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PLANNING THE MANAGEMENT OF MARYLAND WETLANDS

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Purpose

The purpose of this paper is two-fold. First, it is intended to acquaint you with recent activities in Maryland concerning wetlands management. Second, there seems to be a lack of published information on the subject of resource planning for fish, wildlife, waterfowl, and especially wetlands management. Notable exceptions are (California, 1966), (Delisle, 1966), and (Stokes, *et al,* 1967). With regard to the lack of published information, we are not suggesting or claiming to fill the void (if one does exist), but intend merely to discuss our recent experiences with the planning process and wetlands.

To achieve the purposes just stated, this paper discusses previous study activity on Maryland wetlands. Then consideration is given to planning guidelines that we believe are essential to a wetlands study and formulating an eventual management plan. Next, discussion elaborates on procedures developed to incorporate the guidelines in the current study in Maryland. A general overview summary of the current study's results to date concludes this presentation.

Background

Recent concern about the preservation and proper management of all wetlands in Maryland resulted in the passage of House Joint Resolution No. 2 (HJR 2) by the 1967 Maryland Legislature. This Resolution requested "that the State Planning Department, in cooperation with the Board of Natural Resources and the Department of Economic Development, prepare a detailed long-term plan for the optimum use of all Maryland wetlands, such plan to be based so far as is possible upon the results of economic, biologic, hydrologic, and recreational research previously completed or underway in Maryland and in other states or nations having comparable wetland types and functions" (Maryland, 1967).

Wetlands are defined by HJR 2 as those "areas on which standing water, seasonal or permanent, has a depth of six feet or less and where the wet soil retains sufficient moisture to support aquatic or semi-aquatic plant life." Thus, wetlands is a collective term for areas of varied ecology more widely known as swamps, sloughs, marshes, bogs, and mud flats.

Prior to passage of HJR 2 in 1967, a number of studies of an inventorial nature had been conducted on Maryland wetlands. These studies include: *Maryland Marshes*

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(Nicholson and Van Deusen, 1954), *Wetlands of Maryland* (Nicholson and Van Deusen, 1956), *Permanent Water Inventory –Maryland* (Nicholson and Van Deusen, 1956), *Waterfowl Populations in the Upper Chesapeake Region* (Stewart, 1962), and *Classification and Inventory of Habitats in Maryland* (Maryland State Planning Dept., 1965).

Noting the lack of wetlands legislation in Maryland, it is apparent that none of these studies generated a successful legislative response. This finding is consistent with the intent and inventorial nature of each study since none of them dealt with the need for wetlands legislation. However, each study suggested that wetlands should be preserved. There is one notable exception which is mentioned here for passing historical interest only. The Report of the Conservation Commission of Maryland for 1908-1909 stated that:

> "Very little attention has hitherto been directed to the extensive swamp and marshlands of the State which if reclaimed would add greatly to the total area available for agricultural production.
>
> "It requires little argument to show that this vast area of unproductive land, which might become the richest in the State, should be made available for agricultural purposes at the earliest opportunity."

It is interesting to note the apparent negative attitude of the Conservation Commission regarding the natural values of wetlands. Such statements might cause one to wonder how existing wetlands acreages have survived to this time. Also, the statements suggest one of the problems a wetland plan must handle—misconceptions about the natural values inherent in wetlands.

It is essential to establish a clear and mutual understanding of the terms or concepts—planning and plan—used throughout this paper. We perceive planning, including its processes and results, to be the systematic application of analytical techniques to the identification of problems, and the thoughtful and deliberate preparation of appropriate responses. The result or objective of such activities is to sharpen the focus on the problem at hand in order to promote and improve the background needed for wise decisions. The wetlands management plan that is anticipated from the current study and planning efforts on wetlands is not envisioned as a fixed projection or blueprint which is to be followed faithfully without present or future alteration or modification. Nor are we attempting to answer the question of how the planning function can best be implemented with regard to wetlands. For there is probably no single, simple one best method. Therefore, the planning activities and resulting wetlands management plan discussed herein should not be construed as the ultimate answer to providing managment tools. Rather, methods discussed here are suggested as initial means of improving the decision-making process for administrators so that those who are concerned and responsible will be better prepared to act.

Guidelines Essential to Formulating a Wetlands Study and Management Plan

Guidance in formulating a wetlands study that would develop a management plan was sought from previous wetlands studies, recent publications on resource planning and from another resource management field with much to offer in terms of planning experience--water resources.

