Dorado (Cal.)	96,887	(56%)	12,004	
Placer (Cal.)	46,291	(20%)	34,150	
Washoe (Nev.)	19,700	(9%)	13,949	
Douglas (Nev.)	23,538	(12%)	16,210	
Carson City (Nev.)	5,830	(3%)	2,678	
City of South Lake Tahoe (Cal.)	5,482		5,482	
Total land area	201,898 acres		84,473	(38% total)

Sources:

*Goldman, C. and E. de Amezaga. 1975. "Primary Productivity in the Littoral Zone of Lake Tahoe, California - Nevada" Symp. Biol. Hung. 15:49-62.

**Tahoe Regional Planning Agency. 1971. Guides for Planning -- Technical Committee Reports, prepared for the TRPA and Forest Service, South Lake Tahoe, California, p. 3.

feature attracting large numbers of visitors for reasons unrelated to the lake. A wide variety of recreation opportunities now bring people to the region year-round. Unlike most lakes, the water quality is no longer threatened by sewage wastes since legislation mandates that all wastes be exported from the basin.[2] However, the available capacity of the local sewage treatment plants has also allowed development to exceed the former limits set by the septic tank capacity of the basin, and a new construction boom has resulted.[3]

In many ways, Lake Tahoe epitomizes a recurring phenomenon among recreational tourist attractions. Lewis Mumford aptly describes this problem in his book, The Urban Prospect:

> So again in attempting to fill up the empty hours of leisure that our mechanical achievements have brought about, we tend to turn every great recreation area into a congested metropolitan slum, pretending to find solace in the beauties of nature, at Yosemite or Lake Tahoe, in an actual environment that strangely resembles a parking lot around a hamburger joint. If the places where we live and work were really fit for permanent human habitation, why should we spend so much of our time getting away from them?[4]

Apparently, one of the problem sources is out of the reach of the planning and politics of the local and regional governments at a recreation area like Tahoe. Regional planning, despite its best efforts, will not be able to prevent the occurrence of outside developmental pressures. While such exogenous forces are beyond the scope of this study, they should be kept in mind during the proceeding analysis.

Another advantage to examining the shorezone issue at Lake Tahoe is the vast amount of information which has been collected.

Over 1000 research papers, ranging from archaeology to zooplankton, have been written on the region since the earliest investigation in 1878.[5] The lake's distinctive qualities and problems attract researchers from all over the world as well as substantial funding from public and private sources. As of February, 1976, the total funding for 47 current research projects in the basin was estimated to be $6.5 million.[6] Probably no other lake in the world has received such a thorough examination in both breadth and depth as has Tahoe. As a result, an analysis of its shorezone system can begin at a much higher level than can one of less-studied lakes.

New data was also collected by the author during her research investigation at the lake (July 1975 - July 1976). At that time, the final deliberations were being made for the passage of a new Shorezone Ordinance by the Tahoe Regional Planning Agency (TRPA), the culmination of a four year struggle. The TRPA was the first agency in the country to adopt a land capability system as part of law and is the only interstate regional planning agency to have serious enforcement powers.[7] The details of the history, the planning process, and the effectiveness of shorezone planning at Tahoe will be reviewed in greater detail later on in this chapter.

First of all, the physical and ecological status of the region's watershed and the lake itself should be discussed in order to understand some of the cause-effect relationships involved with the shorezone system of Lake Tahoe.

The Physical Setting

The land use impact upon the water at Lake Tahoe is directly tied to the basin's physical characteristics. Although the Tahoe area is described ad nauseam as a "unique environment," some of its unique attributes need to be mentioned. The Environmental Protection Agency (EPA), in its recent report "The Lake Tahoe Study," called the basin a "geo-hydrologic rarity" because of its special combination of altitude, geology, climate, topography, and hydrology. Of particular significance is EPA's description of the Tahoe environment as one "in which the integrity of the land directly determines the quality of the waters."[8]

The Tahoe landscape was formed by a combination of faulting and volcanism about 2 million years ago.[9] Most of the bedrock is of granitic origin, except in the north and northwest portions of the basin. There, lava blocked all river outflows but one, causing the lake level to rise to an eventual elevation of 6223 feet. Considerable glaciation on the west side left deep canyons and large piles of morainal debris.

The erosion potential is great. The soils tend to be shallow, coarse-textured, and lacking in humus and other soil binding and moisture-holding materials. Also, the topography is generally quite steep, with about half the land having a slope steeper than 20 percent. Revegetation is slow and difficult because of the short growing season and eroded slopes. Over 400 meters of sediments are contained in the basin.[10] Presently about 50,000 tons of sediments

are deposited in the lake each year.[11]

A physical description of the shoreline was given by two geologists:

> Disturbance of geologic units along the shoreline area is extremely destructive in terms of erosion and siltation because the geologic units are principally unconsolidated fine-grained lake bed sediments.[12]

Precipitation varies between an average of 80 inches per year on the upper western slopes to 20 inches on the eastern shore. Sixty-five separate watersheds drain into the lake. The largest watershed is the Upper Truckee River, which accounts for about one-third of the total runoff into the lake and drains one of the most urbanized and rapidly developing areas in the basin.

Regulation of the lake level by a dam at the Truckee River outlet for water storage purposes can alter the lake surface elevation between 6223 and 6229 feet. During the past decade, the water level has been kept quite high, which has reportedly induced accelerated shoreline erosion.[13]

The Ecological Setting

The lake's present trophic status can best be described as ultra-oligotrophic, meaning it possesses a very low nutrient content (5-10 μg/l NO_3-N). Representative of this condition is the unusual clarity of the water. A white disk can be seen to a depth of about 135 feet (40 meters) on a calm winter day. Photosynthesis is thus able to occur at depths of over 100 meters and attached plants are found down to this limit. The nearshore, or "littoral zone,"

represents 18.7% of the lake's surface area.

The stability of the lake system is critically affected by retention time and limiting nutrients. Due to Lake Tahoe's extreme depth (313m average) and large volume (156 km^3), the retention time is calculated to be approximately 700 years.[15] On the human time scale, the accumulation of nutrients is essentially permanent and irreversible. Algal-limiting nutrients are nitrogen in the form of nitrate, and, to a lesser degree, iron. Unlike many other lakes and reservoirs, phosphorus is only secondary in importance as a nutrient species for limiting primary productivity at this time.[16]

To simplify the complex ecological interactions involved within the lake system, the food web cycle of Lake Tahoe is depicted in Figure 5B. It traces the exogenous nutrient sources of soil and precipitation and illustrates their influence in a very generalized manner. Recently, significant disruption in the aquatic ecosystem was caused by the introduction of two exotic species (kokanee salmon and opossum shrimp). The ramifications of this perturbation are being studied but have yet to be thoroughly analysed and understood.[17]

The sources of nitrate-nitrogen include: natural input by nitrogen-fixing vegetation (e.g., alders, lupines), precipitation (nitrate levels higher than those of the lake), disturbed soil, sediment, and old septic tanks. The relative significance of these sources is still being investigated.[18]

Tahoe studies confirm that runoff from both newly developed and well-established urban watersheds contribute more nutrients to

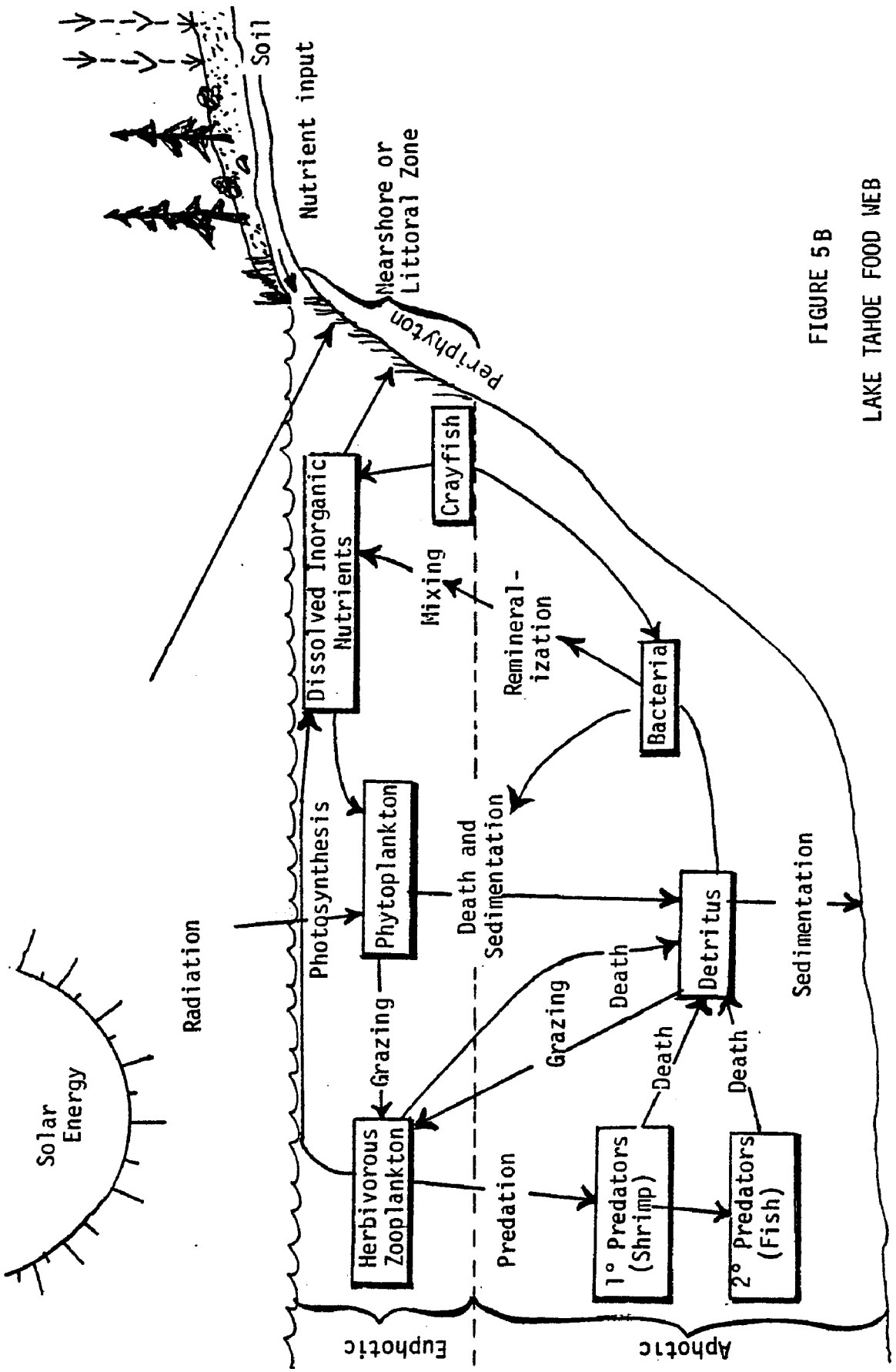


FIGURE 5B

LAKE TAHOE FOOD WEB

(Adapted from drawing by Dr. Max Tilzer)

the lake than undeveloped drainages.[19] These disturbed creeksheds have contributed twice as much nitrogen as undisturbed ones. Results also indicate that with the current amount of developed lands, it will be impossible to return to the rate of eutrophication characteristic of more pristine conditions.

Another interesting finding has come from the modeling efforts of the Tahoe Research Group of U.C. Davis, under the limnologist Dr. Charles Goldman.[20] A lag effect is involved in measuring the impacts of watershed disturbance. For instance, at the current level of 5% land development, it will take about 25 years for the effects to be noticeable in overall water quality. The impact of present development may not be measurable then until the end of this century. Conversely, the lake is slow to react to a reduction in nutrient input and any severe perturbations will have a long-lasting effect.

According to the 1974 California-Nevada-Federal Joint Water Quality Investigation of Lake Tahoe, "There is an immediate threat . . . to the shallow near-shore areas as a result of shoreline development and up gradient construction." Since the deeper portions of the lake have shown little or no change in water quality, this program increased its sampling stations near-shore, on-shore, and in tributaries to improve detection of critical changes. Prof. Goldman of the Tahoe Research Group states that research to date demonstrates that nutrient-rich tributary waters circulate around the lake margins and that most of the lake's inshore areas are visibly green in spring and early summer.[21]

The nearshore littoral zone is of great importance to the aquatic life of the lake, as it provides much of the food, cover, and reproductive sites necessary for maintenance of the food web. Since the organisms living in the nearshore area have the first opportunity to concentrate inorganic nutrients into organic matter, they can reduce the amount available for spring phytoplankton blooms and thus buffer the system against loss of transparency. Crayfish, for instance, are effective grazers which can reduce benthic primary productivity. Although obvious evidence of eutrophication, the fertility of the nearshore/littoral zone contributes only 10% of the total lake primary production. The productivity of the open water is quantitatively more important in this deep, clear lake.[22]

Certain advice concerning human activity in the lake's shorezone has been offered by some of the researchers:

1) To protect aquatic life and water quality, disturbance of the waterfront should be strictly limited (e.g., dredging, fertilization of lawns adjacent to lake, overfertilization of golf courses, stormwater runoff.)[23]
2) A vegetation buffer strip (e.g., 50 feet) should be left undisturbed along the shoreline for the following reasons:
    a) Erosion control
    b) Reduction in nutrient influx from the watershed, especially from subsurface seepage
    c) Valuable habitat
    d) Screen for aesthetics.[24]

Obviously, not all the necessary research has been done and not all the necessary solutions have been proposed. The shorezone of Lake Tahoe has yet to be studied as an entire system; only fragments are examined here and there by geologists, limnologists, biologists, and geomorphologists. A truly inter-disciplinary examination of the lakeshore region, by both aquatic and terrestrial specialists, would provide a more complete picture of the ecological relationships within the shorezone.

Land Use Changes and Water Quality

Extraordinary changes have taken place at Lake Tahoe since it was first visited by white man in 1844. Since then, it has been exploited both for its fabulous resources and its scenery. The first sweeping assault on the basin's natural balance began in the 1860's with the vast stripping of the forest slopes for timber to supply the booming Comstock Lode mines in Nevada. Most of the virgin forest in the area was removed between 1870-1900, with only a few private holdings left intact. The resulting erosion and sedimentation must have been substantial, but, of course, no measurements or studies were made at the time to determine this impact on the lake's water quality.

A common argument often brought up by the pro-growth faction at Tahoe is that if the extensive logging of the last century did not seriously damage the lake's clarity and purity, then the development of more roads and houses, which disturb less land, should not significantly harm the water quality today. The limnologist's retort to

this statement is that the logging caused an intensive disturbance for only a short period while recent development in the basin has been causing an extensive disturbance for a much longer period of time. As a result, the lake system has no chance to recuperate or absorb the continuous nutrient loading into the waters.[25]

The twentieth century saw an increase in summer tourism to the basin, but the real boom and cause for worry began in the 1950's with the advent of large-scale gambling casinos and ski areas at the lake. New sources of pollution resulted from the tremendous population growth and accompanying commercial and residential development: landfill, dredging, stormwater runoff, highway construction, septic tank seepage, sewage plant overflows, and sewage spray irrigation.

One large second-home development, through "experienced land reclamation techniques," transformed 740 acres of meadow and marsh on the south shore of the lake into "inviting forms of land, inland lagoons, and channels . . . to orient the greatest quantity of land to water."[26] While admitting the artificial waterways must be dredged on a full-time basis, the developers promised to "do everything possible to preserve and protect the unsurpassingly beautiful native setting upon which the Tahoe Basin is so greatly dependent for its economic well-being." Today the productivity in these channels is 3 to 20 times higher than that of the lake, and the original approval of the project by the city is now viewed by many as a major mistake.[27]

Thanks to a very thorough and highly respected report on the need for an improved waste disposal system in the area,[28] the impact of sewage on the lake waters was greatly reduced by the upgrading of the area's sewage treatment plants in the late 1960's (including construction of the world's most advanced tertiary plant in 1968), the prohibition of septic tank use, and the exportation of wastes out of the basin. However, an interim measure for waste disposal allowed the spraying of treated sewage over a portion of a small watershed in the basin for several years. A decade later, this area continues to yield the highest levels of nitrate of any drainage in the watershed system.[29]

The fertility of the lake has continued to increase despite the instigation of these sophisticated and expensive sewage disposal measures. Between 1959 and 1968, the primary productivity increased about 20%, but a rise occurred of 25% during the next five years. The annual rate of increase has seemed to level off since 1972, however, to a current rate of 2.5%. The present primary productivity rate is still 250 times more than the natural rate of algal growth.[30]

The major source of concern now is the nutrient release from soils eroding into the streams and nearshore waters of the lake, stimulating the growth of algae. Attached algae, not apparent two decades ago, is now seen growing on piers, boats, and rocks along the shoreline. The first algae bloom at Lake Tahoe was officially observed in the summer of 1969 at the south shore, though "unofficial" blooms had been noticed earlier.[31]

Declaring erosion and stormwater runoff the major threat to the lake's water quality, the Tahoe Regional Planning Agency began in 1975 a two-year, $702,000 program under Section 208 of PL 92-500 to study solutions to these pollution sources. The program's draft plan warns that if the existing and potential water quality problems of the area are not soon solved, "the nearshore area of the lake is going to become more murky and algae are going to become more evident than they already are."[32] It also proposes certain solutions, such as revegetation of disturbed areas, mechanical stabilization of steep slopes, local drainage collection, and the paving of dirt roads, which total to a minimal cost of $69.5 million for the worst problem areas. This figure is an estimated cost of mitigating damage from past development and does not include mitigation costs needed for current and future development.

The questions to ask now are the following: 1) Will the public (local, state, and federal) or can the public pay such a large amount to correct past mistakes and further protect the quality of Lake Tahoe's waters? 2) Will the federal and state agencies be sympathetic to the region's financial needs to solve these problems, when most areas in the country are still suffering from inadequate sewage treatment facilities and much lower water quality? 3) Will people and/or planning agencies be concerned enough that the nearshore waters are deteriorating and becoming more and more algae-laden, to take some strong preventative measures in land use and shorezone use to protect the water quality?

The Planning Agency Setting

Until the late 1960's planning in the Tahoe region was guided almost solely by a ferocious faith in unrestricted progress, home rule, and free enterprise. Local governments in 1976 still believe in unrestricted progress, home rule, and free enterprise, but now must contend with conflicting policies set by higher authorities. Regional government finally was forced to step in to counteract the growth-oriented direction of local planning.

In 1967, the existence of 75 agencies with full or partial jurisdiction over 31 important functions or goals epitomized the problems of governmental fragmentation. Development in the Tahoe basin was proceeding at a feverish pace when regional planning was first seriously proposed in 1967 by the Lake Tahoe Joint Study Committee formed by California and Nevada. Prior to then, regional planning had only been attempted by the Tahoe Regional Planning Commission. The Commission, however, was purely an advisory agency to local authorities. The initial outcome of the Committee's proposal for a permanent bi-state regional planning authority with broad powers was the creation by California of the California Tahoe Regional Planning Agency (CTRPA) in mid-1967 and by Nevada of the Nevada Tahoe Regional Planning Agency (NTRPA) in 1969.

