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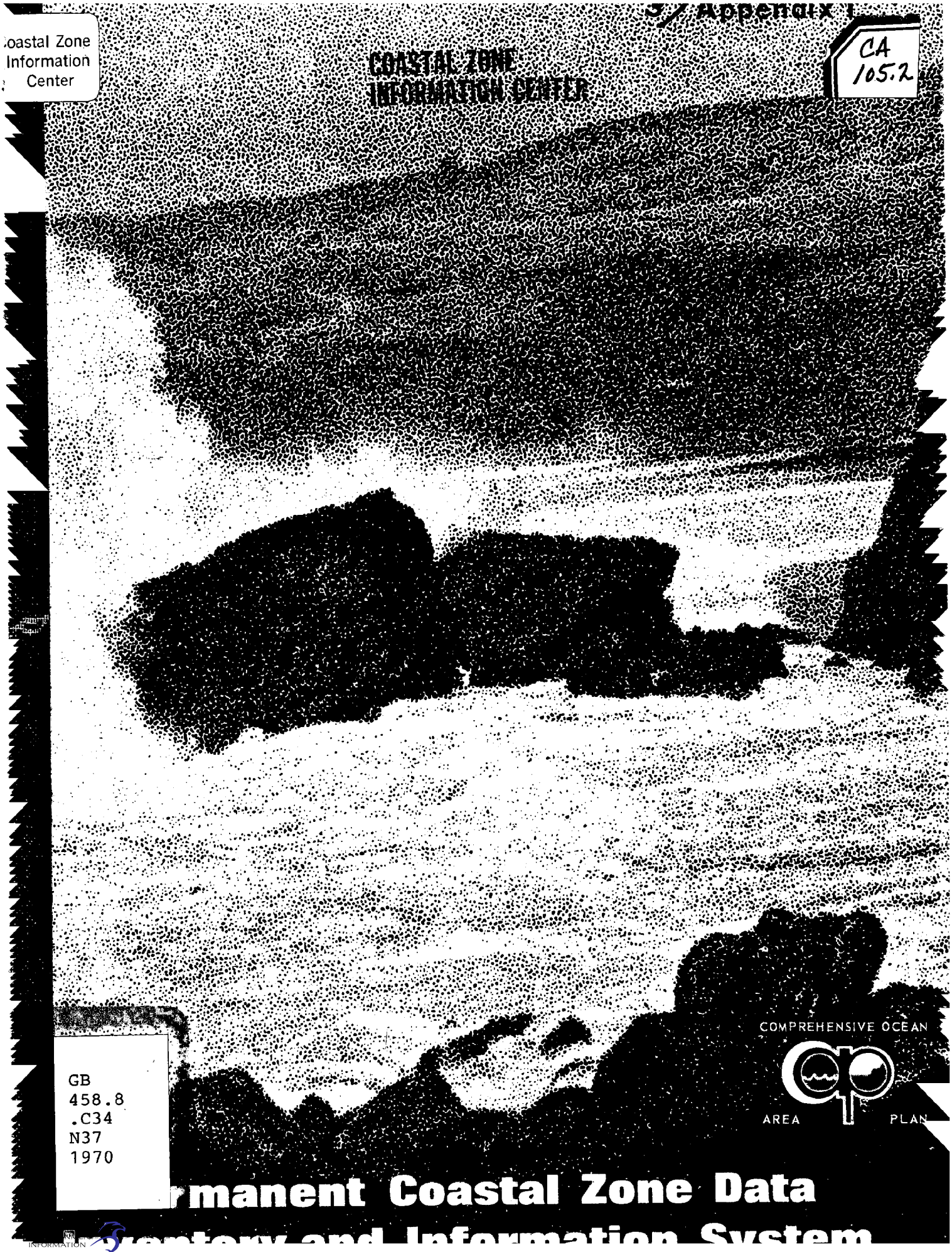

COMPREHENSIVE OCEAN AREA PLAN

rmanent Coastal Zone Data

ventory and Information System

INFORMATION GPO

This appendix has been prepared as a contribution to the California Comprehensive Ocean Area Plan (COAP).

The subject matter herein has been developed following discussions with COAP staff, however the content remains the responsibility of the contractor

DEPARTMENT OF NAVIGATION AND OCEAN DEVELOPMENT

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PERMANENT COASTAL ZONE DATA INVENTORY AND INFORMATION SYSTEM

by

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Prepared for:

State of California Resources Agency
Department of Navigation & Ocean Development

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PERMANENT COASTAL ZONE DATA INVENTORY AND INFORMATION SYSTEM

The compilation, analysis, and proper use of planning and management data for a large region, such as the 1200-mile long coastal zone of California, presents problems of a magnitude that, it is generally agreed, are solvable only by use of comprehensive information systems. The concept of planning and management information systems is now widely accepted, and an extensive literature on information systems of this kind has been developed over the past decade [1] . Such a system, conceived as an integral part of the Comprehensive Ocean Area Plan, is consistent with State policy as reflected in the "Marine Resources and Development Act" of 1967 and statements recognizing the needs for a broad and accurate inventory of data about the coastal zone [2] . Large quantities of data are currently being collected by agencies concerned with coastal zone problems and development, but needs of the planning and management processes require a systematic selection, manipulation, and communication of specific data.

Organization of the Chapter

This chapter presents the results of a study that was undertaken to inquire into some important factors that should be considered in determining the characteristics of a data inventory and information system to satisfy the requirements of planning and managing the California coastal zone [3] . The conclusions and recommendations drawn from the study precede the methodological discussion which is divided into three main parts concerned with requirements, concept, and evaluation of the system in that order. A summarization of an examination of the needs for planning and management information, its uses, and its relationship to a requisite base of coastal zone data is followed by a description of the functional requirements of the system which includes the processes necessary to generate the required information. Criteria for the system are established on the basis of the foregoing examination, after which there is a physical description of a system satisfying the functional requirements and consistent with the criteria. Operational and organizational procedures and a plan for system implementation provide a means of assessing the facilities, methods, and personnel that comprise the system environment. The conceptualized system is then subjected to an evaluation in which issues of compatibility, cost, feasibility, and effectiveness are scrutinized. Alternative methods of satisfying some of the functional requirements according to work load are then described. The benefits and penalties associated with having or not having a coastal zone data inventory and information system are contrasted, and the chapter is concluded with a recommended schedule for funding the system.

Assumptions and Limitations

The following assumptions and limitations guided the development of the system concept:

(1) The "Marine Resources and Development Act" of 1967 provides a sufficient basis of State policy statement to undertake the study.

(2) The purpose of the recommended system is to aid the continuing process of planning and management of the coastal zone by those people and agencies who will make the ruling decisions on usage of the coastal zone.

(3) The system envisioned is intended primarily to support State planning and management functions, although the contents of the inventory will be made available to other interests.

(4) The conceptual design of the system emphasizes definition of the basic functions and components of the system and identification of the problem areas to be considered in a detailed design effort. This is done to the extent necessary to provide a basis for funding decisions to proceed with establishing and maintaining the recommended system.

(5) The design of an inventory and information system to aid the coastal zone planning process depends on the nature of this process and on the organizational structure employed to carry it out. This planning process will change as experience is gained with the implementation of coastal zone plans, and such changes may be expected to induce modifications in the system concept.

(6) Initial data requirements for an inventory to support the continuing planning and management processes for the coastal zone have been suggested in previous investigations.

(7) The recommended system concept is predicated on an incremental transition from present procedures, especially those employed in the course of accumulating and using the inventory for this Comprehensive Ocean Area Plan. The system concept is also based on the assumption that existing systems, components, and procedures are to be utilized as much as possible in order to arrive at a reasonable cost of implementing and operating the system.

(8) There will be a State coastal zone authority, a planning and management organization.

(9) The coastal zone authority may exercise eminent domain and regulatory powers.

(10) The coastal zone authority may exercise its authority through autonomous regions or other State agencies.

(11) The information requirements, and hence the data requirements, can be identified for planning and management functions pursuant to State policy for the orderly development and conservation of the coastal zone.

(12) Budgetary and calendar limitations preclude a more comprehensive treatment of this topic at this time.

CONCLUSIONS AND RECOMMENDATIONS

(1) A permanent data inventory and information system is necessary to the support of essential decisions for planning and managing a region as large as the California coastal zone.

(2) The data required for planning and managing the California coastal zone is available, for the most part, from State, local, and Federal agencies that have collected it for their own purposes.

(3) The continued lack of a sufficient data base forestalls any possibility of effectively planning and managing the development and conservation of the California coastal zone pursuant to enunciated State policy concerning this region.

(4) Automation of portions of the data inventory and information system are warranted by the volume of data necessary to the coastal zone planning and management operations.

(5) The data inventory and information system should be operated by the State.

(6) The required automation of the system can be attained through the use of relatively low-cost remote access terminals connected to an existing State-operated computer center.

(7) The flexibility of a system employing a remote access terminal is adaptable to operation under a wide range of organizational structures.

(8) The automated portions of the data inventory and information system should be the responsibility of a single organization, even though a number of users may have direct access to it.

(9) The automated portion of the system can be implemented by a gradual changeover from manual procedures.

(10) The recommended system utilizes commercially available equipment, current and standard techniques, and does not require inordinate design costs.

(11) The recommended system is planned for incremental growth responsive to the changing demands that may be placed upon it.

(12) The recommended system is cost-effective.

(13) The recommended system is compatible with existing and planned State systems, procedures, and policies.

(14) The establishment of a coastal zone data inventory and information system will require an initial funding of approximately $300,000 over a two-year period with an annual operational cost of approximately $300,000.

(15) An operational coastal zone data and information system can be made available to the coastal zone authority within approximately two years after funding approval.

(16) Allocation of the necessary funding is recommended.

SYSTEM REQUIREMENTS

Any information system can be thought of in very simple terms; it has input, throughput, and output, which are analogous to raw material, manufacturing process, and end product. By cultural practice, machines are named by their output, e.g., a "rope-making" machine. Given some additional description of the rope to be produced, such as its kind or intended use, the raw materials and processes for making a certain kind of rope can be specified. The terms data and information are used in this discussion to distinguish between the facts of observation or measurement (data) and statements derived from those facts (information). The domain of data is at the raw material end of the information system. The importance of the distinction is that it is necessary to define what information is wanted as an end product or output so that the raw material (data) and processing can be specified.

The substance of this chapter is a data inventory and information system. A "data inventory," sometimes called a data bank is a mechanism for storing and retrieving data. Some other functions of a data bank are given below, but the important feature for this discussion is that the data is not changed by any process in the data bank. The data is retrieved in the same form in which it was stored. The "information system," on the other hand, is a mechanism for generating information from raw data. This portion of the system, often designated "data processing," changes the data that was stored in the inventory into information that the operator wants. It manipulates the data by reorganizing it, performing mathematical operations with it, changing numerical data to a graphical form, and other conversion operations.

In this section, the first steps in formulating the concept of a data inventory and information system are reported. Several notions of the fundamental purpose of such a system are examined. The needs for information have been established by a rational process for determining the responsibilities of a coastal zone authority with respect to enunciated State policy. The nature of the information that is needed, the kinds of data that are necessary to generate that information, and the required data processing are discussed. Based upon these considerations of information and data, the functional requirements and criteria for system design have been developed.

Scope of the Data Inventory and Information System

More than one idea concerning the scope of the coastal zone data inventory have been put forward. One concept envisions the inventory as containing all of the data on the coastal zone that is collected by all of the State agencies having an interest in this region. To this State agency-collected data would be added all data collected by Federal agencies that pertained to the California coastal zone, all applicable data collected by regional and

local agencies, and as much of such data as could be acquired from private organizations and individuals. This central data bank, or information service, could supply any required data or information that was available from almost any source to any user for whatever purpose he might have. The benefits that an all-encompassing service of this magnitude might confer on potential users can be readily appreciated, but extremely high costs of initiating and supporting the service can be just as easily anticipated. The role of the State as the organizer and supplier of data and information collected by Federal and local agencies is difficult to justify. The role of the State as middleman in the sale -- for such services cannot be supplied without cost to the user -- of data and information collected by private organizations and individuals introduces problems of proprietorship and competition that are without precedent.