Previous wetlands studies (besides those in Maryland) were useful in providing historical perspective, supplying ideas on study organization and methodology, and furnishing previous inventory information (when applicable). More importantly, however, such studies suggested what was inadequate or ill-advised to do in generating desired responses in terms of wetlands legislation or management policy. Studies of a survey or inventorial nature exclusively are satisfactory for their scope, but apparently are unsatisfactory from a legislative policy standpoint for several reasons. First, the information assembled probably presents too narrow a perspective to legislators. Previous studies were notably single-purpose—preservation of the *status quo* concerning wetlands habitat, the shortcomings of which are described in "The Fallacy of Single-Purpose Planning" (Gilliam, 1967). Gilliam suggested that planning

must move toward a multiple-purpose concept so that recognition will be given to the full spectrum of human needs. Whereas, single-purpose planning generally disregards shifting demands, determining the multiplicity of uses from the same resource base, a changing environment (natural or man-made), accounting total environmental impacts from man's activities, and assessing other dynamic factors of contemporary society. Consequently, single-purpose (inventorial) wetlands studies probably were inappropriate for generating any response from decision-makers. If wetlands were worth preserving at the time of previously cited studies, then those efforts should have been commensurate with the value of the resource.

Second, most of the previous studies examined showed evidence that their findings were obsolete before completion. A major problem for resource planners and managers is measuring and evaluating the many different uses of the resource base. Frequently, the resource base being measured is experiencing changes in intensity or frequency of use during the course of a study. Also, the uses and users themselves are often changing both as to character and intensity. Perhaps one of the most significant facts about our environment and/or resource base is the speed at which man can cause changes to occur. And further, it is important to realize that the results or trends of yesterday's and today's changes often cannot be altered in the future regardless of one's wishes. At the current rate of change, the present becomes the past before we recognize it. Such speed drastically narrows the options of today to deal with the problems of tomorrow. With specific reference to wetlands nearly all the previous wetlands studies can be faulted for failing to grasp the dynacism of the resource being investigated, for failing to project adequately into the future and thus, failing to present sound guidance to decision makers on matters of legislation, policy and consequent managerial action.

Third, in line with what has just been said, previous wetlands studies examined were too static and inflexible for the resource being dealt with. There seemed to be a failure to recognize that other legitimate claims to shoreline frontage exist which quite often encompass wetlands. Wetland areas were valuable only as wetlands. Such philosophy seems inconsistent with reality and fails to recognize the fact that wetlands are not static but dynamic resources. What yesterday was a valuable wetland due to its natural productivity and contribution to an estuarine ecosystem may not be true tomorrow—or five, ten or fifteen years from now. Likewise, wetlands that are not of prime value today for natural productivity may be of tremendous benefit in the future. Wetlands by themselves represent resources that are in continuous natural transition. Consequently, the inflexible philosophies apparently behind previous studies produced results inconsistent with the resource at hand and traditional management problems.

What is suggested or required for an effective wetlands plan is the inclusion of some mechanism or technique which will produce results with inherent flexibility. Flexibility, meaning the capability to rapidly and effectively update, augment, revise, or review inventorial results, is necessary in a wetlands management plan to provide legislators, planners, administrators or private citizens with an accurate and timely status report on the State's wetlands resources.

Further amplification of the planning function and flexibility is provided in *Maryland's Role in Water Resources Development* (Craine, 1966). In discussing water resources planning Craine states that: "The emphasis must be on flexibility for adjusting to changing needs as we move nearer to and become more certain of future conditions which at first may only dimly be perceived."

Now turning for a moment to a brief examination of the Federal Government's experience with water resources development—one finds that originally it was based on single-purpose planning. Initial Federal ventures were the result of Congressional laws and policies of limited scope that were generated to deal with specific problems in particular areas. Examples are navigation on the lower Mississippi River Valley, irrigation in the reclamation programs for western states, and flood control again in the Mississippi River Valley. Gradually, it became apparent to those concerned that resources were interrelated and a need was recognized for multiple-purpose systems to develop several resources simultaneously. Also, the view developed that if

comprehensive plans were formulated resources would be used more productively. Thus, there was a transition in Federal water resources development philosophy from single-purpose planning for particular places to multiple-purpose and comprehensive planning for entire river basins or regions.

A recent examination of water resources management suggests that there is a need for further refinement in water resources planning. "Management of water resources has evolved to a stage where planning should center upon the needs of people rather than upon water *per se,*" (N.A.S., 1966). This is an important point and very applicable to natural resource planning. What is the objective of a fish, wildlife or waterfowl management plan? Are we preserving and managing these natural resources for their own sake? Are we doing so because of the intrinsic values their existence represents to people? Are management endeavors directed toward producing a type of goods and services consistent with contemporary society's tastes and high standard of living? The answer to these questions would probably be that all of these objectives are being sought but with different degrees of intensity for each purpose. The ultimate planning question for fish, wildlife and waterfowl might evolve to be—what is the optimum mix that can be produced—*for people?*

The Federal Government's experience has not been lost on those concerned with water resources development in Maryland. "All use of water and the development of the water resources shall be on a multiple-purpose basis . . . Recreation and the related fish and game activities shall be considered co-equal purposes in such planning . . ." (Maryland State Planning Dept., 1961).