Although both CTRPA and NTRPA developed and adopted their own plans, ordinances, and maps, their responsibilities became (temporarily) superceded in December 1969 when Congress ratified the Tahoe Regional Planning Compact. A single bi-state agency, the Tahoe

Regional Planning Agency (TRPA), was then created with the ". . . power to adopt and enforce a regional plan of resource conservation and orderly development, to exercise effective environmental controls and to perform other essential functions . . ."[33] Money is provided by the two states and five counties, and enforcement effort is required of the local county district attorney offices.

The decision-making body is the Governing Board, whose members represent each of the five counties (usually a county supervisor/commissioner), the City of South Lake Tahoe (city councilman), one gubernatorial appointee from each state, the director of each state's resources agency, and one nonvoting presidential appointee (presently Regional Director of U. S. Forest Service). Such a representation tips the balance of votes in favor of the local governments. In addition, a majority of the five members from each state must concur on an issue before it is approved. If no such "dual majority" decision is reached within 60 days after an application for a project is submitted, then, by default, the project is approved.

Both the Staff and the technical Advisory Planning Commission (APC) are responsible for making recommendations to the Governing Board about pending projects, ordinances and plans. However, the APC's role has declined in recent years and is no longer very influential.[34] To date, the Staff has drawn up a General Plan and nine implementing ordinances and has had all but three of the ordinances adopted into law by the Governing Board. The most controversial aspect of this planning and implementation process was the original

land capability map portion of the General Plan and the Land Use Ordinance. Incorporating an immense amount of ecological data on the Tahoe Basin, an interdisciplinary group of consultants from U. C. Berkeley and the U. S. Forest Service created a Tahoe Data Bank, with the help of a computer, to determine the land's inherent capacity for development. This approach, though very much influenced by Hills' and McHarg's methods, was a new and more sophisticated method since it allowed the combination of a larger number of variables for analysis.[35] Seven land capability classes evolved from this technique, from least tolerant (e.g., wetlands and very steep areas) to most tolerant (e.g., flat with good drainage), and restrictions for development in terms of allowable impervious coverage were related to each class. Many landowners and developers feel such restrictions are equivalent to an unconstitutional "taking" of land, but to date no such claims or lawsuits against TRPA have held up in federal or state courts.

Despite this strong reliance on ecological factors as the basis for planning, the TRPA effort has suffered from several weaknesses:

1) Commercial development disturbance was not successfully limited by the system.
2) Many lots were grandfathered in and exempted from the land capability restrictions.
3) Virgin land was still allowed to be subdivided since much of it was zoned previously for development.

4) The population could still eventually double.

5) Due to the "dual majority" ruling and grandfathering provisions, expansions to existing casinos and construction of new casino/hotels have been approved by default.

Also, the Staff was oriented towards a middle-of-the-road policy. One TRPA observer noted that the Staff believed "to be effective you have to be realistic and only attempt to do what has a reasonable chance of succeeding."[37] In the political climate that prevailed at the time, few environmental or growth restricting measures had much "chance of succeeding."

As a result, a vocal group of California conservationists and out-of-basin legislators convinced the state legislature in 1973 to reinstitute the CTRPA and give it a broader mandate and a full-time staff. Such a move was part of a strategy to effect changes in the bi-state compact in order to improve TRPA's decision-making rules and to broaden the representation to additional out-of-basin menbers on the TRPA Governing Board. So far, the CTRPA Governing Board has taken a strong environmental stance with its new Regional Plan and Land Use Ordinance. Using the same land capability maps as TRPA, the CTRPA downzoned the allowable densities of TRPA's General Plan so that now the maximum peak population for the basin is potentially 232,000 instead of the former 300,000.[38] In addition, enforcement capabilities are provided to CTRPA through the state attorney general's office whereas TRPA is dependent on the appropriate county district attorney. Facing stronger local opposition than TRPA ever faced,

the California regional agency is presently holding its own and actively planning in a tense political environment.

This brief background and status report of the regional planning situation at Tahoe ignores many of the subtle interactions and political struggles which are involved in the planning process. For instance, some of the local governments still challenge the authority of any regional agency to plan for their areas and refuse to help enforce any of the TRPA or CTRPA ordinances.[39] However, numerous articles, reports, and theses have already been written on the subject and the details need not be repeated here.[40]

It should now prove enlightening to turn to the planning and management aspects of the lakeshore. The physical, ecological, and historical descriptions of the shorezone at Lake Tahoe have shown that it is a very fragile system, with a highly erodible shoreline, nutrient-rich nearshore waters, and critical habitat for the lake's food web. Development continues along the shoreline and in critical creeksheds despite the fact that the lake is still suffering from the impacts of past development. Both of the regional planning agencies are presently responsible for controlling these land disturbances and for protecting the quality of the shorezone. By exploring the process involved in regulating the use of this land-water interface, then the influence of scientists on policymaking, the concerns of the public, planners, and decision-makers, and the effectiveness of the Tahoe approach can all be ascertained.

TAHOE SHOREZONE PLANNING AND MANAGEMENT

A common opinion among Tahoe's devotees is that the shoreline is probably the lake's greatest asset. Aesthetically and recreationally, it is the focal point for many visitors' activities: sightseeing, photography, swimming, picknicking, and fishing. For some people, the shoreline is their only contact with the lake and views of the shoreline from the perimeter road or from a cruising boat are the major attraction for coming to Tahoe. Despite these attributes, only 22 of the lake's 71 shoreline miles are now publicly owned (See Table 8).

The present situation of Lake Tahoe's shorezone depends greatly upon one's perspective. As described previously, scientists are concerned about nearshore water quality and shoreline erosion. However, most shoreline owners feel there is no shorezone problem and no changes are needed, except perhaps the removal of a few abandoned piers. Federal agencies, including the Forest Service and the Bureau of Outdoor Recreation, believe that current practices of individual shoreline parcel owners are interfering with the public's right to use and enjoy the shorezone.

Legally, it should be recognized that Lake Tahoe is defined as a "navigable lake." At the time of their admission to the Union, California and Nevada received title to the lake bed "in trust for the public." The California State Lands Commission, responsible for managing its portion of the lake bed, claims that legally, "it seems

TABLE 8

LAKE TAHOE SHOREZONE FACTS

Shoreline:	Miles	%
Total length (California/Nevada)	71	100
California	42	59
El Dorado County	21.3	30
Placer County	20.7	29
Nevada	29	41
Douglas County	12.7	18
Carson City	4.2	6
Washoe County	12.1	17
Public ownership (total)	22	31
U. S. Forest Service	9.78	13.7
California State Parks	8.50	12.0
Nevada State Parks	3.25	5.3
City of South Lake Tahoe	0.75	1.1
Private ownership (total)	49	69

Distribution of Lakefront Lots and Piers:

	# Lots	1955	1969	1972
California	1161	270	456	567
Nevada	560	70	76	120
Total	1721	340	532	687

Shorezone Capabilities (Orme, 1972):

	% Total Shoreline
Low Hazard (Levels 9, 8, 7)	33.0
Moderate Hazard (Levels 6, 5, 4)	22.6
High Hazard (Levels 3, 2, 1)	44.4

clear that the public has rights over all lands covered by the waters of Lake Tahoe."[41] The specific limits of the lake waters are still a matter of controversy, though. Does public ownership extend to the low water (6223 ft.) or to the high water (6229 ft.) level of the lake? No ruling has yet been made by either state attorney general on this issue.

Many governmental entities have planning and/or management responsibilities for Lake Tahoe's shorezone. As can be seen in Appendix , there are 2 regional, 8 federal, 7 state, and 6 local agencies involved in one way or another with the area. In addition, several citizens' groups and other interests are active participants in the issue. Each entity represents different responsibilities, authorities, and perspectives, the implications of which will be discussed in the last section of this chapter.

Aesthetics, ecology, economics, law, and philosophy are all intertwined in the struggle to determine the status of the shorezone. To be examined now are some past approaches to protecting the shorezone, including local regulations to national lakeshore/park proposals; a chronology of regional shorezone planning events by TRPA and CTRPA, and the planning processes involved; an ecological basis for planning shorezone uses; and the pertinent participants in the process.

History of Shorezone Planning Events

Concern over the deteriorating condition of the lakeshore was voiced long before any action was taken by responsible authorities. Back in 1957, a Nevada newspaper reporter lamented:

> Only 30 years ago the shores of Lake Tahoe, one of the scenic and recreational wonderlands of the nation, were a virtual wilderness . . . In the summer of 1956, a picknicker at Lake Tahoe would have to "know his way around" indeed to be able to find a sandy shore with enough elbow room to munch a hamburger sandwich without paying some sort of fee. Lake Tahoe, in short, is an area that has become "citified."[42]

Various tactics and positions have been tried since the turn of the century by the levels of government involved: local, regional, state, and federal. A brief account of some of the trials and tribulations experienced by these different entities will help to explain the current situation from both the political and planning viewpoints. Progress can then be evaluated after reviewing the recent efforts of TRPA and CTRPA.

Local and State:

The problem of private landowners holding public beaches for personal use in Placer County first became a publicized issue in 1957, but it took until 1966 for the Board of Supervisors to bring title suit for the beach to court.[43] El Dorado County, the Corps of Engineers, and the California State Lands Commission were ready and willing to approve commercial dredging near two public beaches at the south shore in 1959 until the influential Lake Tahoe Area Council brought down the wrath of the Forest Service, the newspapers, and the public

upon the proponents.[44] No commercial dredging in the lake has since been approved. That same year, the Area Council had a special report prepared on the issue of littoral drift and its relationship to beach erosion.[45] Warning that the unlimited approval of new lakeside structures could have dire consequences for the stability of the shoreline, it went on to recommend that such applications receive technical review by the Corps of Engineers, the state engineer, and the appropriate county. At that time, only the Corps of Engineers reviewed shoreline projects and then only on the basis of impact on navigability. It was not until 1974 that the Corps broadened its consideration to environmental and aesthetic concerns for permit review.

Regional and State:

No attempt was made locally to promulgate shoreline regulations for Lake Tahoe until the earlier CTRPA was formed. Due to a lack of staff and other assorted problems, the agency's Interim General Plan adopted the local planning maps as their "plan" but these showed several inconsistencies. All of the shoreline in Placer County was designated in private ownership while the shoreline of the City of South Lake Tahoe was shown to be public.[46] This lack of uniform policy towards the status of the shoreline reflected the confusion of the state's legal position on the foreshore lands, which has yet to be resolved. However, this problem did not deter CTRPA from approving several 250-350 foot piers and a new lagoon and key development in a marsh at the north shore. In May 1968, the agency's

Technical Advisory Committee drafted a tentative list of "Lake Tahoe Minimum Uniform Shoreline Construction Regulations." Among its significant provisions were:

1) Prohibition of restriction of public access to public lands and waters within the high water rim of Lake Tahoe;
2) Prohibition of single-family residence piers, breakwaters, and appurtenant structures;
3) Encouragement of joint-use or community facilities;
4) Prohibition of using waterfront fills to increase the area of waterfront property.

Such strict standards were adamantly opposed by Placer County and certain shoreline owners. When the final regulations were approved by the California State Resources Agency in November 1968, the above four items were missing and in their place the status quo again prevailed.[47] The counterforces proved too strong for the tide to turn in favor of the public use of the lakeshore.

This conflict between "private" and "public" use (of the lake bed) is a recurring theme in both land use and water resource planning and continues to affect decisions on the shorezone at Lake Tahoe.

Federal: National Lakeshore!?

Conservationists have long maintained that the solution to most of the basin development and shoreline problems is the creation of a national park or lakeshore at Lake Tahoe. In 1900, before the area became "citified," Senator Stewart of Nevada proposed a bill

calling for the lake and the surrounding mountains to become a national park.[48] Similar bills were submitted in 1912, 1913, and 1918, but all died in the hopper. In 1935, William Penn Mott, Jr., of the National Park Service (and later California Director of Parks and Recreation) put the kibosh on the idea for the next 35 years because he felt the level of development was too high and the costs of land acquisition would be prohibitive.[49]

National interest in the proposal was revived once again in 1970, mainly due to pressures from influential conservationists in the League to Save Lake Tahoe and the Lake Tahoe Area Council. Passed by Congress, the Bible-Tahoe Lakeshore legislation (after Senator Bible of Nevada) directed the Secretary of Interior to study the feasibility and desirability of a national lakeshore, "in order to consider preserving appropriate segments of the lakeshore of Lake Tahoe and adjoining lands and waters in their natural condition for public outdoor recreation. . . ."[50] A preliminary draft written by the Bureau of Outdoor Recreation was released in June 1971, causing quite a stir locally. This 119-page report carefully examined five options representing a broad spectrum of possibilities for federal-state-local management of a national lakeshore and their implications for TRPA's organizational structure. The controversial recommendations which resulted were:

1) Change the structure of the TRPA Governing Board to one less dominated by local interests favoring development, and give the Federal member voting rights.

2) Provide funding of up to $100 million for purchasing key private lands.

3) Federal control of Tahoe's future may be necessary if TRPA does not soon get development under control.

The preliminary report was "lost" in Washington for some time. Mention was not made of it again until August 1972. Following extreme threats by Sen. Tunney of California to release the report, Secretary Rogers Morton warned President Nixon that a national lakeshore at Lake Tahoe would only serve to encourage more tourists and would thereby "threaten the environment."[51] Still the final report was withheld from public release until after the November election. In January 1973, the new tone of the Department of Interior was obvious in its final findings. Reiterating the Secretary's prior warning, it concluded that designation of Lake Tahoe as a National Lakeshore "would be counter to the desires and interests of the local and regional governments" and that TRPA, as presently constituted, was perfectly capable of effectuating environmental controls.

This radical switch in direction, the mysterious withholding of the final report for 18 months, and the contradictory warning of the Secretary about the environmental damage caused by national lakeshores, were all causes for speculation about the political pressures involved behind the scenes. Some felt election year politics killed it; one observer thought an influential member of TRPA's Governing Board convinced Senator Bible to dilute the measures; and others identified the federal Office of Management and Budget as the

culprit who pushed for the status quo. Environmentalists and concerned citizens were disappointed with the outcome and some have become completely disillusioned with trying to obtain further federal participation in protecting the natural values of Lake Tahoe.[52]

Discounting the peculiar conclusions of the final Bureau of Outdoor Recreation report, the national lakeshore proposal may not be the solution for the protection of the basin and the shorezone for various other reasons. Public land acquisition by the Forest Service and State Parks has been proceeding using funds from Congress and the Land and Water Conservation Fund, or through land exchanges with the Forest Service.[53] As of January 1976, the Forest Service administered 63% of basin lands (mainly for recreation use) and the State Parks (California and Nevada) managed 5%, for a public land total of 68%. Except for a few large private holdings that are left, almost all the prime undeveloped lands have been acquired for public use.

A national lakeshore administration would probably combine the several agency jurisdictions into one under the Forest Service, which could cause some resentment by the two states. Administration by the National Park Service, which commonly oversees national lakeshores, is another alternative but less feasible politically because it would bring in another federal agency to the basin. Also, the threat of further federal management and additional land consolidation would probably encourage increased speculation of potential lands.

About 31% of the shoreline is in public ownership (see Table 8) while legal battles continue in both California and Nevada over the county and state jurisdiction to the land between the low and high levels of 6223 feet and 6229 feet. At the present market value of $1000-$2000 per front foot, the value of the remaining private shoreline is approximately $259-$517 million. Acquisition of all of this property at fair market value would seem to be rather unrealistic at this time.

The formation of a national lakeshore might end up being merely a change of name only and not much change in management or jurisdiction. Without concurrent changes in the TRPA Compact and decisions emanating from the TRPA Governing Board, the regulation of private lands in the basin will remain inadequate and the current problems will continue. Perhaps this realization is the reason why the TRPA Executive Director felt secure in recently recommending a "Tahoe National Park and Recreation Area" to the Governing Board, for the status quo would basically be maintained.

Tahoe Regional Planning Agency: Shoreline Ordinance

The stage has now been set for the entrance of the bi-state regional planning agency. Based on the number of shoreline structures built between 1955 and 1969, the local, state, and federal agencies and the newly-formed CTRPA were not able to control the proliferation of man-made appendages into the lake, nor the sprawl of development in the backshore (see Table 8). With the creation of the TRPA in

1969, a new mandate was initiated "to preserve the scenic beauty and recreational opportunities of the region." In addition, the agency was to plan for the shorezone through means of: a) a conservation plan "for the preservation, development, utilization, and management of the scenic and other natural resources within the basin, including . . . shoreline and submerged lands . . ."; and b) all necessary ordinances, rules, regulations and policies to effectuate the adopted plans, including regional standards for "piers, harbors, breakwaters, or channels and other shoreline developments; waste disposal in shoreline areas . . ."[54]

Following approval of TRPA's General Plan in December 1971, the Governing Board and Staff sought to provide inplementation of most of the areas of regulation through the immediate adoption of four ordinances: Land Use, Grading, Shoreline, and Subdivision. The Land Use Ordinance's regulations included the backshore area of the shorezone but made no distinction between this zone and inland areas. In contrast, the Shoreline Ordinance was to focus on development in the nearshore and foreshore zones within the lake. A "Chronology of Regional Shorezone Planning Events at Lake Tahoe, 1969-1976" can be found in Table 9 and illustrates the rapid succession of events preceding adoption of the original Shoreline Ordinance in February 1972. It is not necessary to relate the details of every item on this list, but it is pertinent to describe the major influences which had an effect on the final outcome.