Consider the relationships of State agencies having an interest in the coastal zone to a central data inventory and information system. No single agency of the State now has jurisdictional authorities and responsibilities for planning or management for the orderly development and conservation of the whole coastal zone on a continuing basis. Many agencies of the State have concern for some portion of comprehensive planning and management in the coastal zone as the region is included in their authorities and responsibilities with respect to the entire State. Implementation of the data bank and information service described above would require that the Department of Fish and Game, as one example typical of most State agencies, supply to the coastal zone information service all of the data collected by that agency pertaining to the coastal zone. The agency would be required to maintain a separate inventory of data and information concerning its widespread interests outside of the region currently defined as the coastal zone and any changes in regional definition could exert costly repercussions. The question then arises as to whether the Department of Fish and Game uses the coastal zone data bank for its routine work. If it is intended that the coastal zone data bank is the only repository of data to support routine work, substantial time lags between data collection and data availability can be expected as a result of the requirements for processing the data before it is stored in the data bank.

An alternative solution to this problem of data unavailability for some period of time is for the Department of Fish and Game, for example, to retain the data as long as it is needed for immediate use and at some appropriate time pass it on to the data bank for archival storage. The example of the U.S. Weather Bureau and the National Weather Records Center is applicable here; the former agency retains data for current use requirements, such as forecasting, and the latter agency provides archival storage of data no longer in current use. If the second alternative were to become a matter of practice, the Department of Fish and Game use of the coastal zone data bank would be limited to inquiries for data or information that the agency does not now collect, which may be a service of great value to them, but there are other disadvantages. It would be expected that the lines of communication between the Department of Fish and Game and other agencies -- State, Federal, and local -- would be routed through the central data bank. This would have the effect of increasing the response time of inter-agency communication and interposing a barrier to many, undoubtedly valuable, personal relationships

that now exist. The loss of personal contacts in the inter-agency dissemination of information could seriously degrade agency efficiency. The coastal zone data bank, under this alternative, would be relegated to a role of preserving historical records for the Department of Fish and Game. Moreover, the central data bank would be incapable of supplying current data concerning Fish and Game activities and the agency would be required to support a separate information service comparable to the one it now maintains.

A third alternative would require that the Department of Fish and Game, to continue that example, both retain the data collected in its own inventory for the period of current use and transmit duplicate data to the coastal zone data bank. The agency may process the data to its own format requirements before transmittal, possibly necessitating reprocessing for central data bank use, or transmit reproductions of original records for central data bank processing. Depending on the use the collecting agency intends to make of the data, much of it may be retained in the form of original records. Aside from the time of data transmittal, the third alternative is not substantially different from the second.

The concept of a data inventory and information system that contains all possible data and information concerning the coastal zone must take recognition of many factors that may include duplication of effort, redundancies of data storage, restructuring of State agency obligations, and probable impedences to information flow. Another idea concerning the scope of the coastal zone data inventory and information system limits consideration to a system appropriate to the support of essential decisions in coastal zone planning and management by a State agency, yet to be created.

INFORMATION NEEDS AND USES

The needs for information and its uses can be directly related to the functions of an organization by considering the ways in which an organization would exercise its functions to accomplish given objectives and the information that is required for those purposes.

Relationship of Information Needs and Policy

The policy of the State, as expressed in the "Marine Resources and Development Act" of 1967 and cited elsewhere in the Comprehensive Ocean Area Plan, provides a range of topics about the natural qualities and human activities in the coastal zone as objectives of management and planning concern. An analysis of the content of coastal zone management and planning functions to accomplish State objectives makes it possible to determine the responsibilities of a coastal zone authority, and even though the structure of that agency is not known and the responsibilities may be divided among regions or agencies, the validity of the analysis is not diminished.

Relationship of Information Needs and Decision Making

Many decisions must be made within the several functional and responsibility levels of the planning and management processes. Decisions, at whatever level they are made, often influence other elements of the processes

in an interactive way, both in the hierarchy of management levels and in the program areas. Moreover, decisions intended to guide or control some specific may have unforeseen or unwanted effects unless the decision is founded on the best available information. An information system does not make decision, but it provides information upon which decision alternatives can be based.

Figure 1 shows the relationships of tasks, goals, and objectives, as the terms are used here to differentiate stages of objective accomplishment. Each stage is preceded by a decision level at which the manager or planner must choose among alternative courses of action. The work of managing and planning includes the defining of information requirements to support the decision-making process. The function of the system to aid in this process is shown on the right side of the figure. The definition of problems, as well as information requirements, logically starts from the top and proceeds downward to lower levels. At each lower level, the manager or planner gets closer to the operating area, and the kind of information required to make a decision becomes more detailed. One of the basic patterns in management and planning systems development is thus revealed with the realization that what is information at one management level is data at another. This fact is particularly true as information is synthesized from several sources.

Defining Typical Responsibilities of a Coastal Zone Authority

In a broad sense, a planning agency often functions to a large extent as a data inventory and information system in which manual operations play a predominant role. The quantity of data that can be manually handled is limited by the size of the work force, which depends on budget limitations, so that for large regional planning jurisdictions the problems of manually handling large quantities of data become intractable. Initially, it is expected that the coastal zone authority will perform many of its functions unaided by a computerized data inventory and information system. In establishing work procedures for these manually-performed functions the conversion to computer-assisted operations should be taken into account in order to minimize reorientation of effort when conversion occurs.

The coastal zone authority will be charged with planning and management for the orderly development and conservation of the coastal zone. A number of bills have been presented for legislation to establish a coastal zone authority, and although none have been enacted, some provide clues to the extent of powers and responsibilities that a coastal zone authority might be expected to have.

Typical Planning Responsibilities

All of the land area in the coastal zone is under the jurisdiction of a coastal county, and each county has a planning agency that is responsible for the preparation of a General Plan for that jurisdiction. One proposed bill required that each coastal county prepare a "coastal element" for its General Plan in addition to the other required elements of land use, housing, and circulation. Other recent legislation has required the incorporation of a conservation element in the plan. It is probable that the responsibilities for detailed planning in the coastal zone are to be retained by county and

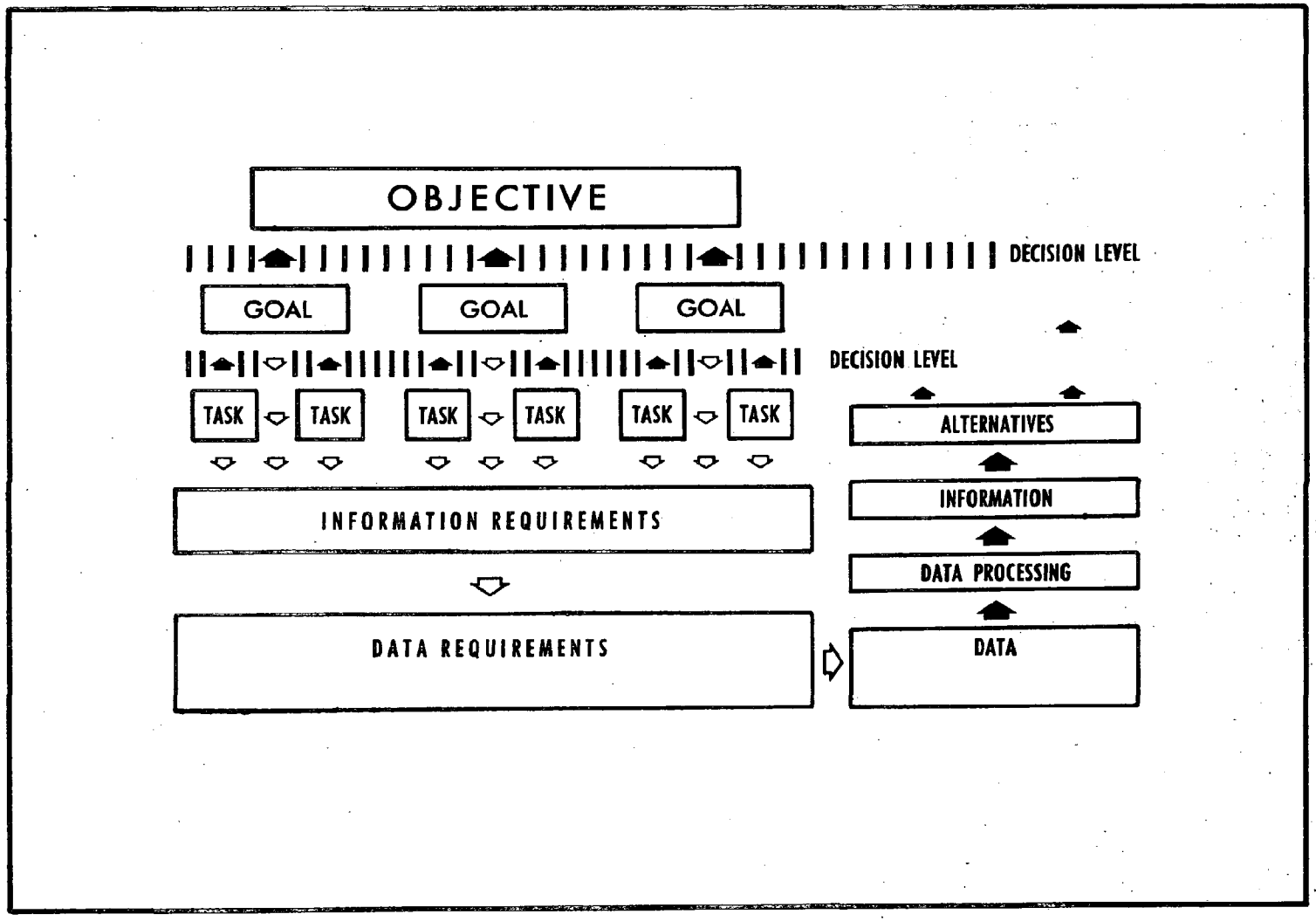

FIGURE 1. Information System Support of Decision Levels for Accomplishment of an Objective

local planning agencies; the coastal zone authority will not be responsible for detailed planning. Tacit recognition of this assumption has already been made in the title of this document, Comprehensive Ocean Area Plan, distinguishing between detailed and comprehensive planning.

For the purposes of this chapter planning can be defined according to the customary activities associated with urban and regional planning.

> Definition: Planning is a process for the purpose of guiding the growth and changes in the physical structure of the planning jurisdiction in accordance with the goals and objectives of the inhabitants of the jurisdiction.

Any process can be defined by describing the steps of the process. The number of steps in the planning process is not important, but it is generally recognized that about four are minimum; (1) research and analysis, (2) goal formation, (3) plan preparation, and (4) plan effectuation. These are shown in Figure 2.

The goals of comprehensive planning comprise three functions; (1) to create a master plan to guide the deliverations of specialist planners, (2) to evaluate the proposals of specialist planners in the light of the master plan, and (3) to coordinate the planning of specialist agencies so as to ensure that their proposals reinforce each other to further the public interest. Plans are proposals of concerted action to achieve goals. [4]

Some assumptions were then made concerning the planning activities of the coastal zone authority.

(1) The long-range policy recommendations of coastal zone authority providing for alternative allocations of resources in the orderly development and conservation of the coastal zone, together with supporting information, comprise the comprehensive plan of the coastal zone authority.

(2) The planning functions of the coastal zone authority is limited to comprehensive planning, which includes the integration of county plans, the resolution of problems that exceed the jurisdictional limitations of the counties, the interfacing and coordination problems, and the resolution of any conflicts that may develop.

(3) A primary responsibility of the coastal zone authority is the coordination of the activities of local planning agencies and Federal and local programs. On request, the coastal zone authority advises local jurisdictions in the development of their planning programs.

(4) There is either (a) a central coastal zone authority at the State government level; or (b) regional coastal zone boards meet to function as a super-board to determine policies, standards, and formats for guidance of the county planning agencies in preparing the coastal element of the General Plan.