More pertinent to our subject, wetlands planning, than the above philosophical statements about water resources and planning are comments on estuarine problems by Secretary of the Interior, Stewart L. Udall. He suggests the need for integrating *all* resources within a common planning framework to facilitate effective environmental management.

> "It is clear that the estuaries must be considered as a total resource system and not simply as a 'water resource' at the end of a river."
>
> "There is a clear recognition within the Department of Interior that the future welfare of the estuaries depends upon the control of water pollution, on an adequate supply of fresh water for salinity regulation, on controlling dredge and fill operations, and effective community planning and/or zoning which recognizes the interactions between water and land use."[3]

By reviewing previous wetlands studies, by examining the transition of planning in Federal water resources projects and by observing the impressions of others on the planning function concerning Maryland's water resources, two principal planning guidelines emerged for the current ongoing wetlands study in Maryland. These are:

1. that a wetlands study (or plan) must be *comprehensive*—meaning consideration should be given to all problems that center on wetlands addition to seeking management techniques to preserve natural productivity; and
2. that a wetlands study (or plan) must have *flexibility* built into it – not only in terms of comprehensiveness, but a structure which is capable of being continuously up-to-date and therefore, can rapidly define, assess and provide accurate information about the resource base to planners, managers or whomever has a need for such information.

Developing a Comprehensive Wetlands Study

To insure comprehensive planning coverage of all problem areas related to wetlands and to coordinate all potential study inputs, a wetlands technical advisory committee (WTAC) was created by the Maryland State Planning Department. The committee is comprised of representatives from State agencies and organizations having any concern with wetlands. Meetings were held to organize the committee, establish a study outline, coordinate study activities, and familiarize everyone with

[3]Statement made before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate, March 27, 1968. p. 16.

the planning requirements essential to fulfilling the objective of HJR 2. From committee work a study plan[4] developed that outlined essential research and investigational activity on Maryland's wetlands. The Department of Game and Inland Fish study plan suggested six phases or segments representing major areas of concern. The study as adopted and currently in the process of completion is structured to produce a workable plan for wetlands management. Due to the diversity and magnitude of the project and to insure a thoroughly comprehensive study, members of the WTAC were assigned specific responsibilities in different segments of the study. Or they were requested to provide expertise guidance or assistance as required by the State Planning Department throughout the duration of the study. Figure 1 shows the composition of the WTAC with each member's general areas of participation in the different segments of our comprehensive wetlands study.

Wetlands Habitat and Competing Uses Inventory – Segment I

Responsibility in Segment I was assigned primarily to the Department of Game and Inland Fish (GIF). However, later in the study extensive support efforts were provided by summer field work conducted by the University of Maryland's Natural Resources Institute. Also, the University's Department of Entomology has furnished information about the plans and activities of the mosquito control program. The habitat inventory developed by GIF provides the basic framework on which current planning efforts have evolved.Briefly, the methodology employed in Segment I is as follows:

1. A set of U. S. Geological Survey quadrangle topographic maps (Scale=1:24,000) was assembled which covered the entire State.
2. All areas charted or indicated as wetland types after Circular No. 39 (Shaw and Fredine, 1946) were assigned a specific identification number unique to the particular county in which the wetland is located. For practical purposes an acreage limitation of at least five (5) contiguous acres per wetland was imposed for inventorial consideration.
3. Acreage measurements were made manually with either a grid (dot system) or a planimeter. Conversion factors of 1.43 acres per grid dot or 91.8 acres per plainmetered square inch were utilized.
4. The accuracy of the information on wetlands' losses obtained from the USGS maps was verified by a Statewide aerial reconnaissance which also authenticated the manually identified wetlands and augmented the inventory with a visual assessment of the wetlands' present physical situation.
5. For shallow water offshore areas (0 to 6 feet depths) appropriate U. S. Coast and Geodetic Survey charts were utilized to determine and compute estuarine areas within the HJR 2 definition of wetlands.
6. Habitat inventory information was obtained on each wetland by field surveys and interviews with cognizant GIF manaagment and enforcement personnel. Information obtained was recorded in encoded language on the respective wetlands habitat inventory data sheet originated for each specific unit identified during the course of the study (Figures 2 and 3).
7. Results and activities of the previous step were used to determine the wetlands vulnerability to changes from other influences or uses and recorded on the inventory data sheet (Figure 3). Wetland vulnerability was subdivided into four categories representing possible present and future conditions.