TABLE 9

CHRONOLOGY OF REGIONAL SHOREZONE PLANNING EVENTS
AT LAKE TAHOE 1969-1976

Dec. 18, 1969 - Tahoe Regional Planning Compact enacted by Congress, creating the Tahoe Regional Planning Agency (TRPA)

March , 1970 - TRPA began operations

July , 1970 - Corps of Engineers' freeze on shoreline permits

May , 1971 - "The Shore-Zone System for Lake Tahoe," by Dr. Antony Orme, published by TRPA

July 15, 1971 - First draft of Shoreline Ordinance (26 pages)

July 21, 1971 - Advisory Planning Commission (APC) of TRPA holds study session on first draft

July 27, 1971 - Second draft of Ordinance (24 pages)

Aug. 11, 1971 - APC meeting on Ordinance draft

Aug. 18, 1971 - Third draft (25 pages)

Aug. 25, 1971 - APC meeting on Ordinance draft

Sept. 1, 1971 - APC transmits Ordinance draft to Governing Board of TRPA

Nov. 18, 1971 - Fourth draft (19 pages)
- TRPA Subcommittee on Shoreline discusses fourth draft

Nov. 24, 1971 - TRPA Governing Board reviews fourth draft

Dec. 22, 1971 - First reading of Shoreline Ordinance; General Plan adopted

Feb. 23, 1972 - Governing Board revises fourth draft with minor changes

Mar. 13, 1972 - Study session by Ordinance Committee and Governing Board

Mar. 22, 1972 - Shoreline Ordinance adopted by Governing Board (19 pages)

Summer , 1972 - "Toward a Shore Zone Plan for Lake Tahoe," by Dr. Antony Orme, prepared for TRPA

July 26, 1972 - Dr. Orme presented findings to the Governing Board

March , 1973 - First draft of Shoreline Plan

June 6, 1973 - Shoreline Plan aired before the Advisory Planning Commission in public hearing

June 28, 1973 - Shoreline Plan approved in principle by Governing Board pending review of proposed Shoreline Ordinance amendment

August, 1973 - First draft of Shorezone Ordinance (86 pages)

Sept. 5, 1973 - APC holds public hearing on Shoreline Plan

December 1973 - APC makes recommendations for Shorezone Ordinance

Jan. 1, 1974 - California Tahoe Regional Planning Agency (CTRPA) reinstituted

Jan. 23, 1974 - Second draft of Shorezone Ordinance (77 pages) discussed by Governing Board

January 1974 - Shoreline owners organize informally

April 1974 - Public information sessions on Ordinance held around lake

May 1974 - Shoreline owners' group incorporated ("Tahoe Shorezone Representation")

Aug. 9, 1974 - Governing Board workshop on Ordinance

Nov. 1, 1974 - Third draft of Shorezone Ordinance (43 pages)

Jan. 10, 1975 - Fourth draft of Shorezone Ordinance (35 pages)

Jan. 23, 1975 - Governing Board discusses fourth draft

Feb. 6, 1975 - Public workshop held on fourth draft

Feb. 19, 1975 - TRPA legal staff analysis of public input and various alternatives

Mar. 27, 1975 - Governing Board alters fourth draft

Apr. 10, 1975 - Fifth draft (28 pages)

Apr. 23, 1975 - Sixth draft (27 pages)
Governing Board public hearing

June 17, 1975 - Seventh draft (28 pages)

June 25, 1975 - Governing Board hearing; minor revisions to seventh draft

Aug. 29, 1975 - Tahoe Shorezone Representation's draft issued (15 pages)

September1975 - Nevada Subcommittee recommendations for Shorezone Ordinance

Oct. 18, 1975 - Federal draft released (47 pages)

Oct. 23, 1975 - Governing Board workshop on Ordinance drafts

Nov. 24, 1975 - First meeting of California Tahoe Regional Planning Agency's Shorezone Committee

Jan. 29, 1976 - Governing Board workshop on Ordinance

March 1, 1976 - Eighth draft (30 pages)

Mar. 24, 1976 - Public Hearing before Governing Board

Apr. 9, 1976 - Ninth draft (28 pages)

Apr. 29, 1976 - Governing Board public hearing; minor revisions to ninth draft
- First reading of Shorezone Ordinance

May 27, 1976 - Shorezone Ordinance adopted by Governing Board

Prior to drafting the Shoreline Ordinance, the TRPA hired a geomorphologist, Dr. Antony Orme of UCLA, as a consultant to prepare a report on the Lake Tahoe shorezone system to include its natural components, the impact from human activity, and some recommended solutions. Identifying the shorezone as an "open system," Dr. Orme stated that it "must be viewed as a dynamic zone that intervenes between the inland watersheds and the deeper portions of the lake."[55] He went on to divide the "shorezone" into its three components: a) nearshore zone--from lake surface to a depth of 30 feet: b) foreshore zone--the area of wave run-up from the lake surface; and c) backshore zone--the land subject to erosion by storm waves. His background description of the natural system discussed the physical processes involved within the lake: erosion, transportation, and deposition. Other natural and aesthetic considerations were omitted from his report.

After determining that the principal influences by humans on the shorezone system were the regulation of the outlet waters, the interference with basin watersheds, and direct manipulation through the construction of shoreline structures, the consultant developed several recommendations. He warned that extensive deforestation and suburban tract development in the backshore and dredging in the nearshore should be strictly prohibited. Before allowing a shoreline project to be built, TRPA should require a thorough report of the present system and an analysis of the potential impact of the proposed structure on the system. Only permeable shoreline protective

structures should be approved where necessary to prevent the triggering of undesired responses, such as erosion scars, on other stretches of shoreline. Since the best shore protection is provided by natural beaches, all necessary steps must be taken to keep these beaches undisturbed.

It is interesting to note that Dr. Orme's recommendations are quite similar to those previously described by aquatic and terrestrial ecologists, water quality engineers, and geologists, yet they were independently derived. All of the natural scientists involved in studying Lake Tahoe appear to reach the same realizations about the shorezone irrespective of their background disciplines. They all agree that the shorezone is a critical area of the watershed and requires extra precautions against human interference.

Several of the consultant's recommendations were incorporated either in the first draft of the Shoreline Ordinance or in other related ordinances, such as Land Use and Subdivision.[56] However, his sense of concern and purpose became diluted in subsequent drafts. Instead of providing justification for the ordinance's regulations based on the protection of water quality, shoreline and underlying lands, fish spawning and aquatic habitats, the public use of the lake waters, and the lake's natural beauty, the final drafts merely included "thou shall" and "thou shall not" types of provisions. Although more concise, the final Shoreline Ordinance lacks an explicit underlying scientific rationale for its regulations and abides more by the letter of the law than by its spirit.

Some members of the TRPA Governing Board believed the Shoreline Ordinance to be as important as, if not more important than, the Land Use Ordinance for the protection of the clarity, purity and visual aspects of Lake Tahoe.[57] However, there was concern that the proposed shoreline regulations were not as protective as the Land Use Ordinance. One Board member went as far as saying, "In the Land Use Ordinance, the Governing Board has gone to great lengths to protect the environment, but when we get to Lake Tahoe, we've thrown it wide open and have said 'do anything you want to.'"[58]

The major points of contention during debate on the Shoreline Ordinance were more philosophical and legal than scientific:

1) Who should administer permits for shoreline projects--TRPA or locals?
2) Do all shoreline parcels have a legal right to a pier? If so, how long?
3) Should boathouses for private storage of boats be allowed on piers extending over public waters?
4) Should the burden of proof be on the applicant (as in the Land Use Ordinance) or on the agency to demonstrate impact on the environment?
5) Can uniform standards be set which will be applicable in all areas of the shorezone?

Discussion on the subject by the decision-makers and advisor/technicians (Advisory Planning Commission) tended to be somewhat emotional and confusing. Comments ranged from calling opponents of private piers "socialists," to decrying the final draft as "a copout to the existing fat cats that already own the shoreline."[59] Aesthetics continued to be a battling issue: "Boathouses look like a row of privies"; "Visually the shoreline is a mess." Where certain members

stood on the issues was at times indeterminable. From the minutes of an APC meeting on September 1, 1971, comes the following quote:

> Mr. Heikka commented that he did not agree with the "shall" or "may" on the development review procedure. He originally recommended a mandatory procedure, but could see Mr. Hanna's view on this concern on the length of time, etc., and if it was made a permissive procedure, it would fall into line in short order under any circumstances.

Another example of TRPA's planning in action was a decision by the Governing Board in regard to public beach designation on the General Plan map. Originally, "green dots" were used to identify areas of high priority for public beach acquisition; but, following protests by a few shoreline owners, the Governing Board soon passed a motion declaring "that the green dots on the General Plan Map be removed."[60] So much for long-range planning for the shorezone, it appears.

These excerpts from various remarks by the TRPA decision-makers serve to illustrate some of the problems involved in carrying out an environmental mandate for planning. Not all environmental issues can be "objectively" or scientifically determined, especially an issue like scenic beauty. Each decision-maker has different values upon which to define "scenic beauty" at the shorezone, and concensus can be impossible to reach, as it was for the Shoreline Ordinance. On the less subjective scientific aspects of the shorezone, opinions were not so varied. The Governing Board did little challenging or questioning of the consultant's report and recommendations. Either they trusted his judgment or they failed to understand his points well enough to determine the appropriate questions to ask.

The emotional basis for decisions by the Governing Board exemplifies the "extra-rational" type of policymaking described by the political scientist Yezekel Dror, where intuition and feelings play a great part. In contrast to TRPA decisionmaking, an "optimal policymaking" process would include both rational and extra-rational components but would avoid the extremes. It would also provide an optimal goal which is more than an incrementally improved extrapolation of the present situation.[61] Such was not the case with the Shoreline Ordinance, nor with subsequent events.

The controversial items in the Shoreline Ordinance were finally resolved as follows:

1) Local review of projects under $500; TRPA review of all others
2) One pier per parcel allowed to elevation of 6219 ft. or 350 ft. in length
3) Boathouses for marinas only, not for individual use
4) Burden of proof on applicant
5) Uniform standards were set but a shoreline plan was considered necessary to relate standards to specific locations and shoreline features.

Although the Ordinance was adopted by the Governing Board in March 1972, the Board and Staff realized that they had put the cart before the horse and needed a detailed shoreline plan before a decent implementing ordinance could be written. The Board concluded that the present ordinance was not workable for single family piers, and therefore the Corps of Engineers' freeze on approving individual piers should be extended until a plan was prepared.[62] The lawyer who drafted the ordinance also noted its shortcomings in his comment,

". . . given the amount of information we had and the amount of political consensus in the basin, it wasn't a bad job, but it wasn't any great shakes."[63]

Shorezone Plan and Capability System

In 1973, Dr. Orme was again hired as consultant to provide the necessary materials and framework for the agency's Shoreline/ Shorezone Plan. The term shorezone as opposed to shoreline was preferred by the consultant in order to emphasize the broader planning consideration of the backshore, foreshore, and nearshore areas. In his second report, "Toward a Shorezone Plan for Lake Tahoe," he revised his former definitions of these zones to encompass a total minimum width of 700 feet, or 350 feet on both sides of the shoreline, because this width is "considered essential for meaningful planning purposes. . . . Without effective control over activities within the backshore zone, a Shorezone Plan would be impotent and meaningless."[64]

The preliminary study for the Plan included three parts: 1) physical characteristics, 2) biological data, and 3) visual/ aesthetic factors. Since the consultant's expertise was in geomorphology, the physical aspects were covered more thoroughly than the others in the report and included much new data which he personally collected. First, the existing state of the shoreline was broken down into four categories: eroding, protected by engineering structures, equilibrium, and depositing. Secondly, shorezone types as

based on composition (e.g., volcanic rock) and geometry (e.g., slope of the backshore and nearshore zones) were classified. For each of these 14 combinations of shorezone types, a qualitative ranking from 1 to 9 was assigned as determined by the innate physical capability for tolerating human disturbance (see Table 7 and Figure 6). For instance, high hazard shorezones (capability levels 1 through 3) include barrier beaches, morainic debris slopes over 30 percent, alluvial areas of 9-30 percent and armored granite zones with slopes above 30 percent. All of these shorelands are highly susceptible to either erosion, slumping, frost-heaving, mass movement, or, in the case of barrier beaches, total destruction. One marsh-filled development did destroy a barrier beach and its wetlands, an event which Dr. Orme declared "a great ecological tragedy."[65] Conversely, low hazard or high capability zones of 7 through 9 consist of gently sloping morainic, alluvial, and armored granite areas. In conjunction with each capability level, the consultant recommended appropriate suitabilities for human use. Areas of low capability, like barrier beach zones, should be preserved as much as possible, guarding beach vegetation from disturbance and allowing swimming and recreational uses only on wide beaches. In areas of moderate capability, unstable shoreline is the chief limiting factor for use. In these areas, some construction is tolerated in the backshore and nearshore, but shoreline development should be strictly controlled. Restrictive access paths are needed to guard against erosion and additional vegetation is necessary to stabilize cliffs. High

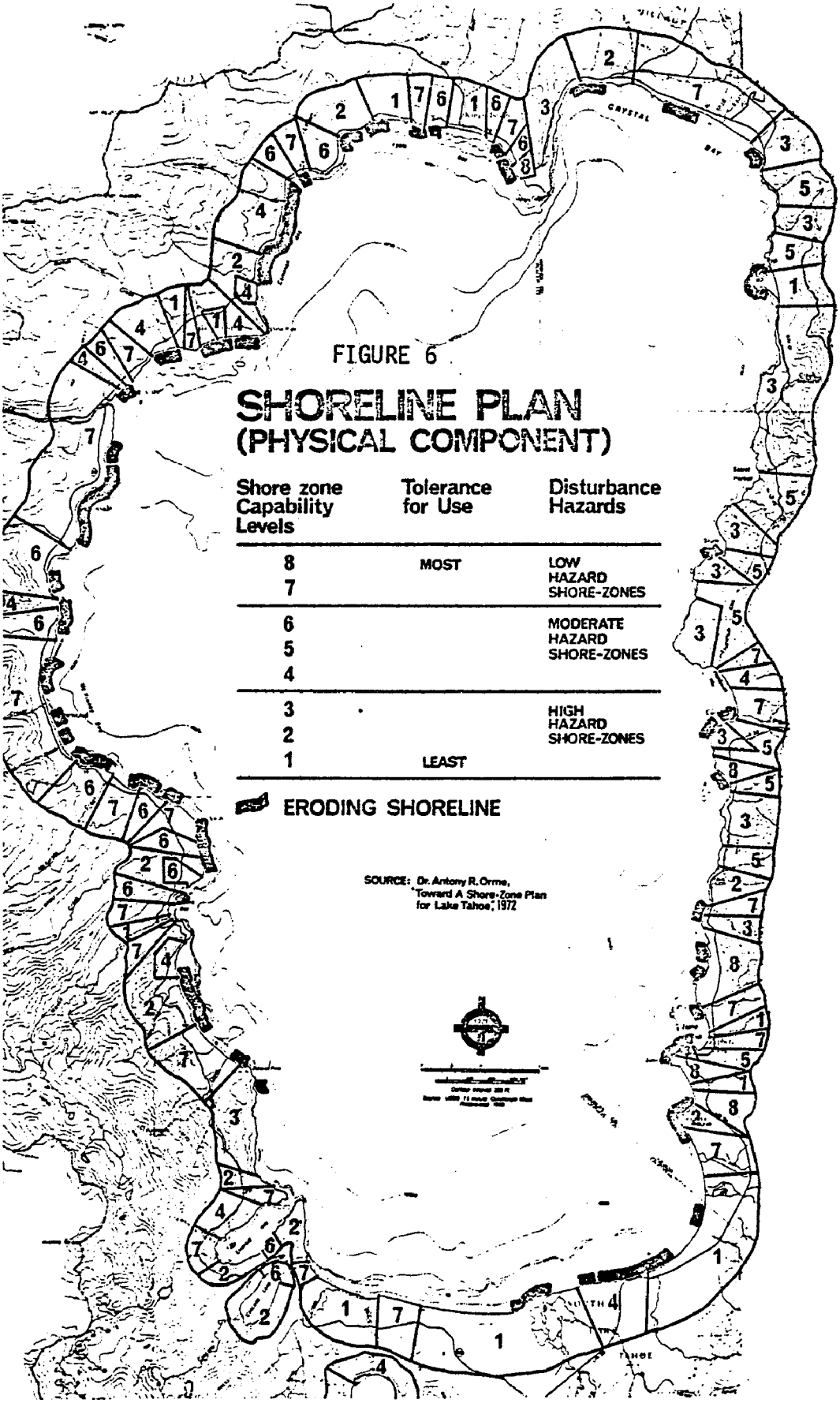


FIGURE 6

SHORELINE PLAN
(PHYSICAL COMPONENT)

Shore zone Capability Levels	Tolerance for Use	Disturbance Hazards
8 7	MOST	LOW HAZARD SHORE-ZONES
6 5 4		MODERATE HAZARD SHORE-ZONES
3 2		HIGH HAZARD SHORE-ZONES
1	LEAST	

ERODING SHORELINE

SOURCE: Dr. Antony R. Orme, "Toward A Shore-Zone Plan for Lake Tahoe", 1972

capability areas would allow more intensive uses, like marinas. No class 9 capability level shorezones exist at Tahoe, since no area is immune from at least minor disturbance. If the land capability level (from Land Use Ordinance) along the shore is in conflict with the shorezone capability, Orme recommended that whichever of the two capability systems is more stringent should be allowed to supercede the other.

The biological section considered vegetation, prime fish and aquatic habitats, and waterfowl (see Figure 7). The consultant's data sources here were not original. They came from the Forest Service and the Tahoe Research Group. Suggested for inclusion in a revised Shoreline Ordinance were these provisions:

1) All shorezone vegetation should be carefully conserved in order to maintain adequate protection against erosion, and to preserve the visual qualities and aquatic habitats afforded by such plants.
2) Vegetation regulations specific to the shorezone should be added to other pertinent ordinances, e.g., Tree Removal, Grading.
3) A map delineating prime fish and aquatic habitats as well as fish spawning areas should be included; nearshore activities should minimize interference with these areas in particular. (Note: about 85% of the shoreline is identified as such.)
4) Exotic plant and animal species should not be introduced unless no potential adverse ecological effects can be demonstrated.