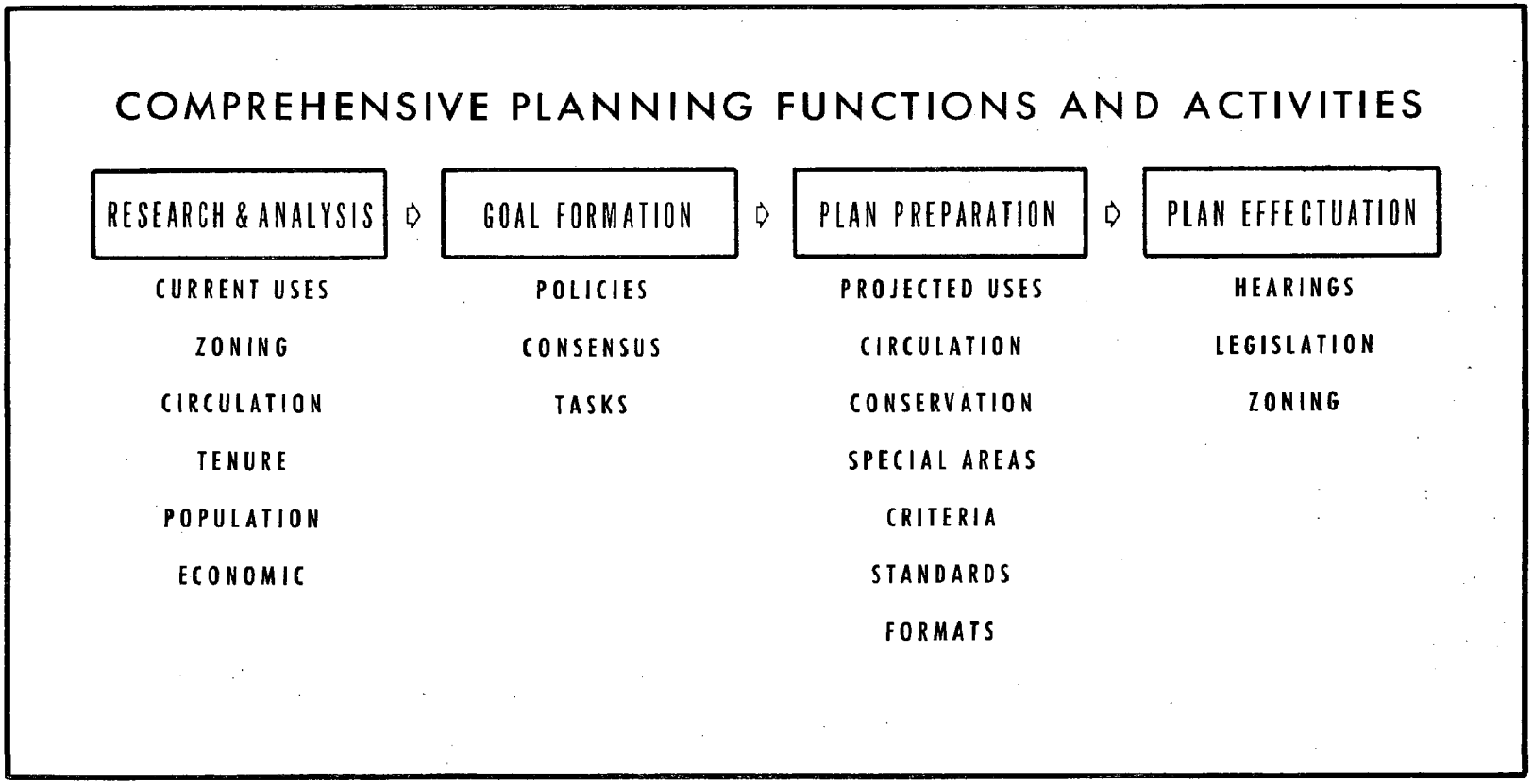

FIGURE 2. Comprehensive Planning Functions and Activities

(5) Detailed planning of the coastal zone, performed by county planning agencies, will conform to policies, standards, and formats enunciated by the coastal zone authority.

(6) The State plan for orderly development of the coastal zone could consist of the regional or county plans for the coastal elements collected in one document. This method would necessitate a uniformity of treatment of the various topics in the plans produced by each county or region to provide suitable comparability.

(7) There will probably be a coastal zone data inventory and information system that is set up to process the data in a uniform manner -- again, stressing the necessity for uniformity. It seems likely that much of the data will be supplied by the counties, but the centralized data processing facility will supply some of the data, especially that acquired from State or Federal agencies.

(8) The coastal zone authority is responsible for undertaking studies of the physical, economic, and social implications of coastal zone development and management.

(9) The coastal zone authority may provide criteria for:

Prohibited uses

Public uses

Increased beach access

Improved
- Beach conservation*
- Commercial and sport fisheries*
- Waste management*
- Water quality*

Reservation of
- Adequate public recreation areas
- Adequate wildlife preserves
- Lands for housing
- Open space for agriculture and public purposes
- Lands for ocean industrial parks
- Lands for commercial activities

Development of
- Ports
- Water resources
- Energy resources
- Transportation facilities

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* Criteria may be provided by other agencies.

(10) There is no duplication of effort by the coastal zone authority in the State government.

Typical Management Responsibilities

Figure 3 shows the major functions and activities that comprise management [5] . The management planning function should not be confused with the comprehensive planning function which refers to the activities of the coastal zone authority as a planning agency and has been discussed above. Of the management activities shown, those listed under the planning function are the ones requiring decision-making support from data inventory and information system.

There are certain activities that can be postulated as outside of the sphere of coastal zone authority responsibilities. There is no duplication of effort by the coastal zone authority in the State government. That is to say, the coastal zone authority does not collect data identical to that collected by some other agency, it does not perform the functions of any other agency in the coastal zone, nor does it exercise any regulatory powers on behalf of other agencies. All of which helps to point out the unique responsibilities of the coastal zone authority as a coordinating agency charged with looking beyond the limits of departmental or minor civil government jurisdiction to ensure an integrated development of the coastal zone that represents the highest possible use of the area in the public interest.

Typical Task Analysis

Having made some judgments on what the coastal zone authority would and would not do, typical tasks were assigned to the planning and management functions considered to be critical to system design. Each task was analyzed as to decision alternatives, information requirements, and anticipated frequency of performance. [6] The results of this analysis are summarized in Table I where information requirements are by category and tasks are by management or planning function. A requirement indicated in the column marked "Extra-System" indicates that information is needed from some source outside of the system and the coastal zone authority, such as the State Legislature, other State or Federal agencies, or the public as represented at hearings or by referendum.

DATA REQUIREMENTS

The information requirements for coastal zone planning and management were grouped in thirteen categories that represent not only the kind of information that can be developed in that category but the kind of data that it contains. The kinds of data necessary to generate the required information was investigated to a sufficient depth that a list of data items, together with many of the characteristics of each, was recommended for establishing the initial data inventory. [7] Information can be generated by combining the data from two or more categories as well. The list below shows the thirteen data categories that were identified.

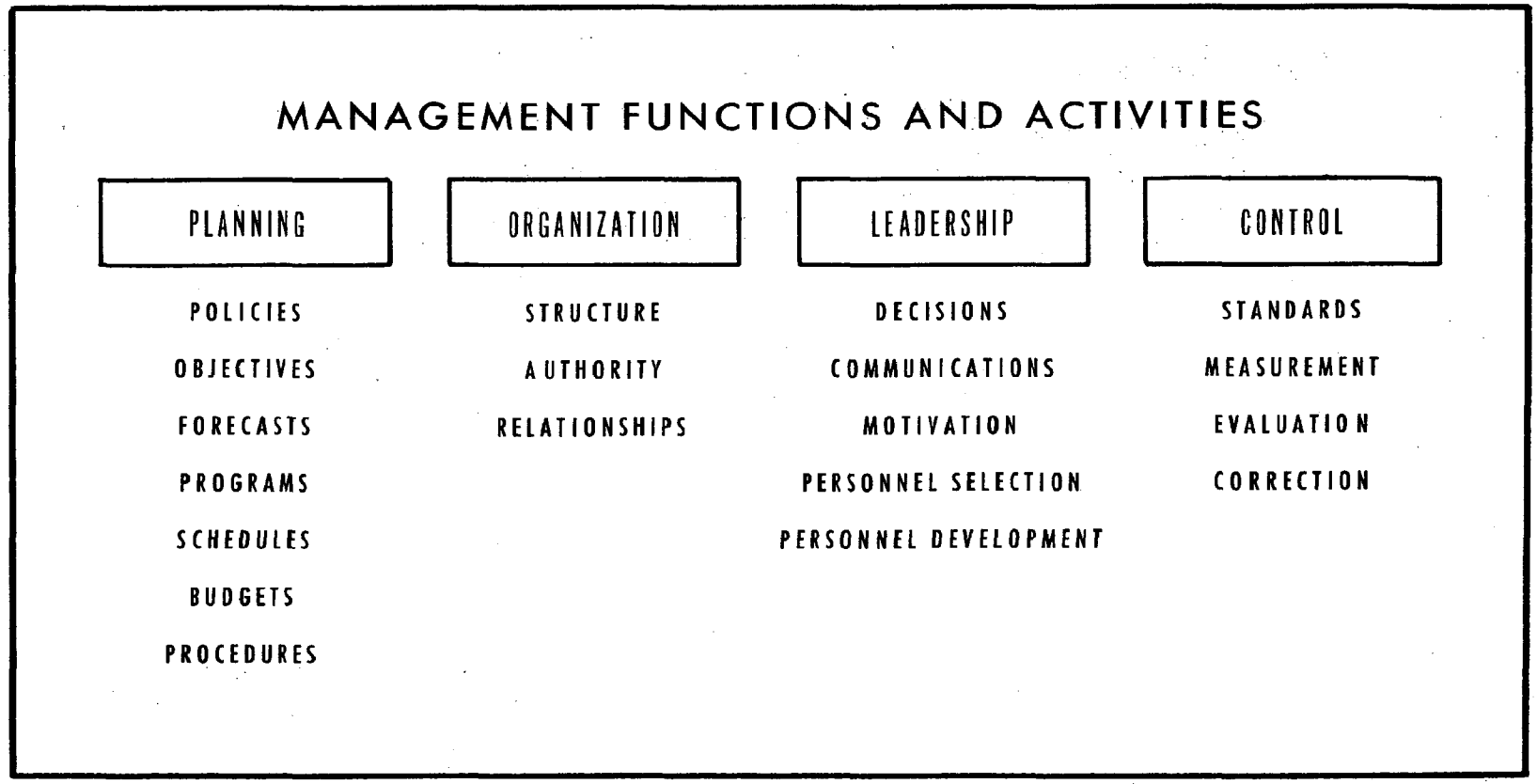

FIGURE 3. Management Functions and Activities

		INFORMATION CATEGORIES																		
				NATURAL QUALITIES								DATA BASES								
		LOCATION	GEOLOGY	LANDFORMS	HYDROLOGY	SOILS	VEGETATION	CLIMATE	OCEANOGRAPHY	TENURE	ECONOMIC	POPULATION	LAND/SEA USES	CIRCULATION	CONSERVATION	MANUAL FILE DATA	EXTRA-SYSTEM
MANAGEMENT PLANNING	FORECAST PREPARATION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	OBJECTIVES IDENTIFICATION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	PROGRAM PREPARATION															●	●
	SCHEDULE PREPARATION															●	●
	BUDGET PREPARATION															●	●
	PROCEDURES ESTABLISHMENT	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	POLICY DEVELOPMENT	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
COMPREHENSIVE PLANNING	RESEARCH AND ANALYSIS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	GOAL FORMATION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	PLAN PREPARATION	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
	PLAN EFFECTUATION												●	●	●	●	●

TABLE I. Summary of Information Requirements by Category for Certain Management and Planning Functions

Natural Qualities
- Geology
- Physiography
- Oceanography
- Soils
- Climatology
- Hydrology
- Vegetation

Data Bases
- Tenure
- Economic
- Population

Land/Sea Uses

Circulation

Conservation

The data lists are now as complete as they need to be; they provide a sufficient basis for undertaking the majority of planning and management tasks. Efforts to increase the number of data items, unless the use of such new entries can be clearly identified, may lead to the preprocessing and storage of data that will not be used thereby increasing initial costs. The data list should never be allowed to become static. The emphasis of the planning effort must change from one year to another if any real progress is to be attained, and these evolutionary changes will impose new data requirements on the system. Furthermore, it cannot be asserted that the data now used by planners is the only, or even the correct, data to lead them to their objectives. Hopefully, new ways will be found to accomplish many of the planning tasks now completed by relatively laborious means.

Characteristics of Data

Data have a number of characteristics that are of great importance if an accurate inventory is to be maintained. The analysis of the data requirements included the examination of every item with respect to the form in which it would probably be acquired, the frequencies of update and access, and the desirable measurements units. [8]

Scale of Data

Another concept that was used in reviewing the data concerns the scale of data that is appropriate to planning and managing large regions as contrasted to that needed for small regions. For most purposes it is unlikely that planning for a region as large as the California coastal zone could utilize data at the same level of detail required for county planning. It is necessary, however, that regional planners have sufficient data available to them for independent decisions concerning problems of larger scope than those encountered in county planning. An effort has been made to simplify and generalize the data so that it is truly useful to the planner and tells

him what he needs to know of a place without extraneous detail. There are other reasons for simplifying and generalizing the data; specialists in the discipline represented by the data are not required for collecting it, there is a greater freedom in selecting the means of data collection, opportunities are presented for making data from different sources compatible, and it reduces the effort of modifying the data for machine readability.