   Category I - (highly vulnerable) - classifies wetlands experiencing man-made changes or assessed as having that possibility within the next five years.

   Category II – (Moderately vulnerable) – classifies wetlands that are generally in private ownership where destructive changes can be anticipated within the next ten years.

   Category III - (safe) - classifies wetlands that are highly inaccessible or isolated from societal activities, or are in the ownership of wealthy landowners.

[4]Maryland Wetlands Project drafted by the Director and staff of the Department of Game and Inland Fish for the Maryland Board of Natural Resources. Unpublished and undated (mimeo).

Wetlands Study Segment	Objectives of each segment	Board of Natural Resources	Chesapeke Bay Institute	Dept. Chesapeke Bay Affairs	Dept. Economic Development	Dept. Forests and Parks	Dept. Game and Inland Fish	Dept. Water Resources	Md. Geological Survey	Md. State Planning Dept.	U. Md. Natural Resources Institute	U. Md. Dept. Entomology (Mos. Control)
I	Wetlands habitat inventory						X				X	
	Inventory of competing uses						X					X
	Assess wetlands real estate values					X	X			X		
	Wetlands dependent production	X		X			X			X	X	
II	Recreational uses and values	X		X	X	X	X				X	
	Ecological values	X		X			X			X	X	
	Identify ecologically unique areas	X	X	X		X	X			X	X	
III	Wetlands-aquifers relationships								X			
	Wetlands-shoreline erosion								X			
IV	Investigate wetlands/estuarine pollu.		X				X	X		X	X	X
	Evaluate Segments I, II, III			X	X		X			X	X	
	Outline problems-potential solutions									X		
V	Review Maryland laws - wetlands									X		
	Review other states' wetlands laws									X		
	Develop wetlands data process, sys.									X		
	Organize study results									X		
	Develop wetlands mgmt. plan									X	X	
VI	Develop wetlands legislation			X			X	X		X		
	Adopt plan recommendations	X	X	X	X	X	X	X	X	X	X	X
	Produce final report									X		
	Conduct public hearings	X			X					X		
VII	Advise Maryland Legislature	X		X	X		X	X		X	X	X

Note:
The order of the segments does not represent the study sequence of events. Some segments occur simultaneously.

Wetlands Technical Advisory Committee (column headings above)

Figure 1. Wetlands Technical Advisory Committee with each member's general areas of participation in the different segments of the wetlands study

WETLAND HABITAT INVENTORY DATA SHEET FOR SPECIFIC UNIT FOR MARYLAND

1. STATE	2. COUNTY(S)	3. COUNTY WETLAND UNIT NO.
4. ELEC. DIST.(S)		5. QUADRANGLE(S)
6. PHYSIOGRAPHIC REGION		7. NAME OF WETLAND

8. DESCRIPTION ACREAGE	TYPES	ACRES	DOMINANT VEGETATIVE SPECIES
	9. TOTAL		10. RELATIONSHIP TO OTHER WETLAND UNITS

11. LAND USE ON WETLAND	12. ON SURROUNDING AREA	13. OWNERSHIP

14. WILDLIFE INFORMATION	GROUP	SPECIES, NUMBERS, TYPE OF USE, PERIOD OF USE
	WATERFOWL	
	OTHER MIG. GAME BIRDS	
	FUR ANIMALS	
	BIG GAME	
	UPLAND GAME	
	SHOREBIRDS & WADERS	
	FINFISH	
	SHELLFISH & CRABS	
	REPTILES & AMPHIBIANS	
	SONGBIRDS	

15. SOURCE OF DATA & DATE

16. ADDITIONAL REMARKS:

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Figure 2. Wetland habitat inventory data sheet for a specific unit (page 1 of 2).

Category IV - (destroyed or partially destroyed) - classifies wetlands that have the natural productivity functions or capacities destroyed or reduced by either man-made or natural events. (The latter refers chiefly to shoreline erosion.)