The aesthetics section examined the "visual vulnerability" of the shoreline from certain public viewing spots and determined that headlands had high visual vulnerability, straight shore areas had moderate, and bays were low in potential aesthetic impact (see

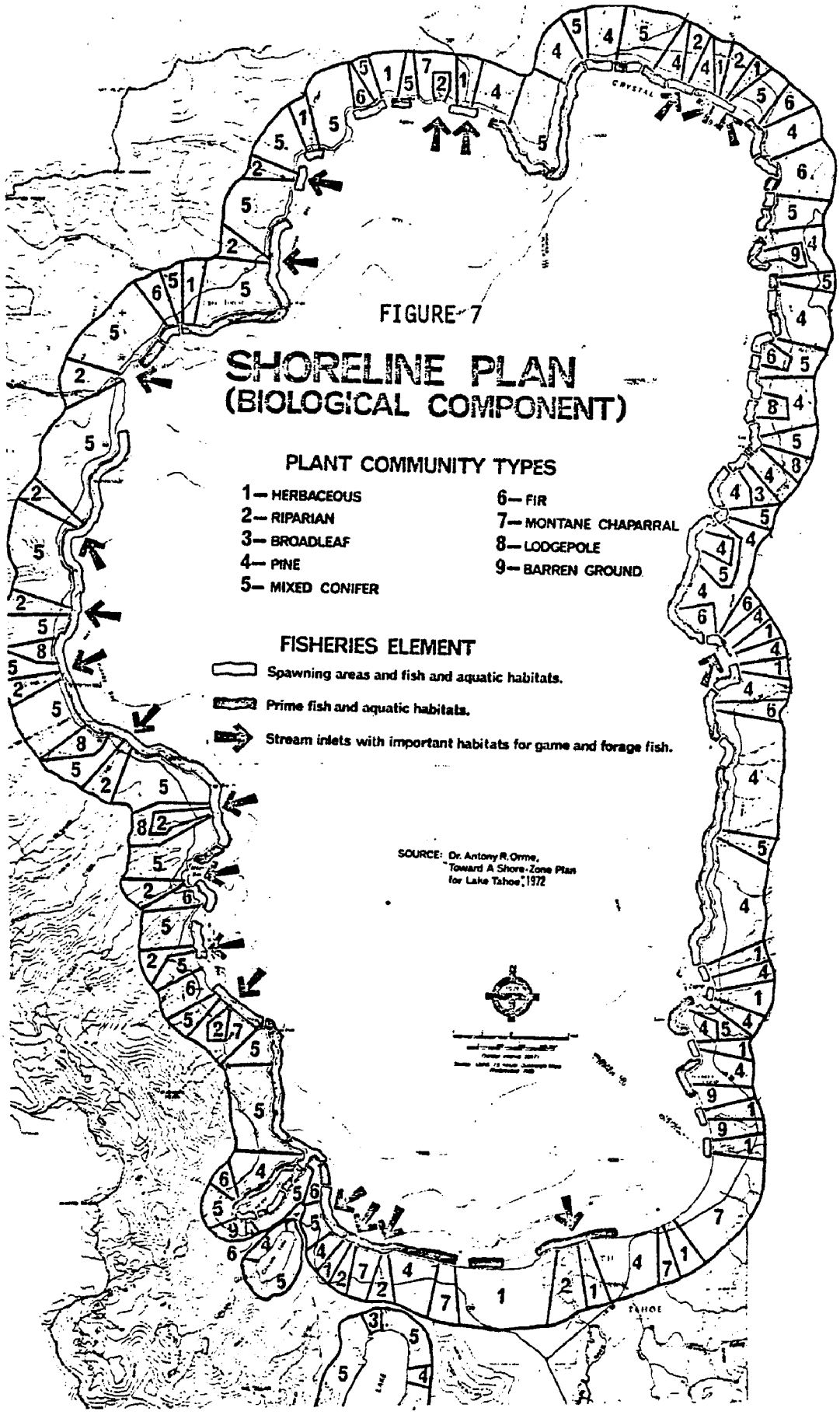
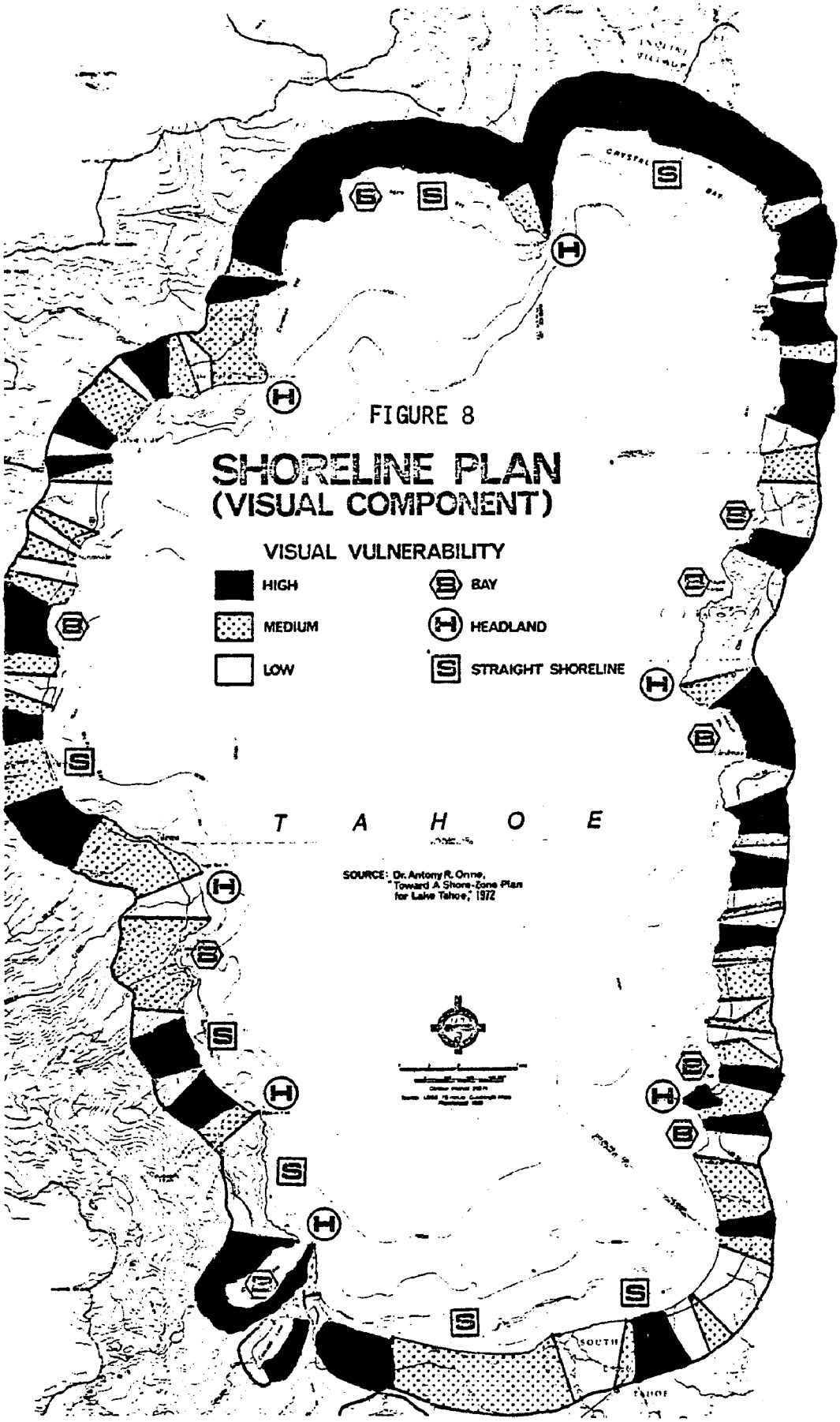

FIGURE 7
SHORELINE PLAN
(BIOLOGICAL COMPONENT)
PLANT COMMUNITY TYPES
1— HERBACEOUS
2— RIPARIAN
3— BROADLEAF
4— PINE
5— MIXED CONIFER
6— FIR
7— MONTANE CHAPARRAL
8— LODGEPOLE
9— BARREN GROUND
FISHERIES ELEMENT
Spawning areas and fish and aquatic habitats.
Prime fish and aquatic habitats.
Stream inlets with important habitats for game and forage fish.
SOURCE: Dr. Antony R. Orme, "Toward A Shore-Zone Plan for Lake Tahoe," 1972

Figure 8). Combining these three visual categories with the low-moderate-high levels of physical capabilities, Dr. Orme proposed relative setback limits from the shoreline for backshore developments. These setbacks ranged from 50 feet for low physical/low visual impact to 300 feet for high physical/high visual tolerance areas. This approach was considered superior to setting one arbitrary setback distance for the whole shorezone.

The consultant presented his completed report, "Toward a Shorezone Plan for Lake Tahoe," to the TRPA Governing Board in the summer of 1972, and explained the basis for the shorezone capability system. The decision-makers seemed quite receptive to the expert's recommendations at the time and requested the Staff to prepare a Shorezone Plan from the report. In 1975, Dr. Orme received an Award of Merit for this study from the Sacramento Chapter of the American Institute of Planners.

Eight months later, the Staff produced a 51-page draft plan which, aside from some new maps and a few introductory and concluding paragraphs, was almost word for word from the consultant's report. Unfortunately, the preliminary study's wording was too general and ambiguous in places and needed revision. As a policy statement, the plan lacks one very major element--objectives. What is the long-range goal or policy for the shorezone (i.e., should private use be phased out since the shorezone contains public water and lands? Or should the "rights" of shoreline owners be allowed to dictate its future use?)? Also, what direction is the plan taking to carry out


FIGURE 8
SHORELINE PLAN
(VISUAL COMPONENT)
VISUAL VULNERABILITY
HIGH
MEDIUM
LOW
BAY
HEADLAND
STRAIGHT SHORELINE
T A H O E
SOURCE: Dr. Antony R. Orme,
"Toward A Shore-Zone Plan
for Lake Tahoe," 1972

the goals of the bi-state compact (i.e., will the protection of "scenic beauty" be a high priority item upon which to evaluate decisions?)?

These are just a few of the issues that should have been addressed at the outset of TRPA's shorezone planning process. It was not the consultant's responsibility to set objectives. The Governing Board should have done so but did not, and the Staff did not request or propose any. The only reference to policy was written by the Staff in the conclusion to the final Plan:

> The Shoreline Plan, as represented in the text and accompanying maps, is a policy statement based upon ecological and social input relative to Lake Tahoe, its immediate shoreline, and the uses of both. To be effective it must be considered a living composite of social and environmental values flexible to change with new information, new social values and public participation. The tools recommended for implementation of the plan are therefore also flexible and responsive to change.[66]

Such nebulous statements contain the requisite planning jargon but leave the reader at a loss for what the "policy statement" really is. The language appears more like a disguise for the absence of goals, focusing on future changes instead of a present statement. One APC member warned against a clear statement: "Once a policy statement is adopted by an agency, it often turns around and bites them back."[67] Apparently, the only objective in mind was to get a Shorezone Plan and Ordinance approved and on the books. Despite this serious weakness of the Shorezone Plan, it was adopted "in principle" (pending a revised ordinance) by the Governing Board, with little public input. With the Plan behind them, they could then turn

to amending the original Shoreline Ordinance. However, the lack of objectives was to plague the shorezone planning course at Tahoe for some time to come.

TRPA: Shorezone Ordinance

As can be seen from the Chronology (Table 9), deliberations on the Shorezone Ordinance continued for almost three years after the first draft was issued in August, 1973. Reasons for this long delay in approval stem from the following factors:

1) An overly long and complicated first draft (86 pages)
2) Delay tactics by a well-organized and wealthy group of shoreline owners
3) Strong disagreement on philosophical issues
4) Change in composition of members on the Governing Board (i.e., losing a conservationist and gaining a shoreline owner).

After the first draft was released, the Staff was most enthusiastic about the provisions and optimistic that it would be approved soon. It successfully incorporated the physical, biological and aesthetic components of the shorezone capability system and most of Dr. Orme's recommendations. Despite a complicated permit review procedure, the draft was strong environmentally and seemed worthy of adoption. Since the Board had already approved the Plan, then the implementing ordinance should also be readily approved. However, the Staff underestimated the strength and power of the shoreline owners. These citizens were not actively involved in the discussion on the Plan but did not ignore those on the ordinance.

At the first public hearing on the north shore, where many of the wealthy shoreline owners reside, the Staff's recommendations and the ordinance draft were torn apart. Property owners were terribly upset about the entire concept of limiting shorezone development on the basis of physical tolerance levels. Even more disturbing to them was the use of visual vulnerability categories for determining setback distance. They erroneously interpreted the draft to imply that TRPA has total discretion to allow or disallow anything in the shorezone, including existing homes which do not meet the capability or setback standards. In sum, they saw the draft's provisions as a direct threat to their property values and legal rights as riparian property owners.

Eventually organizing under the name "Tahoe Shorezone Representation," the property owners' group included 450 members out of the 1721 shoreline parcels around Lake Tahoe and spent $57,000 fighting the ordinance.[68] Their goal was to obtain as lenient an ordinance as possible and ideally, to stalemate the ordinance discussions in hopes of getting an exasperated Governing Board to maintain the status quo. They hired a lawyer and engineering consultant, circulated a periodic newsletter, drew up their own maps, sent copies of all the various ordinance drafts to their members, and attended every TRPA Governing Board meeting. Not above bending the truth to suit their needs, the group's directors sent out emotional statements to the press and all shoreline owners claiming dire consequences would result from the ordinance.[69] For every supporting point the

Staff brought up, the shoreline owners would counter with an opposing argument, including their own "expert" testimony. All in all, their effort was most influential in the final outcome.

No other citizen's group was actively involved in the shorezone issue. The League to Save Lake Tahoe, often outspoken on environmental matters, was quite silent on this issue because several members of its Board of Directors were shoreline owners themselves. As the TRPA Staff Director remarked, the agency was dealing with "self-serving conservationists who are all for saving Lake Tahoe one mile from their lakefront homes."[70] A spokesman for the Sierra Club was only heard at one meeting, when he called the ordinance (the seventh draft) an "obscene document" which was an "invitation to the rich people who own the lakeshore to do what they have always done with it in the past: lock it up, exploit it, and degrade it."[71] This item of criticism was too little and too late, and had virtually no effect on the decision-makers. Other concerned citizens did not actively participate because of their disaffectation with TRPA. Thus, there were no counterbalancing citizen forces to the demands of the shoreline owners.

Philosophical and social differences created lengthy discussions and significantly stalled progress on the ordinance. The controversial issues were basically the same as those of the earlier Shoreline Ordinance, centering around private versus public use of the shorezone. Property owners claimed they have a "constitutional" right to "wharf out" to "navigable" waters, which at Lake Tahoe can

mean piers over 1000 feet in length in a few locations. Certain lawyers disagree. A U.C. Berkeley law professor and drafter of the original ordinance believes that owners have no legal right to access by piers.[72] A Nevada law firm gave the opinion that any historic rights of shoreline owners to boat access to Lake Tahoe were nullified by Congress in 1969 with the adoption of the Bi-State Compact.[73] Even the San Francisco Chronicle felt the issue was of enough importance to warrant an editorial comment in its February 3, 1974, edition. While encouraging shared-use piers in the ordinance, the editor of the newspaper, a shoreline owner, went on to warn that the Agency should not interfere with existing private shoreline facilities. Local opinions were quite hostile. The City of South Lake Tahoe Planning Commission and the Douglas County (Nevada) Board of Commissioners both voted to oppose the ordinance for its "reprehensible attempt at usurpation of constitutionally guaranteed private property rights."[74]

Momentum built up fiercely during 1975, with attempts by separate groups to write their own ordinance drafts. The shoreline owners' group proposed an ordinance with the physical capability and visual vulnerability provisions omitted for being too arbitrary, no special standards for the backshore, 250-foot piers, private boathouses, the burden of proof on the agency, and variances allowed on the basis of "safety." In sum, not many restrictions were left. On the other side, a group of federal agencies (Forest Service, Bureau of Outdoor Recreation, Corps of Engineers, and Fish and

Wildlife Service) came together and drafted a position statement and new ordinance, asking for a greater emphasis on public use and protection of natural beauty. A strongly worded statement of purpose was included in the ordinance in support of the latter, and uses were separated into "long-term" and "interim." By the year 2000, the long-range goal called for joint-use community facilities and the elimination of individual-use shoreline facilities. In the meantime, the transition from individual to community facilities would be aided by certain incentives in the ordinance.

With three different drafts up for consideration, the Governing Board was not particularly pleased with any of them, least of all with the federal agencies' proposal. Resistance and distrust by the local members on the Board to any federal suggestion were strong enough to cause that draft not to be politically feasible, particularly with the federal member of the Board unable to vote. The federal government was not going to get a national lakeshore at Lake Tahoe, nor was it going to get a shorezone ordinance to its liking. With no other significant input on the issues the Board compromised towards the position of the shoreline owners. The approved ordinance, in many ways, once again affirmed the existing situation in the shorezone:

1) No purpose or objectives stated for either the short- or long-term period
2) Shorezone Tolerance Districts included, but with little mention of the biological aspects and no setbacks required as a buffer zone between land development and the lake

3) Existing piers are "grandfathered in"
4) Private boathouses over public water allowed by variance for "safety"
5) No incentives for community facilities to be favored over individual ones
6) Non-conforming structures have until December 31, 1999, to conform.

In the meantime, the California Tahoe Regional Planning Agency has been contemplating an ordinance of its own for the shorezone. To date, the agency has only adopted a Regional Plan and a Land Use Ordinance but is receiving applications for permit review of shorezone projects ranging from pier repairs to shoreline homes on low shorezone capability lands. Since the agency's existing regulations do not cover these items adequately, and its legislation asks for shoreline protection, it would like some specific shorezone regulations. A citizens' Shorezone Committee, composed of both shoreline and non-shoreline residents, began meeting to discuss the issues in November 1975. Its recommendations were expected to be presented to the Governing Board during the summer. Upon the request of the Board, the TRPA Ordinance was to be evaluated and necessary changes were to be suggested. On the basis of the CTRPA decision-makers' past actions, they will probably want stricter regulations than those of TRPA to protect the shorezone environment. It is still too early to evaluate CTRPA's role and effectiveness, however.[75]

THE EMPEROR'S NEW CLOTHES: AN EVALUATION

In reviewing the series of regulations proposed for Tahoe's shorezone over the years, one might conclude that little progress, if

any, has been made since the 1968 tentative regulations of CTRPA. Private piers are still allowed to proliferate, public access to and use of the shoreline is not yet a high priority, and the issue of aesthetics in the shorezone is again relegated to the back seat in planning considerations. However, some progress was made in the application of ecological planning.

Certainly the original development of a shorezone capability system and its inclusion in the Shorezone Plan and Ordinance were significant breakthroughs towards a new approach in shorezone planning. In fact, TRPA is probably the first regional agency to adopt a shorezone capability system as part of law, just as it was the first one to adopt a land capability system. Unlike the land capability system, however, the shorezone tolerance districts of the ordinance are overly dependent on the physical capabilities element, ignoring much of the biological element. The resulting imbalance in favor of physical factors detracts from the credibility of the shorezone capability system. Political trade-offs resulted in a system quite different and considerably weaker than that designed by Dr. Orme.

Other differences between the land capability system and the shorezone capability system were in format, in the amount of data used, and in the time, money, and expertise involved. As explained previously, the land analysis method was done by overlaying 30 natural system variables on a computerized grid map. Enormous amounts of data of varying quality were inventoried for this effort during

an 18-month period by an interdisciplinary team from academia and agencies, all at a cost of $20,000.[76] Although this method helped "legitimize" the Regional Plan and implementing ordinance, it also antagonized the public through the confusing and mysterious process of computer analysis and scientific jargon.[77] In contrast, the shorezone system was much more low key, using general maps and comparatively simple language, and low budget ($4000 in consulting fees to Dr. Orme).[78] As a result, the shorezone analysis system was easier for the layman to comprehend. Less data and expertise were used since its scope was not as far-reaching as the land system. If the Land Use Ordinance and land capability system had not already been developed and implemented, the evaluation of the backshore capabilities would have needed greater attention than was given in the present shorezone analysis. The two systems need to work together and complement each other, especially in those locations where their tolerance levels are in conflict. The most environmentally protective of the two should prevail in those planning decisions.

The effect of scientific research on the planners and the decision-makers was variable. In the case of Dr. Orme, many of his recommendations were included in the Shoreline and Shorezone Ordinances in one form or another. The Staff supported his suggestions and pushed to have them included, though they did not always understand the meaning of his definitions.[79] The Governing Board was more skeptical and at times questioned the inclusion of the backshore zone and the accuracy of the tolerance districts on the map.[80] (The

accuracy of the maps is suspect because the Staff had to prepare the final maps from the consultant's verbal descriptions.) If the Staff had not remained steadfast on incorporating the shorezone tolerance districts and suitability system in the Ordinance, the Board would probably have omitted it to avoid the complaints of the shoreline owners. Other scientists, like those from the Tahoe Research Group, have had little if no direct contact with the planners and decision-makers on the shorezone issue. When asked, they did provide advice and/or data to Dr. Orme for his study, but did not become directly involved. Unfortunately, the most noted authority on Lake Tahoe, the limnologist Dr. Charles Goldman, has lost credibility with the basin politicians because of his past record of environmental advocacy.[81] For the most part, scientists and politicians in the region have almost no direct communication with one another. However, some research findings have been publicized widely and have thus indirectly sensitized the decision-makers to the environmental problems facing Lake Tahoe.[82]

The current Shorezone Ordinance may or may not be effective in protecting the fragile shorezone system. Of course, it is difficult to predict with much certainty what the impact of the present regulations will be on the quality of the nearshore waters. The entire watershed has an impact upon the shorezone, and its ultimate protection depends upon broader regulations, such as the Land Use Ordinance. Some environmental concerns of both researchers and conservationists are addressed in the Ordinance. Provisions are included to restrict

dredging, prevent the disturbance of wetlands, minimize disruptive activities in the backshore, guard against interference with fish spawning areas and prime fish and aquatic habitats. On the other hand, no buffer strips or setbacks were required in the backshore, nor were very stringent restrictions included against vegetation removal in the foreshore or backshore. Due to the grandfathering clause and past zoning determinations, shoreline construction on low capability shorelands can still continue. Concern for the cumulative impact of incremental decisions is absent. Enforcement will have to be administered under the "nuisance" clause prohibiting activities causing erosion into the lake waters or the impairment of water quality, water clarity, or fish spawning areas. The agency will also probably have to withstand several lawsuits against the Ordinance, so time will tell how effective the provisions are implemented.