Sources of Data

The potential sources of data to be incorporated in the inventory were investigated to gain some notion of the forms in which data could be acquired and the frequencies with which it was collected. The retention practices of the agencies collecting the data were noted as to length of temporary or permanent storage, place of storage, and availability. [9]

Rules for Data Systems

The data in each category was reviewed to see that it complied, in every respect, with six rules that have been found to be very useful in the design of information systems [10] .

(1) The system should not contain a particular type of data for which there is no known use. This rule is particularly pertinent to automated management systems, and it is intended to help reduce the complexities of file creation and the cost of file searching. A well-designed system should be sufficiently flexible to permit the addition of other classes of data as the need arises.

(2) Only as much of a particular class of data as is needed should be put into the system. The collection of data and the mechanics of data input account for a large portion of the expense of developing and operating an information system, and one of the most prevalent abuses of the concept of an information system is over-collection. Experience has demonstrated that as more data is placed in a computerized system, the operations of file creation, maintenance and search become more costly. The principle of this rule is particularly appropriate if the system is to be employed as a management tool. Information for management purposes is not required to be available down to the level of greatest detail possible but is required to be timely and readily accessible at not too high a cost per unit of information retrieved.

(3) The frequency with which data is needed should determine its accessibility in the system. Data that are used relatively infrequently need not be capable of being retrieved as quickly and inexpensively as data that are required most often for planning and management purposes.

(4) The way data is used should determine the way it is put into the system. Data may be classified as numerical, verbal, and visual and data may be stored in an information system in any one of these forms. For example, visual data can be stored with the use of aperture cards which enable one to mount maps or photographs (reduced to 35 or 70 mm sizes) on cards that can be identified by numerical codes for sorting and retrieving and also for describing the attached film. For each class of data one of the ways of storing it may

be preferable to the others, but in some cases the same data needs to be put into the system in more than one way to serve different purposes. An example is vegetation distribution which can be described verbally, numerically in terms of distribution densities, and visually in the form of a distribution map. Moreover, data which has already been collected, but in a form not readily adapted to one's purpose, ought not to be put into the system in that form. An implication of this and the preceding rule is that the same data, in the same form, may be stored in the system in different files. For example, in land use applications, data are frequently stored and indexed according to the geographical or land use unit from which the data arises. Such data can be merged to pertain to geographic areas larger than the primary units. On the other hand, the same data may be arranged by class (e.g., "oil fields") and within each class file the geographical location of its constituents may be specified for mapping purposes. The system may then draw on the same data in two ways for greater efficiency in data retrieval operations.

(5) Data stored in a system should be described according to source and reliability. One of the difficulties in making planning and management decisions on the basis of large volumes of data is that the decisions depend heavily on the trustworthiness of the basic data. Indices of reliability and date should be used to qualify the stored data before it is employed in the decision-making process.

(6) The system should work just as effectively next year as this year. Classifications should permit both internal changes and expansion, and such changes should not make current storage files obsolete. The entire system must be keyed to an element or elements so basic as to furnish stability to the system for the foreseeable future. For planning data this element is location.

Organization and Classification of Data

The organization of the data, which is generally by classification, must accommodate the observations and measurements of points, lines, areas, and volumes by use of nominal, ordinal, or interval scaling. Particular data entries may describe a phenomenon at a singular point or along a line defined by a random-line description. Areas may be considered as independent measurements or introduced through the use of a standard size information cell. Nominal scaling into mutually exclusive classes without ranking permits the grouping of like or similar phenomena. Ordinal scaling introduces a way of quickly grouping things by size (small, medium, large), degree (shallow, moderate, deep), frequency of occurrence (unique, rare, common, ubiquitous), etc. Interval scaling records observations in standard units of measure (feet, grams per square meter, etc.). Furthermore, the classifications must permit expansion, not only at the end, but internally as well.

Data organization by classification eases the problem of codifying the data to conserve storage space in the inventory and increase the speed of retrieval. An example of the classification and coding of soils data is shown in Figure 4. In the example nine characters provide the complete description at a location and represents a compaction ratio of 22:1.

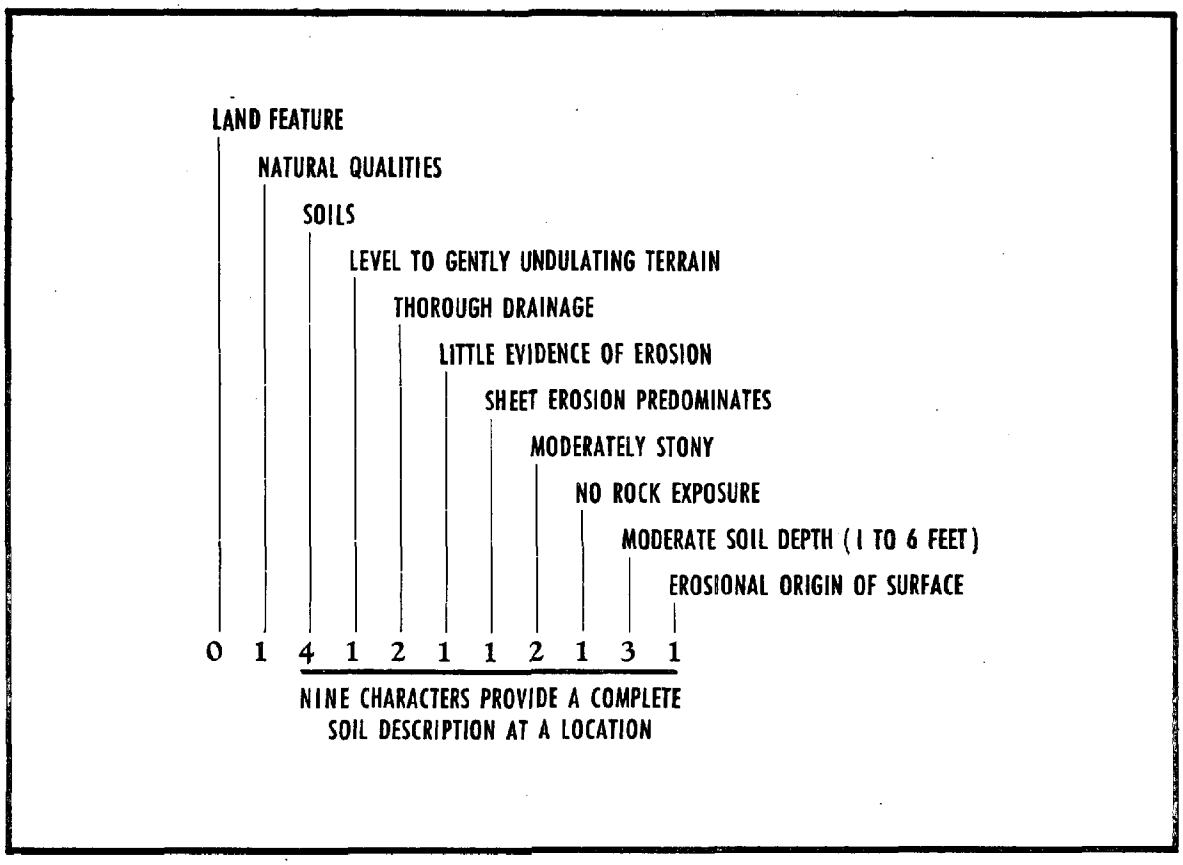

FIGURE 4. Coding Example from Soils Data

The example of Figure 4 also provides an illustration of simplified and generalized data that is useful to the manager and planner. Note also that a soils engineer or pedologist is not required to make the field observations. Provision has been made to store the older soil descriptions if desired, such as "Conejo fine sandy loam," or the more recent descriptions of the 7th Approximation [11] , such as "Haplic Psammaquent." These latter designations have little meaning for the coastal zone planner or manager.

The first of the Data Bases categories has been designated Tenure to provide for the grouping of data concerning ownership and jurisdiction. The Data Base file will be particularly active as two of the categories, Population and Economic, are subject to rapid and continuing change, thus requiring frequent updating. This is the data most often used by the manager and planner and, therefore, requires the most frequent access. It is the data in these files that demands an extensive capability for machine manipulation. Planning and management of the coastal zone without a satisfactory data base on population and economic characteristics is inconceivable. No useful planning can be accomplished without population data which must be specific to the planning area. All planning is about people even if the intention of the plan is to exclude people. Planning is not required for areas in their natural state and to which access would be forever denied. Economic data is

no less important. An effort should be made to provide an adequate file of economic data that does not include confidential material which imposes a serious problem of protection.

The problem of land use classification has provided a major topic of concern for all the years there have been professional planners. There is still no general agreement on which of a great number of systems is best. The problem of sea-use classification has attracted relatively little attention and there are few examples of previous work to draw upon. One reason for this lack of attention may be that human activities at sea present many complications to prevent an orderly classification. In the first place, these activities occur over the sea, on the sea surface, on the sea bottom, and in the space between the bottom and the surface. In the second place, nearly all of the activities, and other phenomena, are by nature transitory. For the purposes of the coastal zone data inventory an attempt has been made to place all used data, whether it pertains to sea or land, in common categories.

A great deal of care must be exercised in selecting a system of land-use classification for the data inventory. It is desirable, of course, that the system adopted be as simple as possible to implement, both in the initial land-use survey and in subsequent updating. There is little justification for adopting a classification system merely because it appears to be simple to implement, however. Any arbitrary classification that is imposed will eventually lead to extensive rework because of a lack of comparability with other statistics that are available and needed by planners. The factor of comparability argues most strongly for adoption of land-use categories that are compatible with the Standard Industrial Classification (SIC) [12] . Such classification systems are widely employed, especially by populous counties, because they are compatible with data collected and published by the Bureau of the Census. These systems can contain up to about 9,000 land-use categories, which are designated by use of a four-digit code. Experience has shown that attempts to maintain current land use maps to the detail of the fourth digit is very costly and of limited use for most planning purposes. It is useful to maintain the data inventory to the fourth-digit level of detail, however. The usual solution to the mapping and planning problem has been to discontinue use of the third and fourth digits and restrict the use of the second digit to provide a desired number of broader land-use categories. The advantages of providing a land-use classification that is compatible with data from other sources, and with those of adjacent planning jurisdictions cannot be overstressed.

The data in the Circulation category encompasses all means for the movement of people or goods on the surface of land or water, below, and above the surface. Here, data and the routes, terminals, and operating areas required for vehicles of all types, and non-vehicular travellers are contained. Included in this category are cableways and pipelines, considered as routes of movement and sometimes as barriers to movement of other kinds. Other barriers to circulation are maintained in this file.

It appears that the Conservation category will probably be a manual rather than an automated file as no requirement has been identified for storing data of this kind for rapid retrieval.

Uses of Data

Questions concerning the kinds, users, and uses of ocean-related information were considered to be best answered in an analysis of the uses that could be made of the data recommended for inclusion in the inventory. [13]

Use of Information Cells

A device that has proven useful for large-scale, gross-feature surveys, such as the data inventory represents, is the information cell, a grid space in which data is collected. The method has been used for many years by the planners of large municipal districts and is particularly adapted to computer operations [14] . A rectangular grid, oriented to geographic coordinates or street direction, provides a suitable number and size of cells between the lines of the grid network. In some applications, each cell is divided into ninths for the purpose of area measurement, of a land use for example, within the cell and the data is recorded as the numerator of a fraction.

The size of the cell to be used is the smallest mappable unit. If it is desired to produce maps at a scale of one inch equals two miles (1:125,000), a common scale for maps of relatively large regions, a useful cell size would be ten acres or 660 feet square, as this would yield an area on the map of 1/16-inch square. This size is rather small for the purpose of map drafting as it would be difficult to draw many such spaces. The size illustrates, however, about the smallest area of significance at the map scale. The cells are located by a matrix notation of rows and columns.

A major advantage of information cell use is that it incorporates a spatial concept that is otherwise difficult to handle. The distribution of a phenomenon can be displayed by use of point data if there are a sufficient number of points. A distribution can be described from a point by noting distances and directions to the edge of the distribution from the point, or by noting a radius if it is central to the distribution. The information cell obviates subsidiary measurements by use of a standard size area for each location.