8. The results of Step (2), individual identification of each wetland, were transformed into county wetlands maps by using the Maryland State Roads Commission's general (county) highway maps (Scale: 1 inch = 1 mile). The location of each wetland with its number was transferred from the USGS quadrangle map to the appropriate SRC county map.
9. By combining selected information generated by Steps (3) and (7), acreage measurements and vulnerability assessments, respectively, with the county wetlands maps produced in Step (8) it was possible to establish an effective base for communication within the WTAC. This achievement permitted a

17. ASSESSMENT OF VALUES AND VULNERABILITY

ASSESSMENT OF WETLAND VALUE

USE	VALUE	SPP. OR TYPE	REMARKS
HUNTING			
FISHING (SPORT)			
FISHING (COMM.)			
TRAPPING (FURS)			
BIRDWATCHING			
OTHER RECREATION			
F. & W. REPROD.			
UNIQUE HABITAT			
UNIQUE WILDLIFE			
IMPROV. CAPABILITIES			
OTHER _____			
OVERALL RESUME			

ASSESSMENT OF VULNERABILITY

FACTOR	VALUE	TYPE	REMARKS
INDUSTRY			
HOUSING			
CHANNELIZING			
PUBLIC WORKS			
AGRICULTURE			
MOSQUITO CONT.			
POLLUTION			
EROSION			
SUCCESSION			
OTHER _____			
OVERALL RESUME			

ACTION TAKEN FOR PRESERVATION _____

Figure 3. Wetland habitat inventory data sheet for a specific unit (page 2 of 2).

comprehensive collection and exchange of information linked to specific wetlands and facilitated the coordination of WTAC study activities. These activities are discussed in the paragraphs that follow.

Survey of Wetlands Values - Segment II

Efforts in Segment II concentrate on identifying and assessing the contributions or values derived from wetlands. Referral to "values" should not be interpreted exclusively as monetary benefits. The use of "values" here is intended primarily to mean that quality of a thing which is desirable or worthy of esteem for its own sake; that quality of being useful, estimable and important.

Figure 1 shows how study activities were distributed throughout the WTAC in Segment II. To expedite committee work and coordinate the results, a system of departmental questionnaires was devised by the State Planning Department. Each

appropriate WTAC member was requested to provide certain information via answering a selected set of reference questions designed for the specific agency. The use of this technique encouraged each agency to examine and evaluate their available information and capabilities in terms of wetlands problems. Also, insight was provided as to the viewpoints and interests of the other participating WTAC members. Responses received reflected the adequacies and inadequacies of the questionnaire formulating process, the availability of relevant information, and the levels of departmental interest and awareness with wetlands problems. Fresh viewpoints and new ideas were also generated by the questionnarie evolution. The kinds of questionnaire requests and respective responses can be ascertained generally without were also generated by the questionnaire evolution. The kinds of questionnaire requests and respective responses can be ascertained generally without further elaboration by inspection of the categories listed in Segment II of Figure 1 and matching them with appropriate WTAC members.

Wetlands and Aquifers and Shoreline Erosion - Segment III

Study activity in Segment III was handled by the Maryland Geological Survey. The principal endeavors were to determine the interrelationships between wetlands, either specifically or non-specifically, and the recharge of aquifers, and to identify wetlands that were protecting fast lands from wave and current caused erosion. The purpose of the latter was two-fold. First, wetlands that are being eroded or subject to it were identified. Second, if a wetland is in such condition, then an activity which proposes to fill in or on the wetland would be subject to the same natural event. Therefore, engineering projects would be required to protect and stabilize the newly created fast land, and such projects are eligible for State cost-sharing support. The State should be aware beforehand of those activities which later may require public financial support.

Wetlands/Estuarine Pollution - Segment IV

The scope of pollution problems is indicated by the numbers of WTAC members participating to varying degrees on this segment. Segment IV was originally perceived to be a straight forward identification of wetlands and adjacent estuarine areas with water quality, e.i., pollution, problems. This approach is still maintained to be viable. However, interpretation of what a degraded water quality situation means in terms of wetland/estuarine values is another matter. Other efforts indicate the complexities of estuarine pollution (Wastler, 1967). For example, Wastler points out that the effects of municipal and industrial wastes on estuaries depends not only on the characteristics of the discharged wastes but also on the nature of the receiving water bodies. Further elaboration in the *Proceedings of the National Symposium on Estuarine Pollution* (Stanford, 1967) points out many other aspects of the problem including the effects of degraded water quality on aquatic life, and the distribution of pollutants by tidal action, sunlight, temperature and other physical, chemical and biological factors. Before study conclusions are reached on wetlands/estuarine pollution, a careful weighing of all information must be undertaken. This is not an attempt to build or justify a cause for further study, hence procrastination, but simply recognition of facts which should justly temper any planning which considers the problem of wetlands/estuarine pollution.

Plan Development - Segments V, VI and VII

The remaining study segments outlined in Figure 1 can be grouped together and collectively titled--the implementation phases of plan development. The results of activities in the preceeding segments are brought together in Segments V and VI and evaluated in terms of study objectives and problems identified during the course of the study. Before conclusions are reached and recommendations formulated the results of the previous step should be carefully meshed with the efforts invested in a review of Maryland's and other states' legal precedents and legislation pertaining to wetlands. In our study, aid was sought from a consultant on this legal phase. Also, it would be well to have the assistance of the Attorney General's office whenever possible.