On the issues of aesthetics and public access to the shoreline, the Ordinance is the weakest. As related in the planning deliberations, these points were considered too controversial to be resolved with much significant change from their present status. These issues are very valid considerations for shorezone planning and management but are too easily avoided for lack of a "neutral" framework for discussion.

While not specifically addressed in the discussion, a Nevada State Senator was recently quoted as saying, "TRPA is indirectly controlling water pollution through land use planning. If you are a

land owner in the basin, this is depressing."[83] The politician was specifically referring to the downzoning of certain properties in the area by TRPA and felt it was unfair to have a few property owners "foot the entire bill for control of Tahoe problems." Although the extent of the economic impact is exaggerated, he does point out the economic dilemma of ecological planning. By basing land use and/or suitabilities on land or shorezone capability in fragile regions like Lake Tahoe, the potential supply of housing will inevitably be restricted to a level below the demand and, as a result, the value of developable land will skyrocket.[84] For the even more fragile shoreline, the property values are very high now and will probably soon be exclusively for the ultra-rich. Public lands used as campgrounds and recreation areas, however, do allow people of lower economic means to enjoy the lake area. The necessity to acquire both low and high capability lands in the shorezone and inland for protection and public use before the advent of ecological planning controls cannot be overemphasized. While Lake Tahoe is fortunate to be of enough national significance to receive considerable federal funds for land acquisition, other lake areas would probably not be as fortunate in being able to pay the higher price caused by land and shorezone capability restrictions.

Figure 9 depicts the evolutionary process for planning and managing the shorezone by TRPA. Note that problem definition and objectives, two important links in the planning process, are missing. Because of their absence, the effectiveness of the management aspects

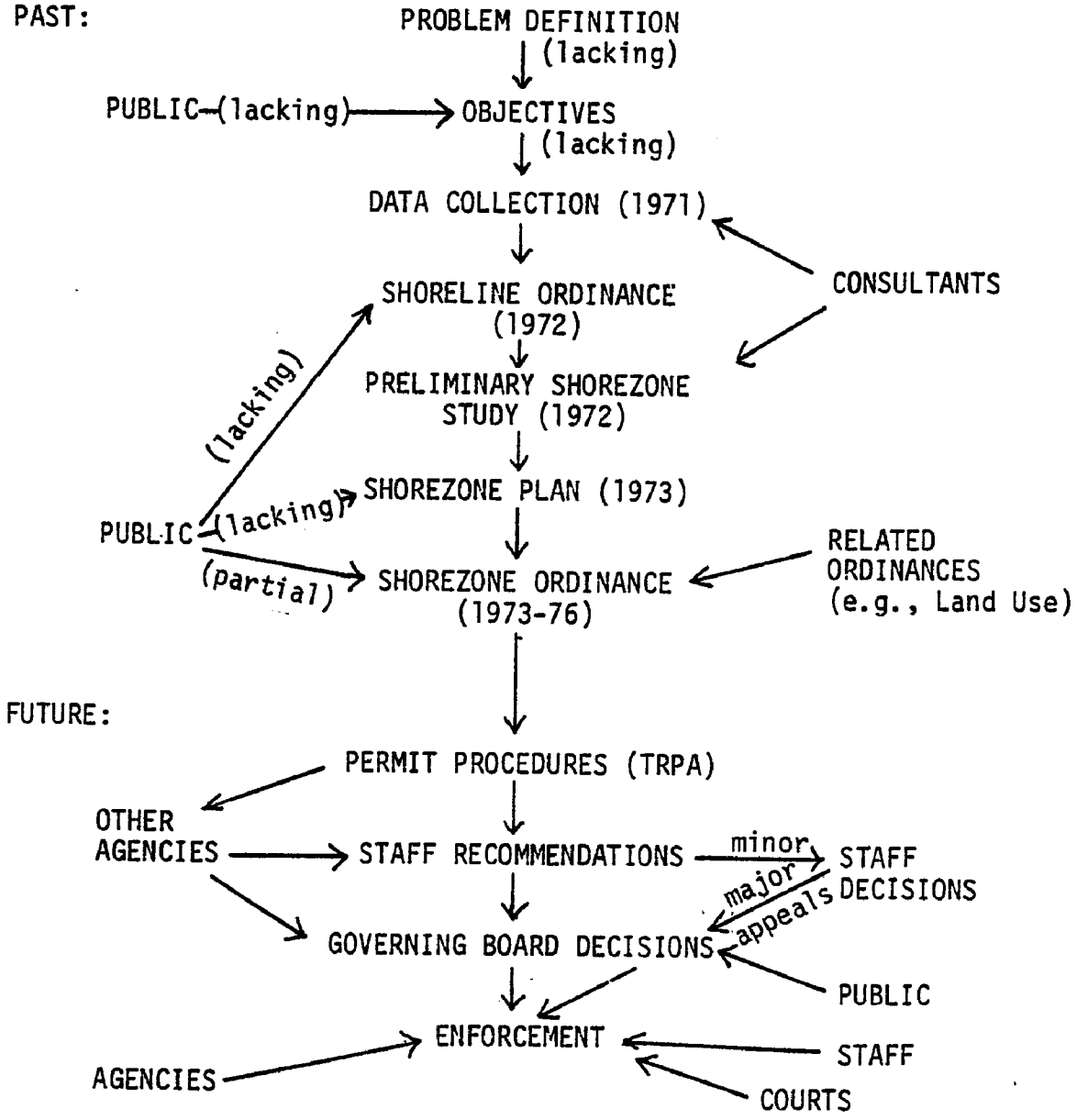


FIGURE 9

A DESCRIPTION OF TRPA'S SHOREZONE PLANNING AND MANAGEMENT PROCEDURE

below will be hindered. Essential to intelligent resource management is the definition of the "problem" and the statement of objectives. Representatives of competing interests perceived the problem differently. Agreement was never reached whether a shorezone problem actually existed at all. Many of the shoreline owners and local politicians consider the water quality problems of Lake Tahoe basically solved[85] and that the Shorezone Plan and regulations were not really needed for that purpose or any other. Regional and federal governments have invested much in Tahoe's problems, and therefore naturally feel the problems are real and require governmental regulation. Without a clear problem definition, the setting of objectives became quite difficult and was finally avoided altogether. Without objectives, evaluation of the plan and implementing ordinance will also become quite difficult for everyone involved.

Public involvement was weak from the very beginning. No citizens' group representative of the various shorezone interests was ever formed by TRPA to study the issue and make policy recommendations. Ideally, public opinion should have been sought for the development of objectives and for each step of the planning process. More people were concerned about the shorezone than just shoreline property owners, especially visitors to the basin. Since the Shorezone Plan received little public examination, the components of the Ordinance were also not generally understood by the users of the shorezone. The Staff failed to develop broad public support within the Tahoe region for the Plan, and, as a result, the Ordinance

received persistent attack by a special interest group at the expense of the "public interest," and was almost scuttled.

In summary, the approach taken by the Tahoe Regional Planning Agency has both strengths and weaknesses. The original intent to focus on the shorezone as an important area of planning and to develop an evaluative method is highly commendable. New insights have been gained from the translation of a shorezone capability and suitability system to its final form as a planning tool. Through conflicting values in the political arena, compromises became necessary and a less stringent Ordinance was passed by the decision-makers. Errors were made in the planning process, some minor and some significant, but most could have been avoided. The Lake Tahoe case study provided valuable lessons for other areas for shorezone planning and management.

Now that the background and analysis of the present shorezone situation at Lake Tahoe have been given, it is appropriate to apply the scheme of evaluation described in Chapter III to the case study.

NOTES

[1]Lake Baikal in the U.S.S.R. and Crater Lake in Oregon are classified as such with Lake Tahoe.

[2]U.S. Environmental Protection Agency, "The Lake Tahoe Study," Washington, D.C., January 1976, p. 42.

[3]J. E. Pepper and R. E. Jorgensen, Influences of Wastewater Management on Land Use: Tahoe Basin 1950-1972, 1974.

[4]Lewis Mumford, The Urban Prospect, p. 9.

[5]Lake Tahoe Area Research Coordination Board, "Inventory of Research Activities in the Lake Tahoe Basin, 1878-1974," South Lake Tahoe, Calif., July 1974.

[6]Lake Tahoe Area Research Coordination Board, "Funding Sources for Research in the Tahoe Basin," unpublished memo, February 1976.

[7]Comments by Dr. Robert Twiss at a research seminar on Sept. 29, 1975; and comments by lawyer Ira Michael Heyman at a research seminar on Jan. 17, 1975.

[8]E.P.A., op. cit., p. 18.

[9]N. J. Hyne, et al., "Quartenary History of Lake Tahoe, California-Nevada," Geol. Soc. Amer. Bull., 83:1435-1448.

[10]Ibid.

[11]J. L. Burnett, "Geology of the Lake Tahoe Basin," Calif. Geology, July 1971, pp. 119-130.

[12]R. Matthews and J. Burnett, Geology for Land Use Planning in the Lake Tahoe Basin, 1971, p. 53.

[13]Tahoe Regional Planning Agency, Hydrology and Water Resources of the Lake Tahoe Region, 1971, p. 21.

[14]C. R. Goldman, et al., Eutrophication of Lake Tahoe Emphasizing Water Quality.

[15]Retention or flushing time is the period it would take to fill the lake with its natural inflow of water if the lake were completely emptied. Compare Lake Tahoe's retention time to that of Lake Washington's of 3.2 years or Lake Michigan's of 200 years.

[16]Goldman, op. cit., p. 258.

[17]R. C. Richards et al., "Where have all the Daphnia gone? The decline of a major cladoceran in Lake Tahoe, Calif.-Nevada," Verh. Internat. Verein. Limnol., 19:835-842 (1975).

[18]Tahoe Research Group, "A Multidisciplinary Research Program in the Tahoe Basin: Proposal and Progress Report," May 1975.

[19]Lake Tahoe Area Council, Eutrophication of Surface Waters--Lake Tahoe, 1971; G. L. Dugan and P. H. McGauhey, "Enrichment of surface waters," J. Water Poll, Cont. Fed., 46 (10):2261-2280.

[20]N. Williams, "Predicting Lake Tahoe's Future," Tahoe Reflections, Dec. 1975.

[21]Goldman, op. cit., p. 259.

[22]Ibid., p. 261; Tahoe Research Group, op. cit., p. 60.

[23]Lake Tahoe Area Council, op. cit., p. 96.

[24]Personal communication with Robert Richards of the Tahoe Research Group.

[25]Comments by Dr. Max Tilzer at a research seminar on Feb. 20, 1976.

[26]Linesch/Reynolds/Evana, "Master Plan Report--Meadowglen/Tahoe," report prepared for the Dillingham Corp., 1965, p. 7.

[27]Goldman, op. cit., p. 4.

[28]P. McGauhey et al., Comprehensive Study on Protection of Water Resources of Lake Tahoe Basin Through Controlled Waste Disposal, 1963.

[29]Goldman, op. cit., p. 7.

[30]Tahoe Research Group, op. cit., p. 58.

[31]Goldman, op. cit., p. 11.

[32]Tahoe Regional Planning Agency, "Preserving Lake Tahoe's Water Quality," a draft plan for the Tahoe Basin, Jan. 1976, by the Erosion and Stormwater Runoff Control Program, p. 3.

[33]Tahoe Regional Planning Compact, P.L. 91-148, Dec. 1969, Article I.

[34]Paul Meyer, "What is the TRPA? A bureaucratic hassle, an eco-sell-out, or a pragmatic problem solver?", Tahoe Research Group, 1975, p. 10.

[35]J. E. Pepper, "An Approach to Environmental Impact Evaluation of Land-Use Plans and Policies: The Tahoe Basin Planning Information System," 1972.

[36]Comments by Dr. Robert Twiss at research seminar on Sept. 29, 1975.

[37]Meyer, op. cit., p. 8.

[38]Twiss, loc. cit. Previous zoning by the local governments would have allowed approximately 800,000 people in the basin.

[39]From the Douglas County-Nevada General Plan of 1974: "Douglas County still has the firm position that it alone has full authority and jurisdiction for all planning activities in all parts of the county."

[40]See W. Bronson, "It's About Too Late for Tahoe," Audubon, May 1971; Pepper, passim; C. Finkelstein and L. Baxter, Planning and Politics: a Staff Perception of the TRPA; Meyer, passim.

[41]California State Lands Commission, Report of Beach Dedication to Public Use at Lake Tahoe, p. 3.

[42]Nevada State Journal, Reno, Jan. 13, 1957.

[43]Sacramento Bee, Sept. 11, 1957; Nevada State Journal, May 27, 1966.

[44]Nevada State Journal, July 19 and 21, 1959.

[45]R. M. Smith, "Littoral Drift--A Study," special report for the Lake Tahoe Area Council, 1959.

[46]L. Ames, "Early History of CTRPA," unpublished manuscript, 1969.

[47]California Resources Agency, "Lake Tahoe Minimum Uniform California Shoreline Construction, Maintenance, and Inspection Regulations," Nov. 10, 1968.

[48]Sierra Sun-Bonanza (Truckee, Calif.), Sept. 6, 1972.

[49]Bronson, op. cit., p. 52.

[50]P. L. 91-425, Sept. 26, 1970.

[51]U.S. Congress, Senate Committee on Public Works, "Environmental Problems of the Lake Tahoe Basin," proceedings of hearing before the Subcommittee on Air and Water Pollution at Brockway, Calif., Aug. 21, 1972, p. 2; Tahoe Daily Tribune, Aug. 18, 1972.

[52]Sacramento Bee, March 4, 1973. A similar transformation occurred with the EPA's "The Lake Tahoe Study" over a period of 3 years. The original draft contained strong recommendations for change but the final report omitted any mention of them.

[53]EPA, op. cit., p. 32. Between 1/65 and 6/73, $23 million was spent for acquiring 21,000 acres; between 6/73 and 12/75, $13 million was spent for 11,000 acres.

[54]Tahoe Regional Planning Compact, Articles I, V, and VI.

[55]Antony Orme, The Shore-Zone System for Lake Tahoe, 1971, p. 1.

[56]The lawyer who drafted the first version of the Ordinance spent 3 days going around the lake with Dr. Orme in order to get a feel for the essential points to include.

[57]Minutes of the Governing Board meeting of Nov. 24, 1971.

[58]Comment by Boverning Board member Ray Knisley at APC Subcommittee on Shoreline meeting of Nov. 18, 1971.

[59]Quotes are from APC meeting of July 21, 1971.

[60]TRPA special meeting of Dec. 21, 1971.

[61]E. Dror, Public Policy Making Re-Examined.

[62]TRPA Governing Board meeting of Nov. 24, 1971.

[63]Ira Heyman, comments at a research seminar on Jan. 17, 1975.

[64]Antony Orme, "Toward a Shorezone Plan for Lake Tahoe," pp. 3, 9.

[65]Ibid., p. 19.

[66]Tahoe Regional Planning Agency, Shorezone Plan for Lake Tahoe, p. 51.

[67]Tahoe World, June 8, 1973.

[68]Tahoe World, April 2, 1976.

[69]Nevada State Journal, July 20, 1975; TSR Newsletter, 1974-76.

[70]Tahoe Daily Tribune, May 2, 1975.

[71]Nevada State Journal, June 26, 1975.

[72]Tahoe Daily Tribune, Nov. 30, 1973.

[73]Tahoe Daily Tribune, Jan. 18, 1974.

[74]Record-Courier (Gardnerville, Nevada), May 9, 1974; Tahoe Daily Tribune, April 11, 1974.

[75]In August 1976, the CTRPA Governing Board voted to postpone until December discussion of the Committee's recommendations.

[76]Pepper, 1972, op. cit., p. 91.

[77]Finkelstein, op. cit., p. 30.

[78]Personal communication with Dr. Orme, Nov. 14, 1975.

[79]Staff made the suggestion to base the scope of backshore review on the physical tolerance districts for visual impact, yet the physical and visual impacts are not related at all.

[80]Governing Board's workshop, Oct. 23, 1975.

[81]Paul Meyer, "Science and Public Policymaking in the Tahoe Basin," p. 31.

[82]Ibid.

[83]Tahoe Daily Tribune, April 15, 1976.

[84]Economic Research Associates, "Socio-Economic Impact Analysis of the CTRPA Regional Plan and Land Use Ordinance," 1976.

[85]Finkelstein, op. cit., p. 27.

CHAPTER V

THE SHOREZONE SCHEME AT LAKE TAHOE

> Environmental planning was nonexistent in 1959 when our project was begun, and had it been existent the project would not have started.
>
> -Dillingham Development Corporation (developer of Tahoe Keys), 1972

The Lake Tahoe region is quite different from the rural lake scenario described in Chapter III, for it is quite urbanized and has the capability to produce and use sophisticated planning tools. In addition, shorezone studies have already been made and a Shorezone Ordinance has been adopted. Much of the staff of the two regional planning agencies are professionally-trained planners or engineers who have the background to use a more complex framework than the proposed scheme. In actuality, no framework/scheme is being used at Tahoe nor are the decision-makers, staff, or public having an easy time planning for the shorezone. In the preceding case study, it was shown that confusion arose over the issues and that philosophical issues dominated environmental concerns. After three years of deliberations, the TRPA Governing Body and staff were still unclear about the problems and needs of the shorezone, and the public was either apathetic or antagonistic.