Geographic Location

The only concept common to every data item in the inventory is geographic location. Without location, the data is not wanted. Thus, location furnishes the key to data file construction. Two methods of location designation have been adopted. For point and line data, ten digits of the California plane-coordinate system [15] will locate a point north and east of the origin of coordinates to within 100 feet. For area data, using information cells, an eight-digit notation will designate row and column of the grid network.

Digital Data Versus Data in Its Original Form

In addition to the data to be stored in machine-readable files, there will be a mass of data required for use that should not be stored in digital form. The determination of whether or not data is to be stored in digital form depends largely upon the desired frequency of access. Data that is constantly required should not ordinarily be converted for machine processing. Data that is rarely used may, likewise, be retained in its original form. Maps and photographs can be stored in digital form, but the uses of such material for planning and management would not warrant the cost of storage and retrieval in most cases. Certain classes of data should be retained in the forms in which it was acquired. This material can be stored in manual files. Material of this class would include county General Plans, special plans, maps, aerial and ground photographs, etc. The frequency of use is a good indicator of whether or not an attempt should be made to store it in digital form. If the material is to be constantly used, it should be retained in its acquired form. Likewise, if the material is infrequently used.

Estimate of Data Storage Requirement

It may appear that disproportionate emphasis has been placed on the data to be included in the inventory, but this portion of the investigation has provided a means of estimating the storage and retrieval requirements for system design.

It has been estimated that the data inventory will include:

Automated Files

Natural Qualities	1,300,000 digits
Data Bases	1,400,000
Land/Sea Uses	2,300,000
Circulation	1,100,000
Information	1,000,000
	7,100,000 digits
	Assume 10,000,000 digits

Base Map Files

20 ea. of 200 7-1/2' quadrangles	4,000
10 ea. of 100 15' quadrangles	1,000
150 County maps	150
100 State maps	100
10 ea. of 100 Charts	1,000
300 Sample maps	300
750	6,550

Air Photo Files

1:20,000	9 x 9 stereo coverage (b/w)	2,400
1:20,000	9 x 9 stereo coverage (col)	2,400
1:10,000	9 x 9 stereo coverage (b/w)	4,800
1:10,000	9 x 9 stereo coverage (col)	4,800
Old USGS coverage		5,000
		19,400
	Assume	20,000

FUNCTIONAL REQUIREMENTS

An analysis of the functional requirements of the system establishes a basis for developing the complete system and reduces the possibility of omitting essential elements [16] . Of immediate concern is the identification of data processing requirements, but the method also provides a means of recognizing the relationships among programs, equipment, procedures, facilities, and personnel. The functional requirements of the system include a number of tasks and activities that are outside of the portion of the system that is handled by a computer. These tasks, also system functions, are properly considered with the major component of the information system that they support.

The coastal zone data inventory and information system consists of six principal components, each of which has major functions and may have subsidiary functions:

(1) Data collection system
(2) Data inventory
(3) Data storage and retrieval system
(4) Information generation or data processing system
(5) Information transmission and dissemination system
(6) Maintenance and improvement system

Figure 5 is a functional flow diagram showing the relationships of the six principal components of the system and the entry and filling of requests for information. To some extent the figure summarizes the material of this section.

Information Transmission and Dissemination System

(1) Communicate specified data or information to the user.

(2) Provide a data and information distribution function for response to interagency or other requirements for permanent distribution.

(3) Maintain a permanent distribution file for selected data or information.

(4) Accept user requests for information in system language and format.

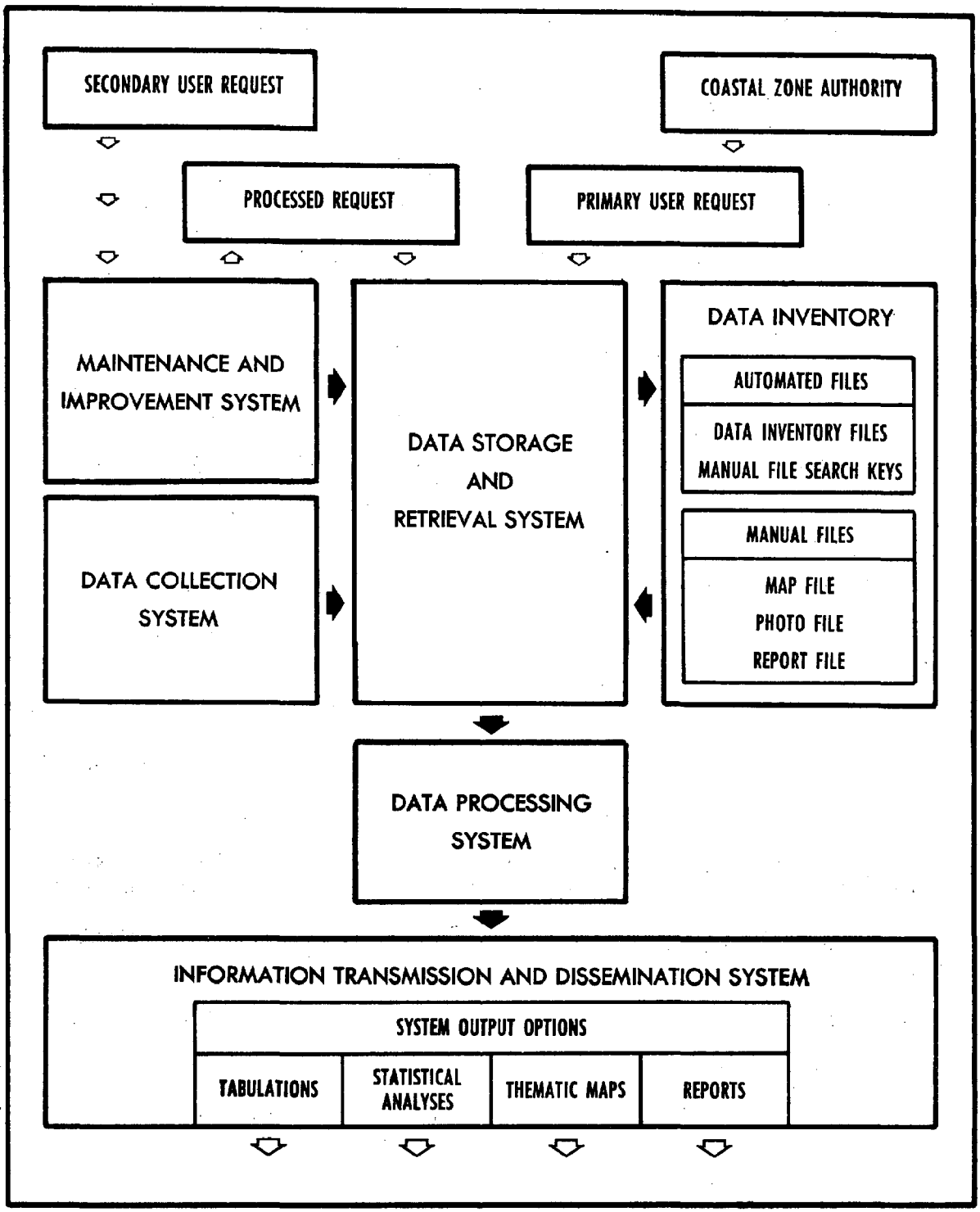

FIGURE 5. Functional Flow Diagram With Routing of User Requests for Information

(5) Accept user requests for information in plain language and process request to system language and format.

(6) Provide reproduction services.

Data Processing System

(1) Assemble retrieved data for subsequent processing operations.

(2) Generate specified information from retrieved data.

(3) Perform logic and arithmetic operations.

(4) Provide specified data for selected locations.

(5) Reorganize and summarize data for reporting purposes.

(6) Combine data from smaller geographical units into larger units.

(7) Provide a list of locations based on finding data by topical description.

(8) Decode data to provide plain language descriptions.

(9) Generate a catalog of inventory content and standard information topics frequently requested.

(10) Perform statistical analyses with and without operator interaction.

(11) System accepts communications with the operator in plain language.

(12) Perform statistical analyses in conjunction with mapping programs.

(13) Perform the necessary operations to provide specified map scales, borders, titles, legends, distribution histograms, computations, and maps.

(14) Print maps showing locations based on finding data by topical description.

(15) Print maps and other graphics to a specified page format.

Data Storage and Retrieval System

(1) Store data so that it may be found in a time consistent with the frequency of its use.

(2) Maintain an automated index file identifying all data elements in the inventory, describing the construction of the files, and directing the search for specific data.

(3) Find data in any part of the inventory, giving search keys for data to be manually retrieved.

(4) Find data by location coordinates or topical description.

(5) Provide for updating, adding to, and editing the data inventory, retaining specified replaced data for subsequent trend analyses.

Data Inventory

(1) Provide storage media appropriate to the specified classes and pieces of data comprising the inventory that provide access to the data within a time commensurate with its utility, its value to the user, and the frequency of access to it.

(2) Direct the search for specified data that is not included in the inventory, listing the file holdings of organizations active in coastal zone research and development.

Data Collection System

(1) Acquire data from other agencies, organizations, or individuals by request or through execution of purchase or exchange agreements.

(2) Acquire data from reports; by interpretation of maps, air and ground photographs, and other remote sensor outputs; by questionnaire and interview; and by field reconnaissance.

(3) Establish procedures for maintaining the flow of data into the system.

(4) Decode machine-readable data to identify that which is wanted, selectively retrieve the desired data, convert it to format requirements and measurement units of the system, classify and encode it, and process it for insertion into the inventory.

(5) Manually process data to system standards, classify and encode it, and perform the operations necessary for insertion of the data into the inventory.

Maintenance and Improvement System

(1) Edit and update the data inventory.

(2) Establish measures for recovery from malfunction.

(3) Compile a periodic system utilization report.

(4) Compile a periodic system validity audit.

(5) Process user requests for information.

(6) Investigate improved methods of handling and processing data, new applications of system output, and new information needs.

(7) Provide consultation services to users of the system.

(8) Train users.

SYSTEM CRITERIA

(1) The system is designed to satisfy the needs of a coastal zone authority for support of essential planning and management decisions.

(a) The system contains data and information necessary to satisfaction of those needs.

(b) The data and information contained in the system is available to other users.

(2) The system is responsive to changing needs.

(a) The system is designed for maximum flexibility making use of general purpose equipment.

(b) The system is planned for incremental growth responsibe to increased demands placed upon it.

(c) The effectiveness of the system is not degraded as additional demands are placed upon it.

(d) The system is divided into modular components to permit modification of specific functions without affecting other functions of the system.

(e) The data inventory can be edited or expanded without re-design of the system.

(3) The system does not compromise the user to achieve minor efficiencies in development and operation.

(a) The system does not require unreasonable specialized knowledge or excessive efforts to request information.

(4) The system is cost-effective.

(a) The system permits a quantity of work to be performed at a lesser cost than the same quantity of work performed by manual methods.

(5) The system is compatible with existing and planned systems, procedures, policies, etc.

(a) The comments and recommendations of the State Electronic Data Processing Policy Committee are applicable to the design of the system.

(6) The system is not bigger than it has to be.

(a) The system does not contain data for which there is no known use.

(b) Only as much of a particular class of data as is needed is put into the system.

(7) All of the processing programs will be written in a higher level computer language such as COBOL, FORTRAN, or PL-1.

(a) Purchased software should conform to 1970, or subsequent, machine language standards to avoid any requirement for incorporating translation or emulation programs in the system.

(b) The objective of this requirement is to provide maximum flexibility in the selection of computer equipment.

SYSTEM CONCEPT

The system requirements furnish a basis for conceptual design of the data inventory and information system. Each functional requirement demands that a structural response be incorporated in the system concept. The satisfactions of these requirements may be expressed in terms of the equipment (hardware), programs (software), material, operational procedures, facilities, and personnel that comprise the complete system. Alternative methods of satisfying system requirements demand that tentative choices be made, usually on the basis of cost, capacity, or constraints that the choice may impose on other parts of the system.

The development of the conceptual design required that attention be given to enough of the details of operations to enable an appreciation of the magnitude and scope of the system. The concept is based on the use of general purpose, commonly available computing equipment. Preferably, the computer should be of recent design so that current languages and computer techniques can be employed. The analysis of hardware and software to satisfy the system requirements shows that the objectives of the coastal zone data inventory and information system can be adequately served by existing State computing centers with only modest complement of accessory equipment to be located at the premises of the coastal zone authority or its field offices. Thus, the equipment recommendations of this study consist of remote access terminals connected to existing computing facilities. [17]

In this section the automated portions of the recommended system are described and overall system configuration is briefly discussed. System operations are summarized and an implementation schedule is suggested.