Problems with legal ownership and powers of the State concerning wetlands and estuaries are important matters, and were noted as an area of major research deficiency in the *Proceedings of the Symposium on Estuarine Ecology* (U.N.C. 1966). Filling both a local and regional need are two useful publications produced recently--*State Programs for Estuarine Area Conservation* (Heath, 1968) and *Estuarine Lands of North Carolina: Legal Aspects of Ownership, Use and Control* (Rice, 1968). We anticipate that the forthcoming results of our study's legal/legislative research, *Maryland's Wetlands, Marshes and Submerged Lands in the Context of Common and Statutory Law* (Maryland State Planning Dept., unpublished) will further clarify the legal issues pertaining to wetlands and estuarine areas.

Also, an effort is now getting underway at the University of Maryland's Law School in Baltimore to study the legal problems related to the development and management of Chesapeake Bay resources. This activity is part of the Federal Water Pollution Control Administration's current National Estuarine Pollution Study.

Segment VII might be categorized as an advisory activity since it is envisioned primarily as an information and education function. The public has the right to be fully informed about the wetlands study's results and recommendations and can be expected to exercise that right. An understanding local and/or county government is just as important as an informed citizenry to eventually achieving study plan objectives. Cooperative attitudes are greatly needed from these governments. If such attitudes are to be expected and received, then local and county government must be made aware of the potential impacts and consequences of their granted powers and adopted administrative policies affecting natural resources, particularly wetlands and estuarine areas.

Just as important as advising local government will be the liaison or advisory activity by members of the WTAC with the State Legislature. Any proposed management plan, especially for natural resources, must expect a critical legislative evaluation. Germane to this issue or anticipated episode is analytical discussion in *Natural Resources and the Political Struggle* (Wengert, 1955). Wengert concludes that the political struggle is for access to points at which decisions are made, and the struggle is based upon winning friends alliances, and alignments as a means of influencing the course of governmental decisions. "Typical weapons are discussion and debate, persuasion and education..." Obviously, advisory activities can be concerned with all of these.

Flexibility - Wetlands Information Retrieval System

Review of previous wetlands studies lead to the conclusion that besides comprehensiveness, flexibility was a principal feature that should be incorporated into the current Maryland wetlands study initiated by HJR 2. The mechanism that can provide the desired flexibility is an automatic data processing system. A programmed, automated information retrieval system especially designed for wetlands management offers an attractive potential for rapidly and effectively handling large volumes of data and information in ways meaningful to planners and administrators.

During early segments of the current study it became apparent that the scope of the efforts being undertaken would eventually establish a data base capable of generating very large quantities of information. This impending result presented both opportunities and problems with desired flexibility.

The opportunities were: 1) all the information collected would not be available anywhere else from a single source; 2) the information assembled was keyed to specific wetland units--each wetland inventoried was designated by the county in which it is physically located and was assigned a distinct, individual number within the specific county; and thus, 3) the wetlands study had established a system of unique information valuable to many interests.

The problems included: 1) the manner in which a large volume of dissimilar information from different sources should be assembled; 2) the requirements levied against the collected information will be of diverse origin and will represent diverse

interests; 3) it was essential that the data base established should be capable of being queried on any element of information present in the system; and 4) the system developed should be capable of summarizing information as well as retrieving it on demand. If all of these requirements were met, then the study should possess the ability to rapidly and efficiently provide accurate information on any facet of the wetlands study.

To assist the State Planning Department in establishing a wetlands data processing system which would systematize collected data, organize, store and retrieve the programmed information, contractual assistance was solicited from private organizations with competence in operations research, systems analysis, and automatic data programming and processing. From among the responses received the one most attractive on financial and operational bases was the proposal presented by Link Information Sciences (LIS) of General Precision Systems, Inc. (LIS, 1968).

The basic feature of the LIS proposal was a wetlands information retrieval system that would permit complete and immediate access to the data collected by the WTAC. The information, when encoded, would be stored in machine readable form for State-operated computers and accessed (or retrieved) by use of the proposed retrieval system.

The system being developed by LIS for the State Planning Department is a program for retrieving stored information. It is not a panacea for resolving all information problems nor does it provide decisions. The system is designed to extract answers from text data, user-specified format data and compiled file data in response to a user's query.