With the Shorezone Ordinance now adopted, the TRPA staff members will have their hands full with the backlog of projects they have to review. The CTRPA staff is also reviewing certain shorezone

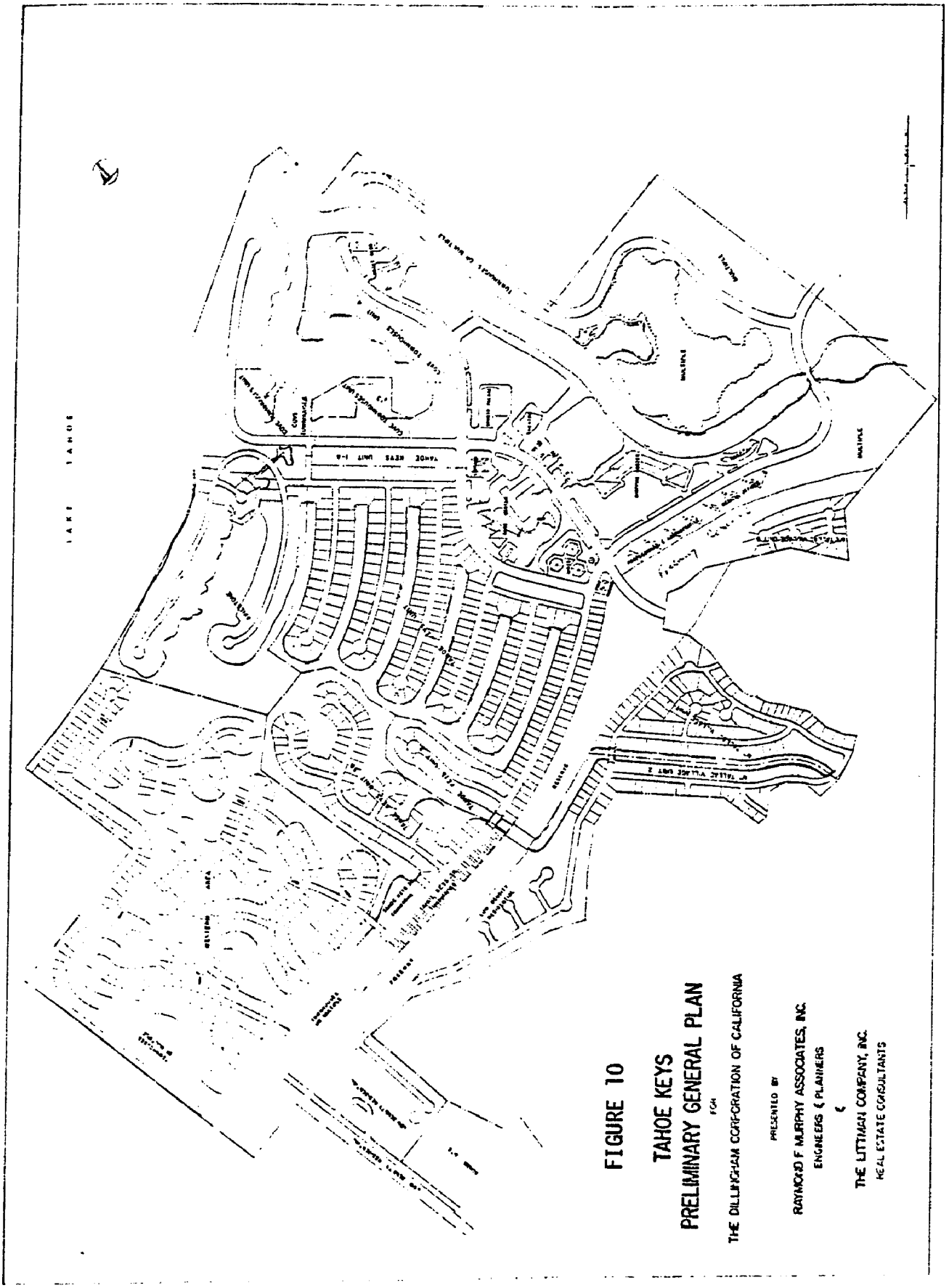
proposals which may impact on the goals and policies of the CTRPA Regional Plan. It will become increasingly difficult for both staffs to see the forest through the trees (or the shore through the piers) without some directing guidelines and explanations. Even with well-trained people, a complex scheme is not practical for helping to make daily recommendations and decisions.

To illustrate the application of the shorezone scheme to Lake Tahoe, three projects will be systematically analyzed: an earlier shoreline development project, a pending backshore building project, and a recent pier proposal. This analysis can be addressed to any of the agencies which comment on the proposals, although the analysis would begin at a more basic level for those with no exposure to shorezone planning. Since TRPA has already defined the shorezone and recognizes its importance, project evaluations would begin with a review of the cause-effect relationships. For the sake of brevity, this evaluation will also begin at this stage.

EXAMPLE #1: SHORELINE SUBDIVISION

A shoreline development, known as Tahoe Keys, was first proposed in 1958 at South Lake Tahoe, El Dorado County, California. Although it was approved by the County Board of Supervisors at that time and is now completed, a reevaluation of the project as if it were presently up for approval should prove enlightening (See Figure 10).

The total project involves a 750-acre channelized development in an existing meadow and marsh area which fronts one mile of Lake


LAKE TAHOE
FIGURE 10
TAHOE KEYS
PRELIMINARY GENERAL PLAN
FOR
THE DILLINGHAM CORPORATION OF CALIFORNIA
PRESENTED BY
RAYMOND F MURPHY ASSOCIATES, INC.
ENGINEERS & PLANNERS
&
THE LITTMAN COMPANY, INC.
REAL ESTATE CONSULTANTS

Tahoe's shoreline. Approximately 600 acres of land area and 150 acres of water channels (10 miles of interior shoreline) are to be created from the marsh through dredging and filling. To alter the elevation from 6,227 to 6,232 feet, about one million cubic yards of fill must be imported. It is planned that 2600 lots will be subdivided, improved, and sold to accommodate an expected level of 10,000 residents. The channels will need to be dredged for maintenance about three times a year. Contemplated in the overall master plan are single family residences, shopping centers, marinas, lakefront commercial complex, and high rise buildings. Jetties will be constructed at the mouths of the two channels connecting with the lake.

Cause-Effect Relationships

Looking at Table 1 of the Shorezone Scheme, one can see that this expansive shoreline development project involves many uses of the shorezone: #1 (construction of nearshore/foreshore facilities), #2 (construction of backshore facilities), #4 (marinas), #6 (residences), #9 (roads and paved surfaces), and #10 (shoreline structures). As a result of the construction uses, there is a strong potential for the following problems/causes to occur: disturbance of lake bottom, dredging/filling, vegetation removal or damage, land filling and draining, and excess noise. The post-construction uses can be related to: oil and gas spillage, sewage wastes, interference with shoreline current, fertilizer use, increased runoff, and high density of structures. In turn, these causes can develop into various effects:

impaired water quality, damage or reduction in aquatic animal and plant life, excess nutrients in water, unwanted erosion and sedimentation, loss of scenic beauty, change in natural drainage, reduced access to shoreline, and disturbance of solitude. The ultimate results include (among others) the change in water color, overabundance of nuisance plants, alteration of the food web and population instability, diminished quality of sport fishing, and reduced enjoyment of the lakeshore.

Information Needed

Scanning the Basic Information list of Table 4, one can see that most of the background material on Lake Tahoe's features and problem areas has already been collected (see Chapter IV). For the Tahoe Keys site, further information which would be helpful includes:

Information	Source
-Direction of nearshore currents	Corps, TRPA
-Soil tolerance	SCS, TRPA
-Slope of backshore/nearshore	USGS, TRPA
-Runoff source and amount	TRPA, site visit
-Location/statue of sewer service	State Water Quality
-Fish habitat and spawning areas	State Fish & Game
-Wetlands/critical habitats	"
-Rare and endangered plants and animals	"
-Wildlife status and location	"
-Vegetation status	SCS, site visit

The available information on these items can be concisely summarized:

-Direction of nearshore currents: at South Lake Tahoe, the predominant nearshore circulation is counterclockwise.

-Soil tolerance: the soil is classified as marsh soil, which is poorly drained, naturally wet, a potential flood site, and the location of ground water replenishment.

-Slope: a 0-10% slope for the existing marsh and meadow .

-Runoff: natural runoff sources presently on the site; the marsh traps sediments and uses nutrients coming in from the river and urban runoff.

-Sewer service: capacity is presently available at the sewage treatment plant for the proposed 2600 lots.

-Fish habitat and spawning areas: as the mouth of the largest river in the basin (Upper Truckee River), the site represents a stream inlet with important habitat for game and forage fish as well as prime fish and aquatic habitat in the nearshore waters.

-Wetlands/critical habitats: the marsh represents the largest wetland area at Lake Tahoe and provides the most important habitat in the region.

-Rare and endangered species: three threatened species of birds use the marsh area for breeding and/or feeding: the Anthony green heron, the American osprey, and the bald eagle.

-Wildlife status/location: the marsh is used for nesting habitat by ten species of waterfowl and is also the location of aquatic insects and other animals.

-Vegetation status: herbaceous and riparian vegetation typical of high altitude marshes.

Environmental Concerns

Those concerns from Table 5 which are relevant to this project are:

-Erosion: Shoreline erosion is possible as a result of the jetties blocking nearshore currents and deposits. Backshore erosion is not a critical concern due to the slope of the land.

-Sedimentation: The construction phase will especially contribute large amounts of sediment to the surface runoff (from land filling) through the site and directly to the lake.

-Runoff: With the loss of the marsh and its natural filtering of runoff, the amount of runoff directly to the lake will increase, especially from the creation of structures and paved surfaces.

-Nearshore currents: Jetties will block the natural flow of materials in the neashore currents and could cause unwanted erosion and sedimentation.

-Water Quality: Erosion, sedimentation, and runoff will all contribute to impaired water quality. The channels will likely be of lower quality than the lake because of reduced circulation and concentration of nutrients. Repeated dredging will also reduce the quality.

-Prime habitat: At least 750 acres of a prime marsh area will be irreversibly destroyed by the project.

-Wildlife: A reduction in the number and/or variety of wildlife will likely result from the destruction of this prime habitat.

-Aquatic vegetation: Plants beneficial to wildlife (e.g., cattail, lilies) will be completely removed and will not be replaced. Nuisance algae growth may result from the modification of the water system.

-Scenic beauty: The removal of a formerly undisturbed marsh and the construction of a dense development will reduce the scenic beauty of the area.

-Open space: A large, valuable open space area will be lost.

-Noise level: During construction, the noise level can disturb wildlife in the remaining marsh area as well as neighboring residents.

-Public access: A one-mile section of Lake Tahoe's shoreline will be closed to public use in the most heavily-used recreational area of the lake.

-Cumulative impact: Such a large-scale development will contribute significantly to the existing problems of the Tahoe region, particularly the south shore. The broad area of shallow or nearshore water found at this end of the lake is particularly susceptible to algal blooms and other water quality problems. Located in the largest creekshed in the basin, the Tahoe Keys project can have a proportionately larger impact on the lake than projects in smaller watersheds. Further stress will also be produced on the remaining wetlands in the region, because of the loss of this large marsh.

Social/Philosophical Concerns

To be addressed to the decision-making body are the following questions:

-What is the "public interest" in this case?

-Who pays the costs and who benefits?

-Is this project an appropriate use of the shorezone?

-What future options might be precluded for the property?

-Does the proposal conform to the short and long term goals of the agency for the shorezone?

Protective and Remedial Measures

Those options which are related to the project include:

Protective:

-No new development on low physical capability shorelands

-Minimize disturbance of natural beaches

-Minimize the area of impervious surface in backshore

-Avoid creating stagnant pools of water

-Make marinas permeable to water circulation

-Restrict access to and use of unique and fragile habitats

-Designate areas for permanent open space

-Restrict development along undeveloped shorelines

-Limit height and density of shorezone structures

-Encourage cluster development

-Set shoreline property as high priority for public acquisition

Remedial:

-Require strict erosion control procedures during construction

-Minimize or prohibit dredging and filling

-Require oil traps at parking lots

-Limit use of fertilizers in the backshore

-Chemical and mechanical controls for nuisance plants

-Improve the quality and/or quantity of aquatic and land habitat

-Design structures to blend in with the natural background

-Encourage revegetation around existing development

-Obtain right-of-way agreements through private property

Management Responsibilities

The following management agencies have at least some regulatory authority over these applicable subjects (from Table 6):

Regulatory Subject	Agency			
	Federal	State	Regional	Local
Water Supply	EPA, BuRec	DWR, PHD	TRPA, CTRPA	STPUD
Water Quality	EPA	WQCB	TRPA, CTRPA Lahontan	STPUD
Lake Structures	Corps	SLC	TRPA	
Sewage Treatment	EPA	WQCB	Lahontan, CTRPA	
Erosion	EPA	WQCB	TRPA, CTRPA	
Dredge/Fill	Corps	WQCB	TRPA, CTRPA Lahontan	
Construction/Grading			TRPA, CTRPA	City
Storm Drainage	EPA, Corps	WQCB	Lahontan, TRPA	City
Fish and Wildlife	EPA	Fish & Game		
*Vegetation (aquatic)		Fish & Game		
Unique Habitat/ Wetlands	EPA, Corps FWS	Fish & Game	TRPA, CTRPA	
Aesthetics			TRPA, CTRPA	City
*Public Access		SLC		
Land Use			TRPA, CTRPA	
Zoning			TRPA, CTRPA	

*Subjects lacking adequate regulatory controls or power

Abbreviations: WQCB--Water Quality Control Board; Lahontan--Lahontan Regional WQCB; STPUD--South Tahoe Utility District; SLC--State Lands Commission; PHD--Public Health Department; DWR--Department of Water Resources.

Epilogue

The Tahoe Keys development is now a well-established community within the City of South Lake Tahoe. Not all of the contemplated components of the original master plan were developed, though. As of 1976, approximately 600 single family residences and 315 condominiums are occupied and the proposed 2600 lots have been downzoned to 1300 by CTRPA's Land Use Ordinance. A private marina was also built, but no shopping centers, commercial complexes, or high rise buildings have materialized and none are now planned.

Of the Environmental Concerns which are listed, many of these concerns were justified. The jetties at the mouths of the two channel entrances have caused a serious erosion problem on the downdrift side, especially in high water years, and this erosion is now coming close to threatening the safety of some lakefront condominiums.[1] Water quality within the interior channels is much lower than the lake, despite the installation of a special water treatment system for the channels.[2] Nuisance plants are still a problem and the water color is more green than blue. Within the nearshore of the lake, the waters adjacent to the development are the most fertile of Lake Tahoe. Dredging continues on a regular basis to keep the channels open for boating, and it may now be necessary in the nearshore waters as a result of unwanted sedimentation.

To date, no concrete evidence is available about the effect on the food web and population stability or on the quality of sport fishing in the area. Opinion is mixed on the aesthetic impact of Tahoe

Keys. Some feel the subdivision is the biggest eyesore at the lake next to the casinos, while others feel the site is the most attractive place to live.

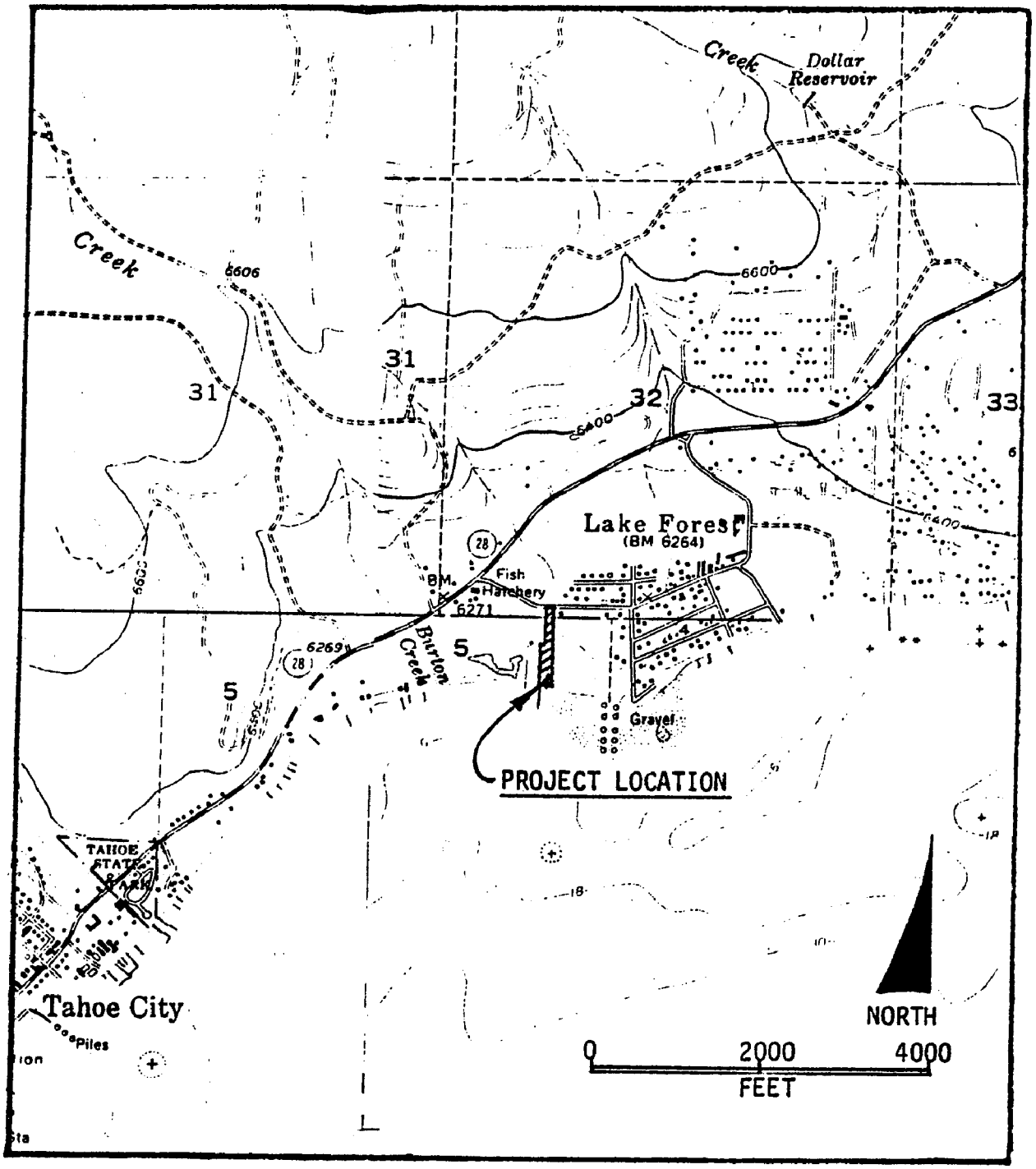
EXAMPLE #2: BACKSHORE

The proposed project involves the construction of three additional recreational housing units on U.S. Coast Guard shoreline property in Tahoe City, Placer County, California (Map 2 and Figure 11). Existing structures on the site were built in 1961 and include two buildings, a pier, and several small service buildings, for a total land surface coverage of 22 percent. Excavation for foundation preparation and utility connection will be necessary all within 475 feet of the highwater level of the Lake. Six gravel parking spaces and sidewalks to each unit are called for in the plans. Adjacent property is quite developed with a condominium project on one side and a paved public parking lot and boat launching ramp on the other side.

Legally, none of the local, regional or state agencies can prohibit a federal project. The project description is circulated among the relevant agencies only for comments and suggestions. The Coast Guard has issued a Negative Declaration statement as a result of its own environmental impact assessment. Due to the shoreline location and the scope of the project, though, the agencies are very interested in commenting on the project.