PHYSICAL DESCRIPTION

In consideration of the modest hardware requirements of the system, and consistent with the development pattern of electronic data processing capabilities within the State government, it is recommended that the automated portion of the coastal zone data inventory and information system be established as a remote access terminal to an existing computing center. This is accomplished by locating a console and some peripheral equipment at the premises of the coastal zone authority and some other equipment, most of which will already be available, at an existing computing center.

Figures 6 and 7 show two possible arrangements of equipment for a remote access terminal. The former, a so-called "non-intelligent" terminal consists of the terminal console, an incremental plotter, a card key-punch, and a card verifier. The latter figure shows an "intelligent" terminal with a wide range of capabilities. The equipment consists of a small general purpose digital computer with a keyboard, a card reader/punch unit, a line printer, an incremental plotter, and a graphics display console. This equipment can communicate directly with a computing center and also operate as a closed system at the terminal. An installation of this type would permit a variety of analytical and experimental operations to be performed with the inventory data and for system improvement without use of the computing center equipment. The routine work of filling user orders for data or information would be performed by the computing center.

Communication between the remote terminal and the computing center will be by telephone line or directly connected if the distance is less than about 2,000 feet. For very high data transfer rates or for a direct connection to the computer, a leased transmission line is required. For low data transfer rates and infrequent access to the computer, a dial telephone line is adequate. With the dial-line service, the terminal operator must place a call to the computer, wait until the connection is made, and then switch on the terminal.

The facility requirements of an intelligent remote access terminal such as that shown in Figure 7 are a room having about 400 square feet of space. A raised floor should be provided for inter-connecting cabling and the room should be air conditioned. The non-intelligent terminals can be accommodated in a small office of 100 square feet or less with no special provisions or services.

The software of the data storage and retrieval system consists of two principal programs; an inventory index file and a retrieval program. The inventory index file provides a description of the data inventory structure, lists the data elements, and locates them within the classification hierarchy. The index directs the search for data in the automated portion of the inventory and provides search keys for manual file holdings. Data that is to be retained in historical record files for trend analyses is identified for use in editing operations. This file also contains the translation table for decoding data entries to provide plain language outputs. The retrieval program provides access to the data relative to a specific location and selects only that data that has been requested.

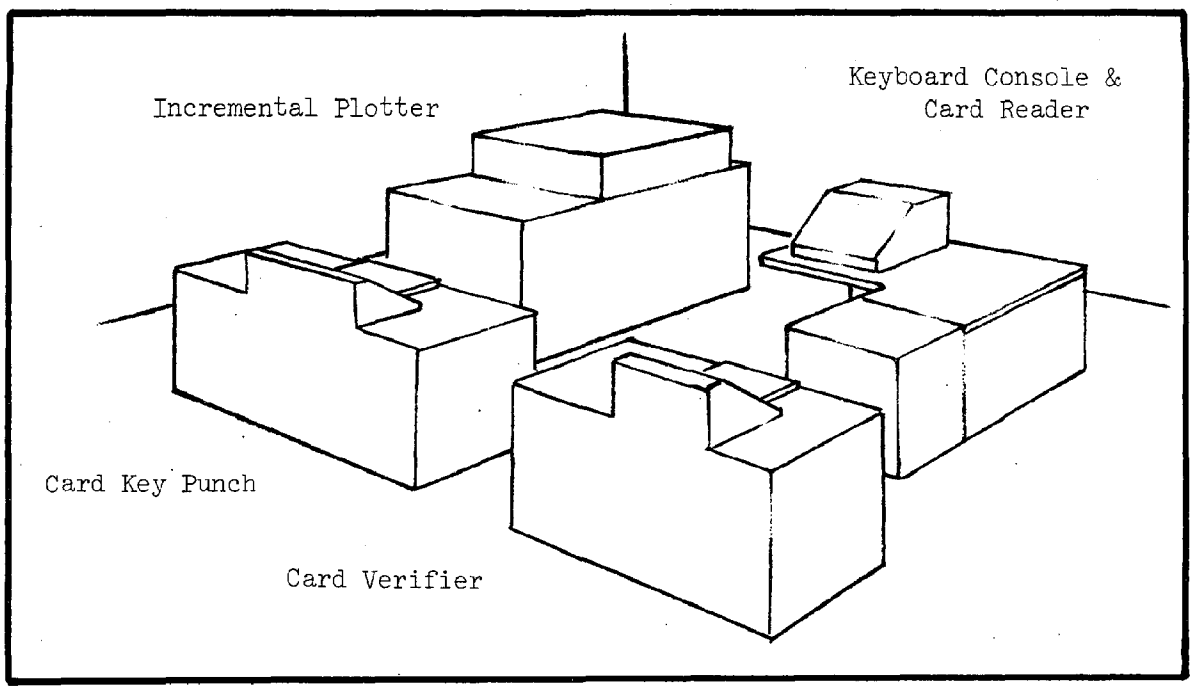

FIGURE 6. Layout of a Non-intelligent Remote Access Terminal

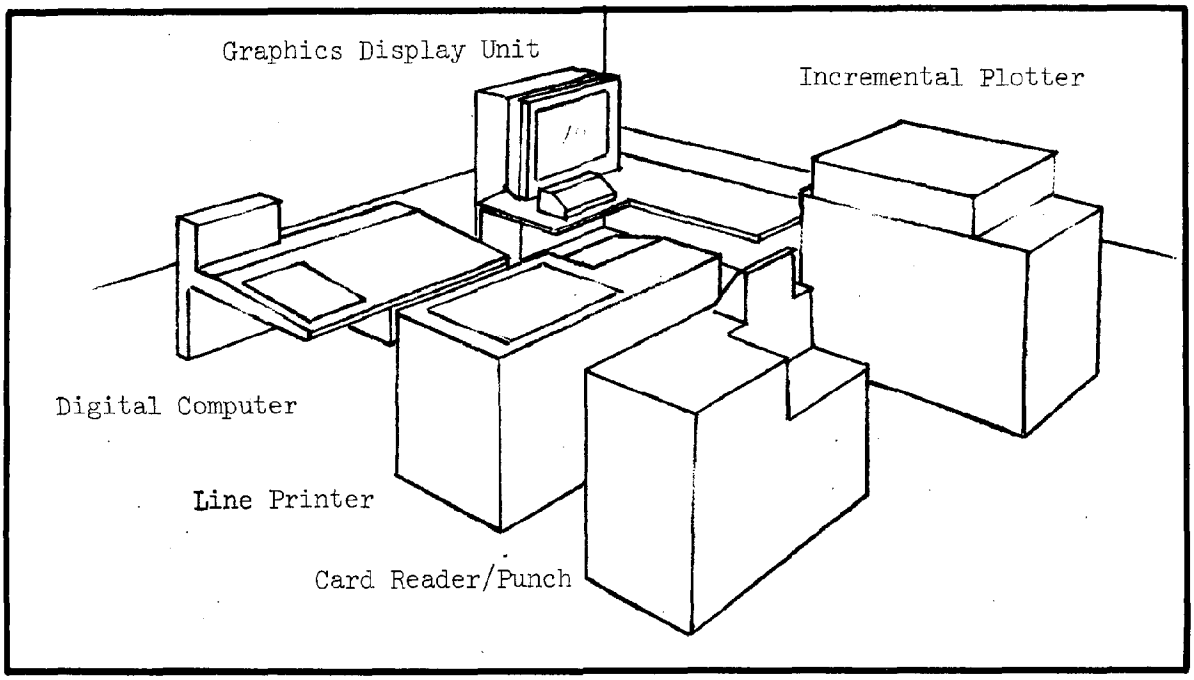

FIGURE 7. Layout of an Intelligent Remote Access Terminal

The software of the data processing system can be divided into three groups; (1) that which pertains only to the computing equipment, (2) the data inventory and information system control program, and (3) specific programs and subroutines. The basic computer software will not be developed as a part of the system described here. The operating software packages that are available from computer manufacturers are adequate for the purposes of the system. All of the computer input and output functions are accomplished by the operating system software independently of the type of data being handled. The data inventory and information system control program provides for selection of the processing programs appropriate to a particular operation, calling up these from any major component of the system, and monitors all system operations. The control program provides a means of communication among programs and input, output, and processing operations. All access to the automated portion of the data inventory is gained through the control program. In the third group are the programs and subroutines that perform the operations that are required for a specified output. These programs reside in the disc storage. There is a separate program for each processing option and each subroutine performs a single operation. For some operations it will be necessary to hold partially processed data in temporary storage to await further processing by another program. While many of the programs in this group will be available by purchase, some programming work will have to be performed to incorporate them into the system.

The data inventory is capable of expansion by an order of magnitude without introducing other changes in the system. Program versatility and modularity permit the introduction of many changes without affecting system operations. The limiting factor of the proposed system is available computing center capacity. When computing center capacity is insufficient for the needs of the coastal zone data inventory and information system, a connection should be made with an alternative computing center.

SYSTEM CONFIGURATION

Whether the system described here should be centralized or decentralized depends primarily on the organizational structure of the coastal zone authority that is adopted. It may seem quite clear that a centralized system would best serve the purposes of a centralized organization, but a structure consisting of autonomous regions might be poorly served by a centralized system that was not under the active management of a strong central organization. The necessity for active management arises from the dynamic nature of such a system if it is to serve its intended purposes.

The system is a powerful and efficient tool for the support of essential management and planning decisions. It is dynamic in content and utility, but only in the hands of an energetic management. If the system were to be under the control of a passive or indifferent management, the purposes of the system would be negated. A realistic view of the coastal zone authority shows that it probably will not be of a size that would permit the completion of all the elements of a comprehensive plan every year, even if that were desirable. More likely, portions of the plan will be prepared in relation to a priority of need with the objective of completing the long-range plan over a period of some years and then re-issuing it when changing factors require new decisions

to be made. The coastal zone management functions are also likely to be concentrated on the most pressing topics and areas. The change in emphasis from one year to another must be reflected in changing information requirements together with changes in the content of the data inventory. Maximum efficiency of the system as a tool for management and planning can only be gained as the system is made to perform the required work.

The desirability of having the system under the direct control of its principal user argues for system decentralization under an organization of autonomous regions, but such a notion is defective in several respects. The uses that a regional administration might make of a system would vary according to the local priorities of need, thus opening the way for as many systems as there are regions. It would be virtually impossible to maintain efficiency or to introduce any level of improvement common to all the systems unless the regional administrations were equally dedicated and effective and unless the systems were at some common level of use. System costs for the State would rise appreciably under the necessity of setting up and attempting to maintain a number of different systems. Unnecessary redundancies would result, and any accounting for systems utilization would be difficult. Complete decentralization according to regions would leave coordination and jurisdictional problems in a condition of non-management and non-planning. Although there is a very decided advantage in locating facilities in the proximity of system users, other than those concerned with the affairs of the coastal zone authority, the system configuration and costs should be justified on the basis of utility for coastal zone planning and management.

The public interest in matters of coastal zone management and planning is probably best served by having the coastal zone authority management situated near the source of major policy decisions in State government and near the centers of management and custodial functions representing other resources of the State. The principal office of the coastal zone authority should be situated in Sacramento. The active work of coastal zone management and planning should be performed in the coastal zone, however. Even though the merits of a detached view in decision making can be rationalized with regard to State policy, the tasks and goals leading to policy objectives necessitates an involvement in the environs of the region being planned or managed. This requirement can be satisfied by the establishment of field offices, possibly on a temporary basis, so that they can be relocated to suit the particular emphasis of the time. The relocation of a non-intelligent remote access terminal as a part of the field office equipment would pose no problems.

Between the extremes of central and divided authority with central or separate facilities many compromise solutions are possible, of which one would appear to offer the advantages of providing one management responsible for making the system work and with maintaining and improving system efficiency. This plan would combine the desirable features of both extremes. Plainly, the system must be responsive to the needs of its users, and this implies a capability to simultaneously support the different information requirements of different regions. The costs, to be discussed later in this chapter, are relatively small for maintaining a non-intelligent remote terminal at a regional headquarters. This configuration would enable the user to gain access to a centralized data inventory and information system in a time

appropriate to his needs. Furthermore, the configuration would better serve the other users of the system services by virtue of there being nearby facilities for making inquiries and receiving answers.