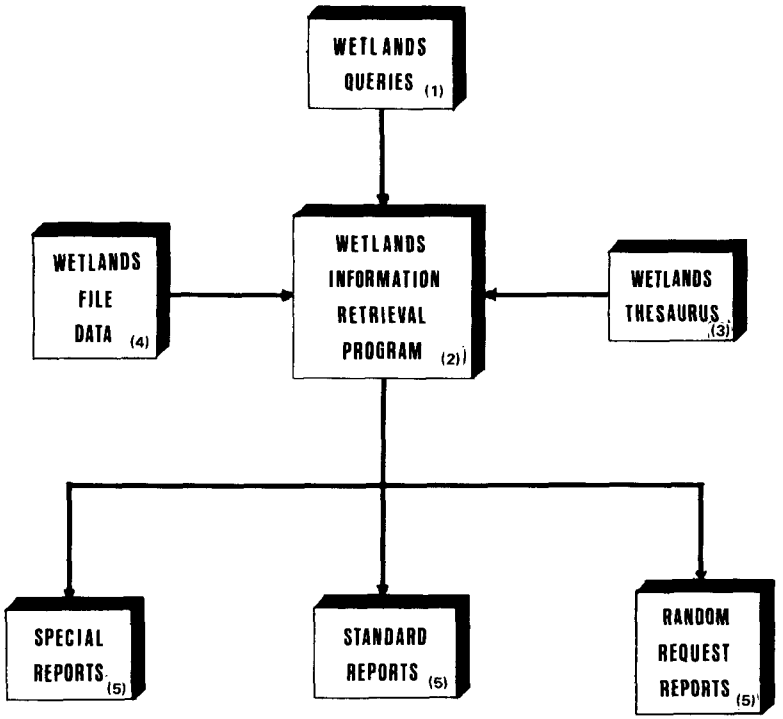
Figure 4 shows the basic organization and operation of the wetlands information retrieval system. A question or query at (1) is formulated to extract desired information. The question is addressed to the system's programmed information at (2). An important aid to questioning the program is the wetlands thesaurus (3), a dictionary containing all individual or distinct words, abbreviations, notations, etc., that have appeared at one time or another on all the wetlands habitat file data sheets (4) shown in Figures 2 and 3. The reply to a query will be in the format shown in abbreviated form (Figure 5). Depending upon the nature of the requested information, the response is programmed to respond and print out in either a special, standard or random request report format (5). Without elaborating further on technical details which are beyond the scope of this paper, it is perhaps more informative to illustrate briefly what can be produced in terms of user interest.

The system will answer such questions as what is the total acreage (of a specified wetlands habitat) for each county (Figure 5) and also for the entire State? Some additional sample questions might be--list wetlands over 50 acres of Type 12 (wooded swamp) by county--by the entire State. List wetlands that possess a unique habitat value ranking of 10 (for endangered species such as the bald eagle, *Haliaeetus leucocephalus,* or the Bryant fox squirrel, *Sciurus niger cinereus).* List wetland units and acreages by county or entire State evaluated to be in the highly vulnerable category (potential acreage losses within 5 years). It should be clear by now that the question and answer combination possibilities offered by an automatic data processing system are, indeed, endless. Moreover, as the human element gains experience with the system's capabilities and deficiencies its usefullness will be better understood, appreciated and utilized in the future.

Results

Rather than conclude this paper with the customary summary, it seems more appropriate to comment briefly on some observations on events that have occurred during wetlands planning efforts in Maryland, since, indeed, the study is not formally concluded.

One aspect that would be of vital concern to interested persons is the effect this study will have on future management policies for wetland/estuarine areas. While it is obviously premature to ascertain the planning effort's results in terms of concrete accomplishments, it is possible to compare the study in terms of some prescribed guidelines for effective management for wetlands/estuarine areas. Especially useful



WETLANDS INFORMATION FLOW

Figure 4. Basic organization and information flow of the wetlands information retrieval system (Courtesy of LIS, 1968).

for this purpose is *Developing and Managing Estuaries* which was prepared by the Estuarine Committee of the Atlantic States Marine Fisheries Commission. The same applies to the approach developed by the Federal Water Pollution Control Administration for its current National Estuarine Pollution Study (Wastler, 1967).

While the list of guidelines useful and, in fact, essential to effective management can be very large, we suggest that it might boil down to these five points from the just mentioned sources:

1. Thorough description of the resources in terms of a detailed inventory.
2. Evaluation of the values represented by the resources, including social, economic and others.