Cause-Effect Relationships

From Table 1, the proposed project is related to shorezone uses #2 (construction of backshore facilities) and #6 (residences). As can



Source: Kings Beach, California-Nevada USGS 7.5' Quadrangle

MAP 2

Coast Guard Project Location

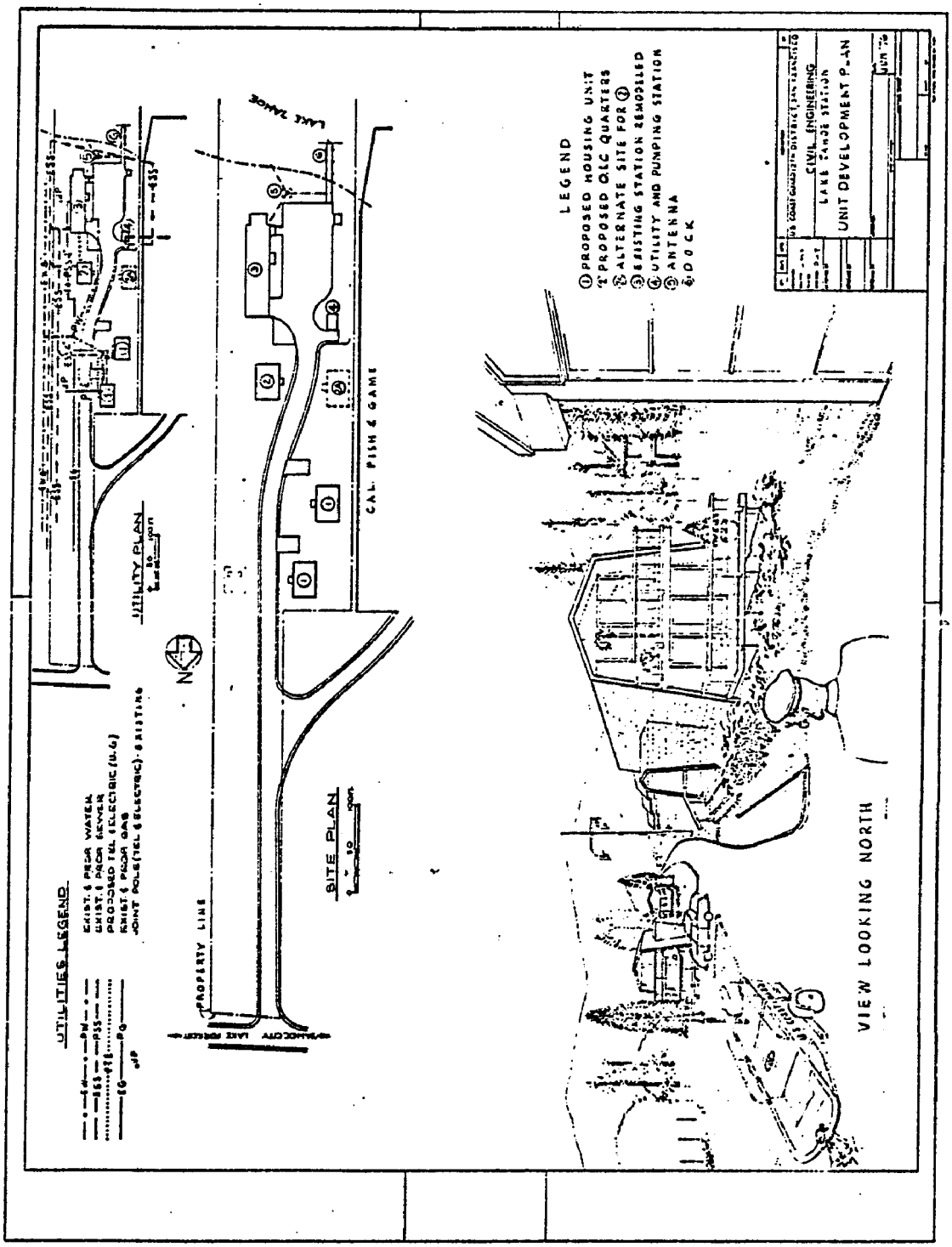


FIGURE 11

COAST GUARD PROJECT PLAN

be seen, the pertinent potential problems and causes during construction include: soil disturbance, land vegetation removal or damage, land filling, and excess noise. Post-construction issues involve fertilizer use, increased surface runoff, and the high density of backshore structures. All of these causes can lead to certain effects: erosion, reduction/damage/disturbance to plant and animal life, loss of scenic beauty, flooding, and impaired water quality (and its associated effects). With this knowledge of potential impacts, the relevant basic information and environmental concerns can be ascertained more easily.

Information Needed

Information	Source
-Soil capability/tolerance	SCS, TRPA
-Slope of backshore	SCS, TRPA
-Runoff sources	(site visit)
-Location and status of sewer service	Tahoe City Public Util. Dist.
-Fish habitat and spawning areas	State Fish & Game, TRPA
-Wildlife habitat	" "
-Rare and endangered species	" , Cal. Native Plant Soc.
-Vegetation status on backshore	SCS
-Zoning	TRPA, County Planning

In brief, the available information tells us:

-Soil capability: the soil is classified as marsh soil, which is poorly drained, naturally wet, a potential flood site, and the location of ground water replenishment. Portions of the site were covered with two feet of fill when the existing buildings were constructed.

-Slope: a 2% slope from the property boundary to the lakeshore; erosion hazard slight.

-Runoff sources: paved parking lot, driveway, and drainage ditch in the backshore.

-Sewer service: one new connection needed, but sewage capacity is extremely limited at the existing plant.

-Fish habitat and spawning: nearshore area adjacent to the parcel is classified as "prime fish and aquatic habitat."

-Wildlife habitat: the marshy site was originally valuable wildlife habitat, but past construction and fill has destroyed this value.

-Rare and endangered species: none are known to exist at the site.

-Vegetation status: once herbaceous meadow vegetation, now only a few lodgepole pine and exotic turf grass.

-Zoning: classified by TRPA as "Public Service District;" 300 feet of the 475 ft. project site is within the backshore jurisdiction of the TRPA Shorezone Ordinance; Shorezone Tolerance District 1--highest hazard shorezone; allowable land coverage under TRPA Land Use Ordinance is 1% for this Class 1B land.

Environmental Concerns

Those concerns from Table 5 which are relevant to this project are: erosion, runoff, water quality, sewage, vegetation (land), scenic beauty, and open space. Each consideration can be concisely described.

-Erosion: A potential for erosion exists during construction from excavation and grading activities, especially if much rainfall occurs at the time.

-Runoff: Increasing the ground coverage will increase the amount of water running directly off into the lake. The site is also a potential flood hazard and flooding would bring much debris into the lake waters.

-Water Quality: Soil erosion and excess runoff from the project can harm the quality of the shore waters by bringing in nutrients, debris, grease, oil and sediment. The original marshy site would have served as a natural trap for watershed sediment, but now the drainage ditch carries it straight into the lake.

-Sewage: Sewage capacity may not be available for the requested additional sewer connection. A sewer permit for the proposed use is not now a high priority for the Tahoe City PUD and approval for such a permit would preclude development of a higher priority use.

-Vegetation: While the former marsh vegetation is gone, the proposed project would prevent the possibility of additional vegetation on the three building sites or the restoration of the property to native marsh plants.

-Scenic Beauty: Much of the scenic attraction of the area has already been lost from past development on the property and adjacent lands. Density of buildings will be increased and views of the Lake from the north will be further blocked. The architectural design of the buildings would be compatible with others in the area.

-Open Space: Increased land coverage and density by the three new buildings will reduce the feeling of open space in the area.

-Cumulative Impact: Surface coverage of the site is already 21% beyond that recommended for this land capability. The adjacent parcel is approximately 85% impervious surface. While the proposed project has a smaller impact than existing development in the area, the cumulative impact of increased coverage, runoff, erosion, sewage demand, and scenic impairment could tip the balance for the overall quality of the shorezone in the area.

Social/Philosophical Concerns

To be addressed to the decision-making body are the following questions:

-Is this project an appropriate use of the shorezone?

-Does this project conform to the requirements of a "Public Service" District?

-What is the "public interest" in this case?

-Who pays the costs and who receives the benefits?

-Does the proposal conform to the short and long term goals of the agency for the shorezone?

-What future options might be precluded for the property?

Protective and Remedial Measures

Those options which are pertinent to the proposal include:

Protective:

- -No new development on low shorezone capability lands
- -Minimize the area of impervious surface and other coverage in the backshore
- -Provide areas of permanent open space
- -Limit density of backshore structures
- -Design structures to blend in with the natural background
- -Discourage or prohibit uses not directly water-related in the shorezone

Remedial:

- -Revegetation of the backshore, preferably with native plants
- -Erosion control/soil stabilization procedures during construction
- -Remove paved surfaces to reduce runoff potential from the backshore
- -Restore site to natural conditions as much as possible
- -Remove or alter unattractive structures
- -Put all utilities underground
- -Improve existing storm drainage facilities, such as the retention of stormwater on-site to be percolated into the soil
- -Require oil traps at parking lots near the lake to protect water quality

Management Responsibilities

The following agencies are known to have at least some power to regulate or enforce certain aspects of the applicable regulatory subject (from Table 6).

Regulatory Subject	Agency			
	Federal	State	Regional	Local
Water Supply	EPA, BuRec	DWR, PHD	TRPA, CTRPA	TCPUD
Water Quality	EPA	WQCB	TRPA, CTRPA Lahontan	TCPUD
Sewage Treatment	EPA	WQCB	Lahontan, CTRPA	TCPUD
Erosion	EPA	WQCB	Lahontan, TRPA, CTRPA	
Construction and Grading			TRPA, CTRPA	County Pub. Works
Storm Drainage	EPA, Corps	WQCB	Lahontan, TRPA	"
Fish and Wildlife	EPA	Fish & Game		
*Vegetation			TRPA, CTRPA	
*Aesthetics			TRPA, CTRPA	County Planning
Recreation		Parks & Rec.	TRPA	
Land Use			TRPA, CTRPA	County Planning

*Subjects lacking adequate regulatory controls or powers

Abbreviations: WQCB--Water Quality Control Board; Lahontan--Lahontan Regional WQCB; TCPUD--Tahoe City Public Utility District, PHD--Public Health Department

Epilogue

Both the TRPA and CTRPA staff were concerned about the additional land coverage the project would require on such low capability land. The TRPA staff recommended that only one unit be built for use as a permanent residence. At the July, 1976 meeting, the TRPA Governing Board accepted the staff recommendation (a variance from the Land Use Ordinance would be needed to provide for such a project) and approved the Negative Declaration statement. The Board, however, was concerned

about the discrepancy in treatment between a federal and a private project. A statement was sent to the Coast Guard for its "strong consideration" concerning better coordination with TRPA policy.

EXAMPLE #3: FORESHORE AND NEARSHORE

A private shoreline owner has requested to "reconstruct" a recently damaged pier located near Incline Village, Washoe County, Nevada. The proposed project entails the construction of an additional 110 feet of the existing 30-foot long pier (see Figure 12). A permit was issued for the original facility in 1960 by the U.S. Army Corps of Engineers and application for a new permit has been made (Figure 13).

Cause-Effect Relationships

Tables 1 to 3 describe the cause-effect relationships associated with piers. During construction, the pier project may involve disturbance of the lake bottom, dredging, and excess noise. Since the pier is permeable, no significant interference with the shoreline will result. The pier does contribute to a higher density of structures in the lake. Related effects which can occur are: siltation and turbidity, sedimentation, damage to plant/animal habitat and life, underwater rock slides, and impaired water quality. These effects, in turn, can produce the more serious or long term consequences listed in Table 3.

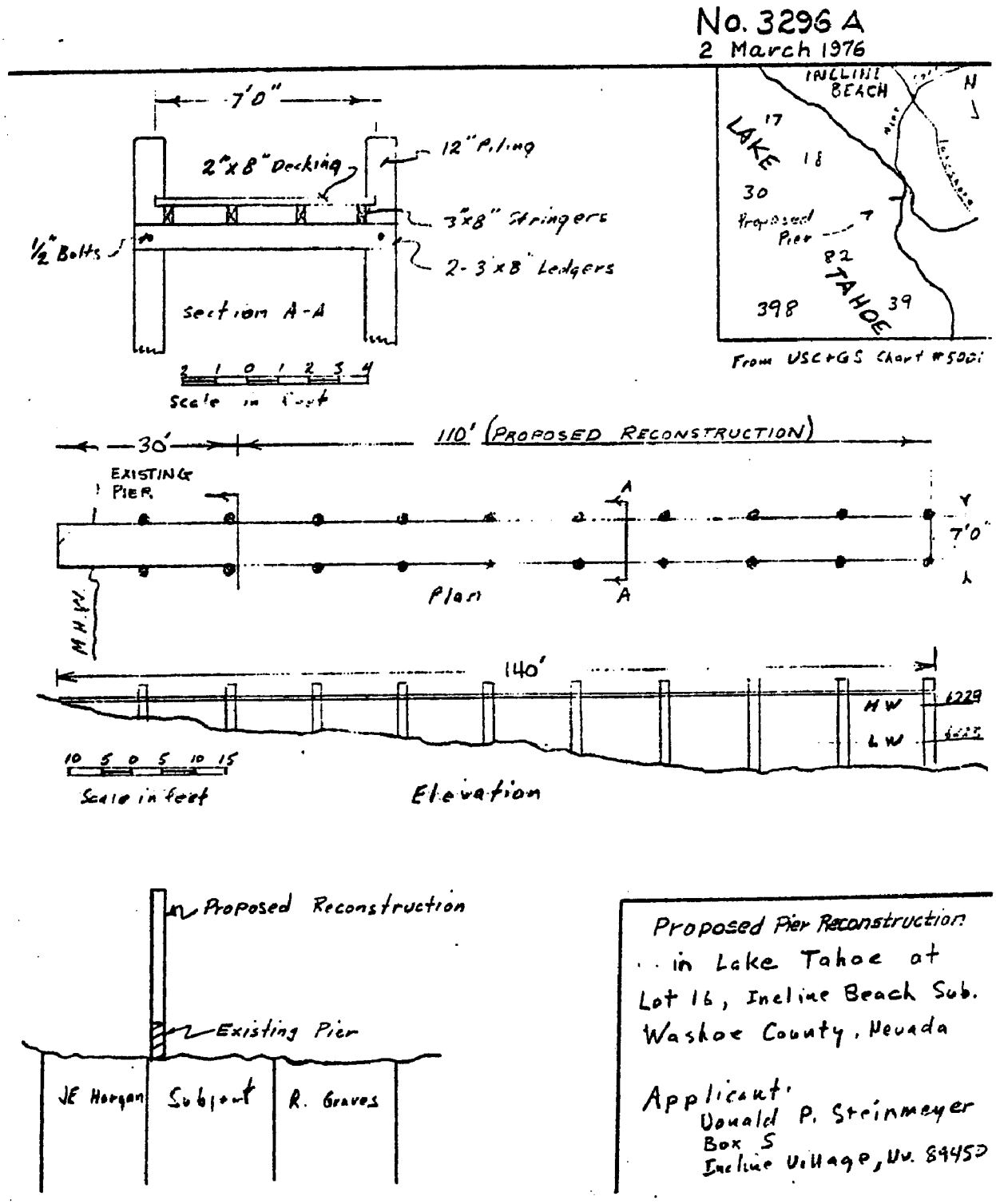


FIGURE 12

PIER PROJECT DESCRIPTION

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

REPLY TO SPKCO-O
ATTENTION OF

5 March 1976

PUBLIC NOTICE NO. 3296A

TO WHOM IT MAY CONCERN:

Application has been made to this office by Mr. Donald P. Steinmeyer, Box S, Incline Village, Nevada 89450, to reconstruct a pier located in Lake Tahoe at Lot #16, Incline Beach Subdivision, Washoe County, Nevada, as shown on the reverse of this notice.

This facility was previously constructed under Department of the Army Permit No. 3296, issued 19 July 1960. The pier was partially destroyed during a storm in late summer of 1975. Applications to reconstruct have been submitted to the Washoe County Building Department, Nevada Department of Fish and Game, Nevada Department of Environmental Health, and the Tahoe Regional Planning Agency.

A permit issued by the Department of the Army does not give any property rights either in real estate or material or any exclusive privileges and does not authorize any injury of private property or invasion of private rights, or any infringement of Federal, State or local laws or regulations, nor does it obviate the necessity of obtaining State assent to the work authorized.

Interested parties are invited to submit in writing, on or before **5 April 1976**, any comments they may have on the proposed work. The decision whether to issue a permit will be based on an evaluation of the probable impact of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered; among those are conservation, economics, aesthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use classification, navigation, recreation, water supply, water quality and in general, the needs and welfare of the people. No permit will be granted unless its issuance is found to be in the public interest. Based on information received it is not anticipated that the proposed activity will require the preparation of an Environmental Impact Statement.

F. G. ROCKWELL, JR.
Colonel, CE
District Engineer

FIGURE 13

CORPS OF ENGINEERS PERMIT NOTICE

Information Needed

From Table 4, the relevant information is determined for this site:

Information	Source
-Nearshore currents	Corps, TRPA
-Slope of nearshore/backshore	USGS, TRPA
-Soil capability	SCS, TRPA
-Fish habitat/spawning areas	Nevada Fish & Game, TRPA
-Aquatic animals	" "
-Land Use	TRPA, County Planning
-Shoreline structures	Corps, TRPA, County Building Department

A brief description of the available material on these topics:

-Nearshore currents: direction of material movement along the shore is counterclockwise at this portion of the lake.

-Slope: Very steep, with slope ranging between 15-30 percent in both the backshore and nearshore zones.

-Soil capability: coarse textured rocky soils cover weathered granite bedrock in this area, and the relative erosion potential is classified as high. The shoreline is presently eroding.

-Fish habitat/spawning: the nearshore waters are not a spawning area, but are considered to be prime fish and aquatic habitat.

-Aquatic animals: as a "prime habitat" area, the nearshore zone is inhabited by both bottom-living and free-swimming organisms in this boulder-covered site.

-Land Use: presently in private residential use, as are the adjacent parcels. A State Park is located about 1/2 mile south of the applicant's parcel.

-Shoreline Structures: the existing 30-foot pier is located in an area which is fairly densely populated with piers and boathouses. Adjacent parcels do not now have any shoreline structures.

Environmental Concerns

From Table 5 are these issues which relate to the pier project:

-Soil erodibility and slope: The steepness of the site for the pier implies that the erosion potential is moderate to high. Construction of the pier, as from the pile driving, could cause rock slides and mass movement in both the foreshore and nearshore.

-Water Quality: Erosion in the foreshore and nearshore zones during construction or in the backshore as a result of access to the pier could create a water quality problem. The pile driver disturbs the bottom sediments, which clouds the water and reduces light penetration.

-Bottom-living organisms: Sediment suspended during construction can smother these slow-moving animals and bury the attached plants on which they feed.

-Other aquatic animals: Fish feed in this area and would be disturbed by the construction activities.

-Scenic Beauty: Increased density of shoreline structures in the area will contribute to a cluttered appearance of the shoreline.

-Public access: Although the backshore is privately owned, the lakewaters below the high water mark are publicly owned and access to these public waters will be reduced.

-Navigability: An additional or extended pier in an already densely covered area will impede pleasure boating and fish trawling along the shore.

-Cumulative Impact: The Incline Village area was only developed residentially within the past ten years and is not yet totally built out. In combination with existing shoreline structures and potential ones in the area, this project will contribute to the aesthetic, access, and erosion problems of the area.

Social/Philosophical Concerns

To be addressed to the decision-making body:

-What should the extent of public access be in the foreshore and nearshore zones?

-Is it a right or a privilege for riparian owners to privately own and use facilities over public land and waters?

-If a privilege, what are appropriate restrictions?

-Is the proposed project an appropriate use?

-Should community facilities be encouraged over individual ones?

-Does the proposal fit in with the short and/or long range objectives for the shorezone?