One alternative configuration that was studied employs an intelligent remote access terminal at the coastal zone authority headquarters, which is probably best located in Sacramento, and non-intelligent terminals located in the northern, central, and southern portions of the coast.

All of the remote terminals are connected to an existing computer center that holds the data inventory and information system files and programs.

SYSTEM OPERATIONS

The essential decisions of planning and management may necessarily have to be made in or near the vicinity of concern, especially those decisions concerned with the accomplishment of goals intermediate to the attainment of major policy objectives. This may imply the localization of coastal zone authority effort in field offices, or regions as proposed by some plans, establishing requirements of the information transmission and dissemination system to provide dispersed terminal facilities. The means of distributing data or information to users should include the use of postal services for requests that are not urgent and at least two other levels of response where urgency is a factor. Some uses of the system will require an interactive capability in which the system performs some part of the requested work but needs operator (user) instruction to continue. Other uses will require immediate response but no operator interaction. Routine planning and management tasks should be scheduled to provide the required data and information when it is needed, allowing a week or more for the requested material. Unless the computing system is standing idle for the greater part of the time, it cannot accommodate the peaks of sporadic demands for instantaneous response.

Consider the curve of Figure 8 which shows an average work load cycle and is based on a normal response time of one week, i.e., requests submitted by the close of the working day on Friday will be fulfilled by the following Monday morning. Early in the week requests are entered and may be filled in a relatively short time, but the buildup of requests during the week lengthens the response time as the work load increases. Near the end of the week the number of requests are increased to create a peak load that is in excess of daily system capacity and the work must be performed after Friday. The area enclosed by the work load curve and the designed capacity of the system at the weekend accommodated the excess of peak loads during the week. The weekend capacity is also the limit of work that can be performed for other users whose demands may be sporadic.

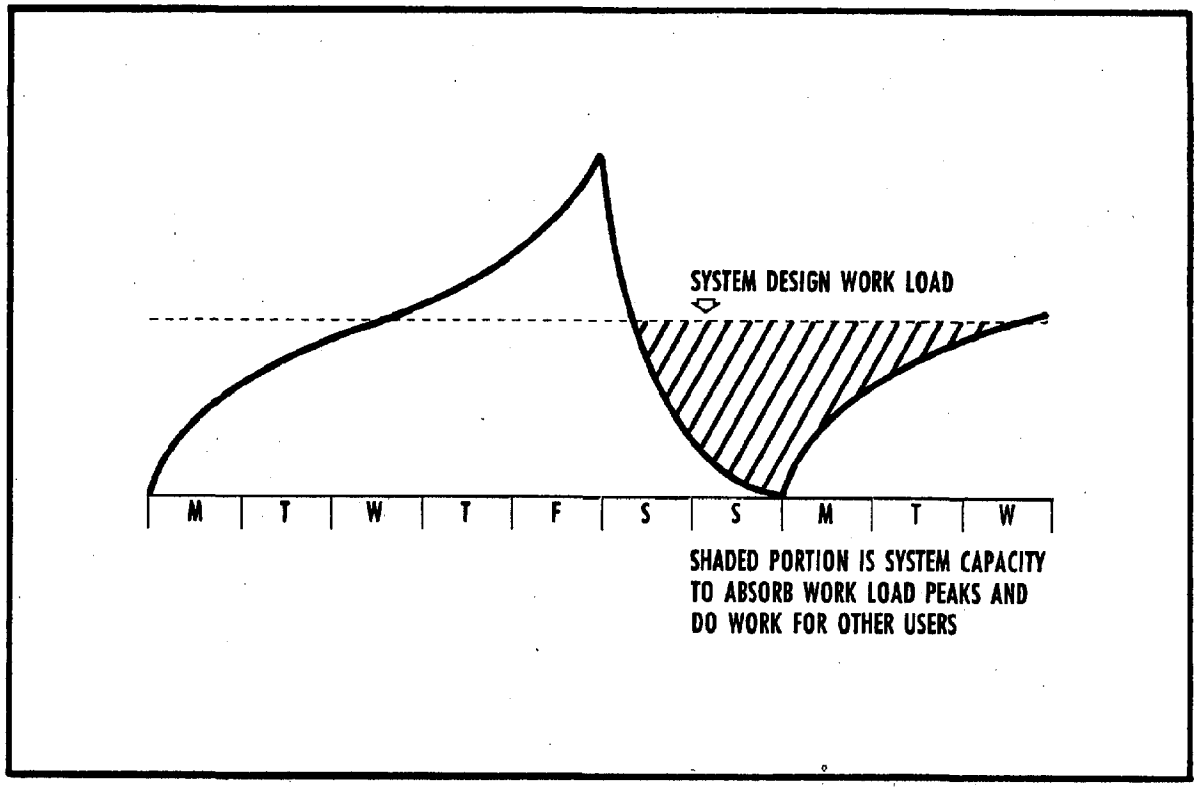

FIGURE 8. Characteristic Work Load Curve & System Design Work Load for One Week Response

SYSTEM IMPLEMENTATION

The plan for implementing the system that is presented here envisions four stages to full operation; (1) system design, (2) system acquisition, (3) partial system operation, and (4) full operation. The implementation plan is governed, not by system complexities or component availability, but by the work of inventory compilation. The time spans of the four stages are shown in Figure 9 and encompasses a period of two years from availability of funds to full operation.

Design of the system requires a minimum period of six months and it is assumed that these services will be obtained from a contractor. The coastal zone authority, however, should provide a full-time consultant to the contractor, preferably in the person of a senior planner who will be retained on the coastal zone authority staff. The importance of selecting a knowledgeable and competent consultant cannot be overstressed. He will be required to work intimately and constantly with a senior systems analyst of the contractor's staff. The success of the design will depend almost entirely on these individuals. The routine work of the design phase will require a senior programmer to design the master control program, requiring about two months, and five programmers working about three months to create the necessary programs, subroutines, and processing options. One month should be scheduled

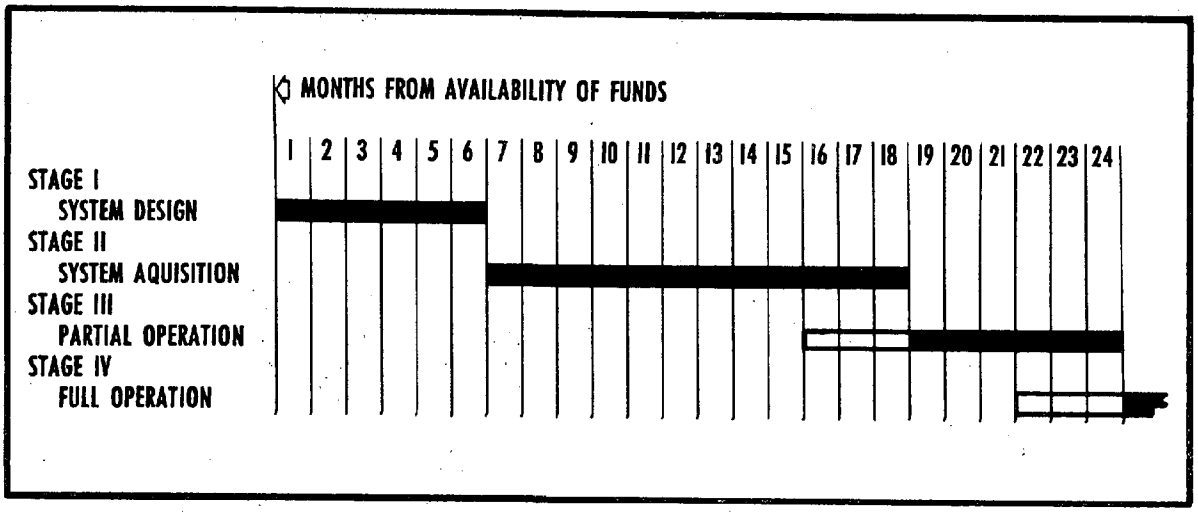

FIGURE 9. System Implementation Schedule

for a senior programmer from the computing center or the Office of Management Services for consultation and review to assure compatibility of the system and computing center interface. Program debugging and output verification, as a part of the design effort, will require computer operations at the computing center intended to be used by the system.

The system acquisition stage includes a rather long period in which the inventory data is being compiled and coded for entry. These are primarily manual operations, but the work of preparing interface descriptions for acquired digital data can proceed simultaneously. The responsibilities of the coastal zone authority will have been identified by this time and management schedules for the plans and projects to be undertaken will establish priorities of data compilation by category and location. The necessary facilities are located and occupation scheduled in conjunction with delivery of purchased and leased equipment. Leased line agreements are executed. A coastal zone authority remote terminal, utilizing non-intelligent equipment if necessary, should be scheduled to permit about three months of familiarization at the end of this one-year stage.

According to the schedule of Figure 9, partial operation could commence one year after completion of system design. The partial operation stage does not include the operation of remote access terminal equipment from field offices. During this period arrangements are made for the change-over to full operation which includes the outfitting of field office remote terminals and expanding the capabilities of the terminal at the coastal zone authority headquarters. A period of familiarization is again scheduled near the end of the third stage time span. The fourth stage is a period of full operation of all terminals.

SYSTEM EVALUATION

The system is evaluated in several ways for the purpose of aiding in the deliberations of State officials upon whose decisions realization must depend. The discussion summarizes the analyses of issues of compatibility, cost, feasibility, effectiveness, and the benefits and penalties associated with having or not having the system. Compatibility issues are concerned with pertinent State government operating standards, existing and planned data banks, information and data flow among State agencies, and the decision-making process whereby plans are developed and effectuated. All ramifications of cost considered in the system studies are here assembled. Feasibility questions the possibility of such a system in terms of getting the data required to satisfy information needs, the availability of system components, and budgetary and socio-political limitations. Effectiveness asks how well the system can perform its role in management and planning decision making, and how well does it perform its required functions. The evaluation is concluded with a cost/benefit analysis.

COMPATIBILITY

The proposed system is compatible with established State standards for electronic data processing operations as reflected by publications of the Office of Management Services [18] and is consistent with the aims of centralizing electronic data processing capability in the State. It appears that centralization of State computer facilities would be beneficial from the point of view of the coastal zone data inventory and information system but centralization is not necessary to its efficient operations. No duplication of effort or equipment between the work and system of the coastal zone authority and those of any other State agency has been noted.

The system is not incompatible with other planned systems, nor does it seek to attain the objectives of some other system. The land-use data categories could be expanded to support State land-use planning requirements, but this is not recommended as it appears that a land-use inventory for the entire State would require a computer center dedicated to that purpose alone. A recommended alternative would be to make the data inventory and information system available to the State Office of Planning for the purpose of compiling statewide inventory of land use and provide them with as much of the retrieval and processing options as were desired for setting up a prototype system for the use of that agency. When the State land-use data bank is established, some consideration might be given to a data-transfer link with that agency to maintain the land-use files. The decision to retain the coastal zone land-use data in the data inventory may rest on the fact that the category also includes sea use and the two are very closely interrelated in the coastal zone.

Recalling that the system is capable of storing land uses in some thousands of categories and of merging them in retrieval to any specified system of classification, this output will be in demand by county planning agencies and there may be a tendency for the counties to depend on the coastal zone authority as the source of land-use data along the coast. It is probable that the coastal zone authority will view the counties as the source of land-use data in setting up the initial inventory, but coastal zone planning and

management requirements will demand that the land-use category in the inventory be brought to a current status at an early date and maintained in a current condition. While the system output is compatible with whatever land-use categories the counties may use, it cannot be said that the reverse is true as regards input. The southern counties data, which has been stored in dititал form, is compatible with the proposed system, but counties that do not employ a classification system derived from the Standard Industrial Classification [19] must be resurveyed for inventory input. The data inventory can accept the land-use data of any system for interim use and its non-compliance with system data standards will be noted in the status flag referencing data reliability.

System compatibility, aside from the integration of selected equipment, commences with acquisition of data from other agencies that is unlikely to be compatible with system formats because of the age of the equipment used in the source agency and its associated logic and software. File format and the use of hexadecimal or binary coding are other characteristics leading to incompatibility. As described earlier, provisions have been made for these inconsistencies.

COST

Cost estimates for the four stages of system implementation are shown in the following Tables (II-V). The estimate of annual cost of operations, Stage IV, is based on the recommended system configuration.