INPUT - LIST/WETLANDS/TYPE/5/CAROLINE/PLANT
OUTPUT - LIST/WETLANDS/TYPE/5/CAROLINE/PLANT

County	*Wetland Unit No.*	*Quadrangle*	*Wetland Name*	*Acreage*	*Dominant Vegetative Species*
Caroline	2	Preston	Hunting Creek	29	Cattail, Nuphar, Pickerelweed, Alder, Arum, Arrowhead
	14	Fowling Creek	Hoy Creek	6	Cattail, Pondweed, Alder, Nuphar, Naids
	42	Goldsboro	Mt. Zion	10	Pondweed, Cattail, Alder, Willow, Algae, Nuphar
	47	Goldsboro	Tidy Island Ck.	6	Pondweed, Nuphar, Cattail, Willow, Alder
	48	Marydel	No Name	10	Pondweed, Naids, Alder, Willow, Ash, Gu, Carex, Cattail
	50	Goldsboro	Broadway Br.	23	Pondweed, Nuphar, Alder, Smartweed, Algae, Gum
	55	Denton	Springbranch	5	Pondweed, Willow, Alder, Maple, Arum, Nuphar
	58	Denton	Garland Lake	49	Pondweed, Algae, Willow, Nuphar, Alder
	65	Hobbs	Williston Lake	49	Pondweed, Algae, Willow, Nuphar, Alder
	69	Hobbs	Fowling Creek	19	Pondweed, Juncus, Cattail, Nuphar, Milfoil, Alder
	70	Hobbs	No Name	6	Pondweed, Algae, Nuphar, Pickerelweed, Smartweed
	76	Federalsburg	Lake Chambers	7	Pondweed, Willow, Juncus, Nuphar, Buttonbush, Milfoil
	81	Hickman	Smithville Lake	40	Pondweed, Cattail, Duckweed, Pickerelweed, Smartweed, Juncus, Milfoil, Nuphar
			Total Acreage	259	

Figure 5. Abbreviated sample format of a printout of information retrieved from the wetlands information retrieval system in response to the query - /List/all/Wetlands/of/Type/5/in/Carolina/County and List/Plants/.

3. Determination of the current controls or management practices affecting the resources.
4. Development of a management system (from the above) leading to responsive action at appropriate levels of government.
5. Clearer identification of the research needs still required to aid government in reaching management policy decisions.

We believe that the comprehensive structuring of Maryland's wetlands study as outlined in Figure 1 and discussed in earlier paragraphs will closely approximate the five points above. In addition, the results will be augmented by the wetlands information retrieval system.

In terms of day to day activities, there are some experiences worth mentioning briefly. Without being too specific, State agencies have on several occasions referred questions to the study's primary investigators about compiled ecological habitat and inventory information. The problem at hand in each instance was to determine the natural values present and the potential losses that would be incurred from proposed projects with activities destroying wetlands.

While it is regrettable to report that habitat losses (acreage) were not prevented, mitigating action was required from those utilizing the wetlands for other purposes. Such results may be discouraging or disappointing, but it is important to appreciate that formerly very slight consideration was given to wetlands' values, much less the requirement for compensation.

The experience of State agencies requesting wetlands information represents an implicit recognition of the fact that wetlands themselves have values which must be considered before proceeding to destroy them. Every State agency with responsibilities that affect natural resources is now cognizant of the existence of a central source for information compiled on wetlands as a result of WTAC participation. Prior to study activities such information was distributed throughout several agencies (and still is). However, available information was sparse and often obsolete. It is not claimed that the above difficulties have been eradicated completely but the way is finally being defined.

None involved with the planning process or any eventual wetlands management activity should be so naive as to believe that values represented by fish, wildlife and waterfowl will always take precedence over all other plans and uses for Maryland's natural resources base. However, the existence of a strong, logical, substantiated plan for wetlands and estuarine areas should have considerable influence on resolving problems of future developmental activities. The previous history of fragmented and uninformed resistance to projects encroaching on wetlands must become a thing of the past, if a significant amount of wetlands are to be preserved and managed for their abundant and critical contributions to mankind.

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AN INVESTIGATION OF POSSIBILITIES FOR CREATING SALTMARSH IN THE ESTUARIES OF THE ATLANTIC AND GULF COASTS

By Edward J. Larimer

Today's conservationists are much concerned with unwise and ill-conceived dredging, filling, dumping, draining and polluting in our estuaries. The immediate and urgent need for an effective estuarine preservation program occupies much of our attention and energies.

Preservation, however, is but a part of the need. Development and restoration of damaged estuarine areas are equally important. There are, of course legitimate and essential uses for estuaries other than as sources of food, as propagation, nursery, and feeding habitat for fish and wildlife, and as recreation sites. National defense, navigation, water supply - including desalinization, population centers, mining, power production and waste desposal are such uses. Unfortunately, these activities do impair or destroy estuarine productivity.

Is it possible to compensate for these necessary and unavoidable losses? Can sterile estuaries be returned to biological productivity or can fertility be maintained despite man's essential activities? Our thinking, now santified by long reiteration, is