Protective and Remedial Measures

Protective:

-Restrictive footpaths in the backshore for access to the lake in order to prevent erosion

-Limit density of shoreline structures

-Encourage shared-use facilities, such as community piers

-Protect views from scenic vistas overlooking the lake

-Make shoreline structures permeable for the free circulation of lake sediments

Remedial:

-Minimize disruption of the lake bottom during construction

-Minimize size of shoreline structures

Management Responsibilities

The listed agencies have at least some authority over these subjects:

Regulatory Subject	Agency			
	Federal	State	Regional	Local
Lake structures	Corps	Bur. Env. Health	TRPA	County Bldg.
Navigation	Corps, CG			
Water quality	EPA, Corps	BEH	TRPA	
Erosion	EPA		TRPA	
Fish and Wildlife	EPA	Fish & Game		
*Aesthetics			TRPA	
Public Access		Parks	TRPA	

Regulatory Subject	Agency: Federal	State	Regional	Local
Recreation		Parks	TRPA	
Land Use			TRPA	County Planning

*Subjects lacking adequate or regulatory powers
Abbreviations: CG--Coast Guard; BEH--Bureau of Environmental Health

Epilogue

The TRPA Governing Board approved the proposed pier project, upon staff recommendation, in June, 1976. It is too early yet to evaluate the actual impacts resulting from the project.

SUMMARY

Thus, the essence of the major concerns for the three projects has been concisely described. The staff of the local and regional agencies can now point out the significant environmental and social/philosophical items for consideration by the governing bodies. Remedial and protective measures can also be recommended to mitigate some of the probable negative impacts. If the reviewing party lacks the legal authority itself to regulate the environmental concerns discussed, it can identify those agencies that do have the authority. Overlapping management responsibilities are also identified through application of the scheme and better coordination can then be sought to improve the management of the shorezone. With the relevant factors clearly spelled out, the responsible authorities can make more informed decisions.

Since the reevaluation of the Tahoe Keys development revealed that many of the potential effects indicated from the scheme did actually result, the scheme appears to be a good guideline for project impact evaluation. The scheme is not intended to point out every ecological relationship involved at the shorezone, but it is intended to delineate the important concerns necessary for effective ecological planning at the local level. This delineation was successfully accomplished in the analysis of the other two projects at Lake Tahoe. The judgment of the relative importance of these concerns and potential effects must necessarily be made by the appropriate decision-makers.

NOTES

[1]G. Budlong, "Processes of Beach Change at Tahoe Keys, California: An Example of Man and Nature as Geomorphological Agents," M. A. Thesis, Chico State University, 105 p.

[2]C. R. Goldman et al., Eutrophication of Lake Tahoe Emphasizing Water Quality, p. 73.

CHAPTER VI

SUMMARY AND CONCLUSION

It is better to ask some of the questions
than to know all the answers.

-James Thurber

The implications of the land-water interface for ecological planning have been made explicit. It is at the land-water interface that the major divisions of the fields of ecology and planning overlap. Before ecological planning can effectively proceed, land use planning must be blended with water resource planning and aquatic ecology must be blended with terrestrial ecology. The threads between these artificial dichotomies and between those listed in Chapter I must be explicitly dealt with in order to successfully plan for the shorezone. Many of these threads have been examined in this paper.

Land use and water resource planning within the shorezone were examined in Chapter II. It was mentioned that land use planning is still separated from water pollution control despite the knowledge that the two are directly related. Few management efforts for lake rehabilitation employ land use controls, supposedly because of the lack of quantitative data to describe the results. The symptoms of water pollution tend to be treated rather than the causes. Cause-effect relationships between land and water are too often ignored in many planning efforts, though recognition and concern for the problem is rapidly growing.

State programs to regulate lakeshore activities, like those of Wisconsin and Washington, have made significant advancements in uniting land use with water quality/resource planning. Shoreland zoning was the most common tool recommended to implement the regulation, but zones were not necessarily related to the inherent capability of the land for use. The emphasis on shore<u>lands</u> as opposed to the shore<u>zone</u> is also quite apparent in these planning and management programs. The inclusion of both the nearshore and backshore zones of the lake as the area of attention is not yet an explicit consideration.

While water quality regulations have been very difficult to enforce and understand, the development of decent land use controls has been even more difficult. The combination of these two resource concerns at the land-lake interface produces an especially complicated situation. The scheme of evaluation proposed in Chapter III, however, overlaps the land-water concerns by describing their interactions and including protective and remedial measures for both areas.

The linkages between terrestrial and aquatic ecology have only begun to be studied. Little is known about the eulittoral zone even though this area represents the most concentrated ecological interactions between land and lake. The nearshore or littoral zone is being studied quite intensely at Lake Tahoe since this area of the lake is most visibly affected by water pollution. Tahoe studies confirm that shoreline development and basin construction present an immediate threat to the quality of the nearshore areas of the lake.

Recent attempts to model the aquatic and terrestrial ecosystems and their connections, though interesting, have yet to provide specific guidelines for management of the shorezone. While the present quality and quantity of our ecological knowledge about land-lake interactions is limited, planning decisions will not and cannot wait until all the necessary facts are gathered and new theories are tested.

The gap between theoretical and applied research was addressed most directly in Chapter III in the introduction to the shorezone scheme. Without more attention to the successful application of theories, decision tools, and environmental data, the environmental problems being faced daily by people across the country will not be solved. This theory-application dichotomy is also related to other dichotomies: researchers/academicians--practitioners/planners; researchers--decision-makers; researchers--public. The separation between these latter groups is increasing because modern researchers are not directing their work to be useful and workable by the people most involved with planning and management. A simplification of approaches to problem resolution and project evaluation rather than more complex methodologies is necessary. The shorezone scheme attempts to address this issue.

The proposed scheme succeeds at this attempt in several ways. Through the application of the scheme to Lake Tahoe shorezone projects (Chapter V), it was shown that the essence of environmental concerns was easily identified and concisely described. Unnecessary information and jargon were omitted, the format was kept simple, and

the basic information essential for sound environmental decision-making was indicated. The scheme also has an educational value by helping laymen understand the importance of certain measures and controls through use-cause-effect relationships. It aids local administrators to better plan and manage the shorezone instead of threatening them to comply with various state and federal regulations. Resentment and apathy, common with the state programs, may be avoided with this more positive approach.

> Recrimination and litigation may sometimes seem to produce rapid results, but they do not lead to good feelings nor to collaboration between the various interests concerned with inland waters. Collaboration can only occur where there is mutual understanding.[1]

Understanding the significance, critical considerations, management alternatives, and agency responsibilities of the shorezone also will help these people work with other levels of government.

Of course there are certain weaknesses resulting from the simplicity of the scheme. The complexity of the aquatic and terrestrial ecosystems is not as accurately addressed as it would be in a more sophisticated approach. Therefore, the dynamic response of the ecosystems and their capacity to absorb impact cannot be precisely described. Instead, a conservative approach calling for the minimization of all impacts within the shorezone is adopted in the scheme.

Further refinement of the proposed scheme of evaluation is desirable. Modifications in the format may emerge after the scheme is put into use on a daily basis. Expansion of the scope to include uses other than those of recreational lakes could make the scheme

applicable to more lake areas. The addition of beneficial effects, though predominantly social and economic, of shorezone uses and activities would also strengthen the usefulness of the approach.

Linkages between the people involved in shorezone planning and management were described in the Lake Tahoe case study of Chapter IV. There it was noted that communication faltered among the various shorezone interests groups: researchers, decision-makers, planners/staff, and the public. The TRPA Governing Board did not appear to completely comprehend the recommendations of the researching consultant for the Shorezone Plan and Ordinance. They questioned the accuracy and necessity of his suggestions. The staff was also confused about some of his recommendations, but they still supported them. Public involvement was, from the beginning, very limited, and the only active special interest group (shoreline owners) had an inordinate amount of influence on the staff and Governing Board. Certain problems in communication between these groups could have been avoided by having the "problem" of the shorezone defined and the planning objectives clearly stated. Social and philosophical issues, like those listed in the scheme, were unavoidable in the TRPA discussions and were important to the resolution of conflicting values. As Lynton Caldwell remarked, "Ecological considerations may facilitate, but cannot eliminate, the political task of reconciling a great diversity of interests and values."[2] Other lake areas can learn from the planning errors made at Lake Tahoe as well as the advantages and strengths of their approach.

Future research applicable to ecological planning at the water's edge should explore several facets of the subject. One issue, only briefly discussed here, is the analysis of the various state shoreland programs in existence across the country. A detailed comparison of these programs, including their strengths and weaknesses, could be enlightening to other areas who are considering lakeshore regulations. A thorough review of shorezone planning and management efforts would also include regional and local programs and perhaps foreign efforts.

The social, economic, aesthetic, and legal aspects of the shorezone deserve special study as common areas of concern. These subjects are frequently brought up for discussion on shorezone matters, but little advancement has been made in comprehending their significance and incorporating their concerns. Examination of the socio-economic issues related to the pressures on recreational lakes, such as the exogenous forces described by Mumford, would be very helpful toward understanding some of the external origins of shorezone problems. As Mumford implied, rural recreational areas might not be in such demand if our cities were more livable.[3]

If more contributions can be made which will enable planners and decision-makers to better utilize currently accessible knowledge about the shorezone, then Ian McHarg's proposal can become reality: we <u>are</u> responding to nature's laws, even when these are imperfectly understood.[4]

NOTES

1. H. B. N. Hynes, The Biology of Polluted Waters (Toronto: University of Toronto Press, 1974), p. 175.

2. L. K. Caldwell, Environment: A Challenge to Modern Society (Garden City, New York: Natural History Press, 1970), p. 20.

3. Lewis Mumford, The Urban Prospect (New York: Harcourt, Brace and World, 1968), p. 9.

4. Ian McHarg, Design with Nature (Garden City, New York: Natural History Press, 1969), p. 97.

APPENDIX

PARTICIPANTS IN THE LAKE TAHOE SHOREZONE ISSUE

REGIONAL AGENCIES

*Tahoe Regional Planning Agency (TRPA)

- As the only bi-state planning agency with enforcement powers, TRPA adopted a Shoreline Ordinance in March 1972 to limit development in the shorezone.
- Has deferred approvals of new shoreline structures for the past couple of years in order to come to grips with better regulations.
- Proposed a new Shorezone Ordinance in 1973 to incorporate shorezone tolerance districts; adopted in 1976.
- Regulates Shorezone also under its Land Use Ordinance

California Tahoe Regional Planning Agency (CTRPA)

- Responsible only for California portion of Basin, its regulations can supercede those of TRPA; General Plan and Land Use Ordinance stronger than TRPA's
- May adopt strict shorezone regulations, if TRPA does not

FEDERAL AGENCIES

*Army Corps of Engineers (Corps)

- Concern for Lake stems primarily from flood control around and downstream from lake and its regulatory permit program to protect and maintain navigable waterways; some consideration also for environmental and aesthetic concerns
- Until the Shorezone Ordinance is passed, only those permit applications to construct lake structures or to dredge and/or fill which are accompanied by TRPA approval will be processed
- Encourages cooperative or group use of piers, etc., rather than individual
- Freeze on permit approvals for new single-family piers since 1970

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*Requires permit for shorezone projects

U.S. Forest Service (USFS)

- Manages 9.8 miles or 13.7% of the shoreline
- Interest lies in the effects upon riparian vegetation, marshlands, shore erosion, water quality, boating use and safety, and the aquatic regime of shorezone uses
- Has removed old piers and boathouses on newly acquired property
- Supports the Federal position statement on the Shorezone Ordinance

Bureau of Reclamation (BuRec)

- Regulates the top 6.1 feet of the Lake as a storage reservoir, which contains 720,000 acre-feet
- By law (the 1935 Truckee River Agreement), it has no latitude in controlling releases from the lake nor the lake level (level must stay between 6223' and 6229.1')

U.S. Coast Guard (USCG)

- Concerned with marine installations, boating safety, and the economic investment in private and public facilities at Lake Tahoe
- Believes that boat noise and speed controls belong under its jurisdiction, not TRPA's

Soil Conservation Service (SCS)

- Concerned primarily with shorezone erosion, stabilization and revegetation
- Not involved with permit review for shorezone construction

Environmental Protection Agency (EPA)

- Interested in the successful implementation of 208 planning for the Basin, or the Areawide Wastewater Treatment Management Plan
- A major concern of this program is the control of sedimentation into the lake, often caused by construction in the backshore area, shoreline "protective" measures, and accelerated shoreline erosion.

U.S. Fish and Wildlife Service (FWS)

- Believes a shoreline plan is needed which is based on ecological, biological, and physical capabilities and limitations of the natural system
- Believes that individual single family piers, docks, and boathouses will result in an incremental loss of fish and wildlife resources and is not consistent with the preservation of the shallow water and shoreline of Lake Tahoe
- Burden of proof should be on the applicants for a permit to show that the proposed work is in the public interest
- Supports the Federal position statement on TRPA's proposed Shorezone Ordinance, encouraging the joint use of piers and other water-related facilities along shoreline

U.S. Bureau of Outdoor Recreation (BOR)

- Administers and coordinates the Land and Water Conservation Fund for Tahoe Basin, which has provided close to $6 million over the past 10 years in matching funds for acquisition and development of park and recreation areas, most of them along the shoreline
- Believes that the Shorezone Ordinance is perhaps the most important to be adopted by the TRPA
- The shorezone is unquestionably the major recreation draw in the Basin; its visual integrity is of paramount importance and should be maintained
- Supports the Federal position statement on the Shorezone Ordinance

STATE AGENCIES

*California State Lands Commission (SLC)

- Manages the beds of naturally navigable California waters such as Tahoe
- Use of Tahoe lake bed requires a lease or permit from Comm., at any point where lakewaters exist in California
- Legal jurisdiction in past exercised only below 6223 ft, or the low water line; in 1976, it claimed jurisdiction to high water (6229.1 ft.)
- Area between the low and high water marks is still legally in question and of most concern for the Ordinance

- Environmental Impact Report required of all new encroachment on shore, such as piers, wharves, pipelines, etc.
- Would like to see a reduction in the number of private piers, bouys, and marinas in order to improve navigation and fishing
- Prepared report recommending beach dedication of 13 new areas

*Lahontan Regional Water Quality Control Board

- Calif. State Agency responsible for water quality control in Tahoe Basin, such as sewage disposal, siltation, and erosion control
- Believes property owners are ultimately responsible for prevention of siltation of Tahoe by erosion of their properties
- Concern for dredging and filling activities in shorezone

*Calif. and Nevada Fish and Game Depts.

- Concerned about shoreline spawning areas, especially of Kokanee salmon and Rainbow trout
- Believes private interference is unwarranted in lake bed since it threatens fish habitats and public navigation
- Would like all piers be made available to the public and no piers allowed in primary fish habitat areas
- Worried that erosion and sedimentation is causing sand barriers at mouths of rivers which might block spawning fish travel
- Requires permits for shorezone projects

*Nevada Bureau of Environmental Protection (BEH)

- Responsible for water quality (also air quality and solid waste) on the Nevada side of the Tahoe Basin
- Requires permits for all shoreline projects
- Has denied all requests for new pier permits last few years, "unlike TRPA"

Calif. Dept. of Parks and Recreation

- Manages 8.5 miles (12%) of shoreline of the Calif. State Parks
- Silent on shorezone issue

Nevada Div. of Parks

- Manages 3.25 miles (5.3%) of shoreline
- Silent on shorezone issue

COUNTIES

El Dorado, California

- County seat located in Placerville, about 50 miles outside the Basin
- Must conform to TRPA and CTRPA standards and cooperate with the City of South Lake Tahoe, but poor enforcement record
- About 31% of the Lake Tahoe shoreline within its borders, much of it in public ownership under the Forest Service or State Parks
- Poorest county in Basin by per capita income due to the large number of seasonal workers

*Placer, California

- County seat located in Auburn, about 70 miles outside the Basin
- Must conform to TRPA and CTRPA standards
- About 29% of shoreline within its borders, with a few county beaches for public access
- Contains many old resorts, long-time second home owners, and small motels
- Snobbish attitude towards the "less desirable" South Shore area
- Requires permit for pier construction from County Building Dept.

Douglas, Nevada

- County seat located in Minden, about 20 miles outside of Basin
- Location of the major Basin gambling casinos as well as largest segment of employment
- Boundaries include 18% of shoreline, with little public ownership or access

- Most vocal opponent of TRPA's plans and ordinances, challenging its "nonlocal orientation"
- Must conform to TRPA regulations, but poor enforcement record

Washoe, Nevada

- County seat located in Reno, outside of the Basin
- Responsibilities of county government as strong as TRPA
- About 16% of shoreline within its borders, including a State Park
- Contains largest segment of condominium-type second home owners
- Highest per capita income in Basin

Carson City, Nevada

- County seat in Carson City, about 10 miles outside of Basin
- No population within Basin; one chunk of land in private ownership
- About 6% of shoreline within its borders, mainly in Forest Service ownership but with little access
- Problems include use permits on FS lands, roads, and utilities

CITY

City of South Lake Tahoe, El Dorado Co., Calif.

- Only incorporated city in the Tahoe Basin, with a permanent population of about 20,000
- Must conform and enforce ordinances as strong as TRPA and abide with General Plans of TRPA and CTRPA
- Considering city-county consolidation within Basin to have more control over its affairs
- Open space acquisition a low priority in its budget

CITIZENS GROUPS

Tahoe Shoreline Representation, Inc. (TSR)

- Private shoreline owners' group that believes TRPA is out to get them

- Feels Shorezone Ordinance is unworkable and cannot be amended to work
- Any shoreline owner should have the right to construct a pier into the lake
- Believes aesthetic review is too subjective and should be deleted from Ordinance
- "Shorezone tolerance districts" (the biological and physical constraints in the Ordinance) are not scientifically "provable"

League to Save Lake Tahoe (LSLT)

- An old guard conservation group which usually opposed the TRPA for not being environmentally strict enough
- Has been very silent on the shorezone issue since many of its members are also shoreline residents potentially affected by the Shorezone Ordinance
- Some members are demanding that no restrictions be placed on shoreline development
- Not representative of environmentalists' position for shorezone issue

Sierra Club

- Local group not very active on a regular basis
- Has made one statement in support of TRPA position on Shorezone Ordinance

Nevada North Shore Property Owners Assoc., Inc.

- A taxpayers' association for the Basin portion of Washoe Co.
- Urges that existing shoreline structures be allowed to remain unless it can be shown that some specific structure is causing "significant" environmental harm and that its removal will not cause more harm than its existence
- Burden of proof should be on agencies
- Supports the position and draft ordinance of the Tahoe Shoreline Representation

OTHER GROUPS/INTERESTS

Tahoe Research Group (TRG)

- Multi-disciplinary research group under Dr. Charles Goldman at the Univ. of Calif. at Davis, supported by NSF-RANN
- Research has confirmed belief that the shallow zone of the lake has dramatically increased in its primary productivity and that nutrients concentrate near shore
- Developing models for use as predictive tools for Basin watersheds
- Its researchers have had some impact on the plans of TRPA and the Forest Service

Dr. Antony Orme

- A geographer from UCLA, Orme was responsible for developing the technical studies leading to the plans for both the original and new ordinances.
- His studies are almost the sole basis for establishing the shorezone tolerance districts and visual vulnerability districts of the new ordinance

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