Operation of the system by a private sector firm should not be considered for several reasons. The system proposed here is intended to support essential decisions related to the attainment of State policy objectives and is designed to generate information specifically required for that purpose. It is likely that a private operator would encounter many difficulties in the collection of data whereas the State would not. The private operator would experience even greater difficulty in trying to sell information of the kind discussed in this chapter. It is possible that the only way a private firm could be induced to undertake operation of the system would be to offer some incentive such as a cost plus fixed fee contract or a subsidy in the form of guaranteed minimum purchases by the State each year. Any advantages that may be seen in planner interaction with the system must be foregone if the system is privately operated.

The operating costs, as well as initial costs, of the system should be justified by coastal zone authority use of the information output. That a service is available to other users derives from the nature of the coastal zone authority as a public agency. The services performed for other users should be based on a full sharing of system operation costs, proportional to the services required to fulfill the request, with a small charge added for postage and handling. On the basis of the estimates, it appears that a typical user request might have an average cost of $17.70 plus $1.00, or $18.70. The output for this request would be thirty 132-character lines of printout representing access to about 180 data codes and subsequent processing.

TABLE II.
STAGE I SYSTEM DESIGN

Contractor Costs		
Detailed Design		
1 Sr. Systems Analyst	$10,000	
Programming		
1 Sr. Programmer (2 mos./control program)	2,500	
5 Programmers (3 mos./5 programs, 5 processing options, 10 subroutines)	15,000	
Burden	27,500	
General & Administrative Expense	2,750	
Profit	5,500	
Total Contractor Costs		$63,250
State Costs		
1 Sr. Planner (6 mos.)	$10,000	
1 Sr. Programmer (1 mo.)	1,250	
Travel & Subsistence	4,400	
Computer Time, Computing Center		
Hook-up Charge, 150 hrs. at $8.40/hr.	1,260	
Service Charge, 45 hrs. at $1.80/min.	4,860	
Purchased Software	5,000	
Total State Costs		$26,770
Total Stage I Costs		$90,020

TABLE III.
STAGE II SYSTEM ACQUISITION

Labor	$ 44,400
1 Sr. Clerk ($7200/yr.)	
1 Key-punch Operator ($6000/yr.)	
1 Programmer ($12,000/yr.)	
2 Jr. Planners ($9600/yr. ea.)	
Burden	44,400
Operations	
Equipment Rental	14,160
Card Key Punch	
Card Verifier	
Disc Drive	
Computer Time	19,760
Materials	1,000
Maintenance	1,000
Purchased Equipment (manual files)	10,000
Transportation Charges	1,000
Total Stage II Costs	$135,720

TABLE IV.
STAGE III PARTIAL OPERATIONS

Labor	$19,800
1 Sr. Clerk ($7200/yr.)	
1 Clerk ($4800/yr.)	
1 Key-punch Operator ($6000/yr.)	
1 Programmer ($12000/yr.)	
1 Jr. Planner ($9600/yr.)	
Burden	19,800
Operation	
Equipment Rental	13,190
Keyboard Console	
Card Key Punch	
Card Verifier	
Disc Drive	
Computer/Console	
Card Reader/Punch	
Line Printer	
Multiplexer	
Computer Time	19,760
Materials	1,000
Maintenance	1,000
Dial Line Service	600
Total Stage III Costs	$75,150

TABLE V.
STAGE IV FULL OPERATION

Labor	$ 39,600
1 Sr. Clerk ($7200/yr.) 1 Clerk ($4800/yr.) 1 Key-punch Operator ($6000/yr.) 1 Programmer ($12000/yr.) 1 Jr. Planner ($9600/yr.)	
Burden	39,600
Station Operation	
Headquarters	
Equipment Rental Computer/Console Card Reader/Punch Line Printer CRT Display Multiplexer Electrostatic Copier Disc Drive	68,300
Computer Time	58,760
Materials (computer)	13,000
Maintenance	3,000
Field Offices (3)	
Equipment Rental Keyboard Console	9,000
Computer Time	50,550
Materials	1,080
Leased Lines	12,000
Total Stage IV Costs	$294,890

FEASIBILITY AND EFFECTIVENESS

The proposed system concept utilizes state-of-the-art technologies, techniques, and equipment components in all phases of its development and operation. All equipment and many of the programs proposed for use in the system are commercially available. The information generated to support the planning and management functions will be as reliable as the data from which it is derived, ever increasing in worth as the information and data requirements are re-defined, refined, and detailed. No part of the requisite data base is unusual in the sense that such data has not been or cannot be acquired. The system can be developed and put into operation without large appropriations of State funds and become a matter of routine legislative business. The proposed system is possible.

The system provides a generalized and abstracted model that assists the decision-maker in handling large masses of data, extracting that which is pertinent to his problem from that which is not. Of particular value to the decision-maker will be the measure of data validity, expressing a confidence value assigned to each data item, which can be projected to a measure of confidence in the information, or lack thereof. The system provides a means of handling masses of data very rapidly thus enabling the decision-maker to perform statistical analyses that are too time consuming for manual methods. Moreover, the system can perform these functions much more accurately than they are performed by human operators. The system is effective.

COST/BENEFIT ANALYSIS

The cost/benefit analysis focuses on the State policy goals expressed in the "Marine Resources and Development Act" of 1967 and the degree to which each of three system configurations satisfy these goals. Measures of benefit are expressed in terms of the relative ability of these alternative systems to provide data (1) within a reasonable response time; (2) with a quality that satisfies the needs of the using agency; and (3) in such quantity, pertinent to the specific problem, that the user could accomplish his basic objective proportionate to the paucity of data determined by its timeliness. Time, therefore, becomes the first controlling factor with quality of data secondary and quantity of data as the factor most likely to be compromised. Work method studies and typical task analyses provided a basis for determining system benefit measures.

The system goals were ranked in the following order of importance in serving the best interest of the public for planning and managing the development and conservation of coastal zone resources.

(1) Resource Development

(2) Expand Knowledge of Marine Environment

(3) Encourage Private Investment

(4) Improve Role of the State as a Leader in Marine Sciences

(5) Advance Education, Research, and Training in Marine Sciences

(6) Develop and Improve Vehicles, Equipment, and Instrumentation

(7) Effective Utilization of Scientific and Engineering Resources

(8) Cooperate with other States, Federal Government, and other Nations

In accomplishing these goals there is a wide range of required data and information output necessary for comprehensive coverage of the factors involved. Unless each of the following topics is adequately considered, goal accomplishment and system benefits are compromised.

(1) Effects of Population Growth and Urbanization

(2) Land Use

(3) Tide and Submerged Lands Administration

(4) Conservation and Utilization of Mineral and Living Resources

(5) Recreation

(6) Waste Management, Water Quality, and Pollution Control

(7) Water and Power Development

(8) Transportation and Trade

(9) Engineering and Technology

(10) Research and Education

(11) Weather, Climate, and Oceanographic Factors

(12) Social, Economic, and Legal Matters

The three system configurations used in the analysis were (1) a completely manual system, (2) a system consisting of one non-intelligent remote access terminal connected to an existing State computing center, and (3) a system having three field office terminals of the non-intelligent type and one central intelligent terminal.

The manual system could not effectively penetrate each of the factors (response time, data quality, and data quantity) in depth when working against a time constraint unless an inordinately large work force was utilized. Coverage would necessarily be sparse, superficial, and heavily dependent upon the skill and motivation of the people employed in the work. It was, therefore, assumed that standard forms and procedures would be established to minimize this dependence.

The system configuration employing one non-intelligent remote access terminal, which may be regarded as a semi-automated system, evolved from the conceptual design. This system eliminates some of the critical dependence upon the human element with the objective of increasing the quality and quantity of data and information output.

The third system configuration was designed with the objective of minimizing the time-consuming functions of processing the data so that it is useful for planning and management purposes. The system concept seeks a near maximum of automation within the constraint that automation is only employed to replace human operator functions where substantial savings in time are possible.

Measures of System Performance

System performance measures were derived for each system goal and quantified for the measurement of the relative benefit of the three system configurations. These are summarized in Table VI. Here the "User Response Time Limit" designates the maximum allowable turn-around time of the system. The manual system (No. 1) operated against this limit consistantly. The semi-automated and fully-automated systems were capable of exceeding this reaction time-limit with varying data quality and quantity outputs as shown in the table. An estimate was made of the total system utilization time towards each of the eight goals, as shown in the last column of the table.

Benefit Quantification

Performance measures were normalized to provide a benefit index for each system that ranged in value between zero (no system) to one (an ideal fully-automated system). These indices are recorded in Table VII.

The algorithm used to designate a single numerical mean benefit index for each system is:

$$B_n = \sum_{1}^{8} \frac{W_i}{3} \quad (T_R + Q_L + Q_T)_i = 1 \ (1) \ 8 \text{ system goals}$$

where:

T_R = Normalized response time index

Q_L = Normalized output data quality index

Q_T = Normalized output data quantity index

W_i = Utilization weighting factor

TABLE VI. System Performance Measures

SYSTEM CONFIGURATION	USER RESPONSE TIME LIMIT	SYSTEM RESPONSE TIME			DATA QUALITY			DATA QUANTITY			ESTIMATED % OF TOTAL SYSTEM UTILIZATION GOAL
		1	2	3	1	2	3	1	2	3	
SYSTEM GOALS											
1. Resource Development	1 mo.	1 mo.	1.5 wk.	1 wk.	60	90	95	1	1	1	40
2. Expand Knowledge of Marine Envr.	Sched. Reports 1 mo, 3 mo, 1 yr.	--	--	--	--	--	--	1	25	100	12
3. Encourage Private Investment	1 mo.	1 mo.	1.5 wk.	1 wk.	50	80	95	40	90	100	20
4. Improve Role of the State as a Leader in Marine Sciences	--	--	--	--	--	--	--	1	25	100	1
5. Advance Education, Research, & Training in Maring Sci.	1 mo.	1 mo.	1 mo.	2 wk.	25	100	100	1	25	100	8
6. Develop & Improve Vehicles, Equip., & Instrumentation	6 mo.	6 mo.	1.5 mo.	2 wk.	--	--	--	1	25	100	2
7. Effective Utilization of Scientific & Engineering Res.	1 yr.	6 mo.	1.5 mo.	2 wk.	--	--	--	1	25	100	12
8. Cooperate with other States, Fed. Gov., & Other Nations	6 mo.-1 yr.	--	--	--	--	--	--	1	25	100	5

TABLE VII. System Benefit Indices

SYSTEM CONFIGURATION	SYSTEM RESPONSE TIME			DATA QUALITY			DATA QUANTITY			ESTIMATED % OF TOTAL SYSTEM UTILIZATION/GOAL
	1	2	3	1	2	3	1	2	3	
SYSTEM GOALS										
1. Resource Development	.25	.6	1.0	.6	.9	.95	1.0	1.0	1.0	40
2. Expand Knowledge of Marine Envr.	1.0	1.0	1.0	1.0	1.0	1.0	.1	.25	1.0	12
3. Encourage Private Investment	.25	.6	1.0	.5	.8	.95	.4	.9	1.0	20
4. Improve Role of the State as a Leader in Marine Sciences	1.0	1.0	1.0	1.0	1.0	1.0	.1	.25	1.0	1
5. Advance Education, Research, & Training in Marine Sci.	.5	.5	1.0	.25	1.0	1.0	.1	.25	1.0	8
6. Develop & Improve Vehicles, Equip., & Instrumentation	.12	.25	1.0	1.0	1.0	1.0	.1	.25	1.0	2
7. Effective Utilization of Scientific & Engineering Resources	.12	.25	1.0	1.0	1.0	1.0	.1	.25	1.0	12
8. Cooperate with Other States, Fed. Gov., and Other Nations	1.0	1.0	1.0	1.0	1.0	1.0	.1	.25	1.0	5

The cost/benefit curve (Figure 10) shows a plot of the ratio of mean benefit (B_n) against the estimated 10-year cost of the system including both development and operating costs. Four points have been established by the study: the zero-zero point, and System Configuration Nos. 1, 2 and 3. The spread of benefit versus cost can be used with reasonable certainty to determine the optimum compromise between a manual and automated system. System No. 2 is so near the point of inflection on this curve, it is estimated that it is near the optimum configuration for this system. The mini-max solution probably lies somewhere between 1.5 and 1.75 million dollars. The ratio of mean benefit to total 10-year cost is given on the curve for each system configuration to show the relative benefit per million dollars of cost.

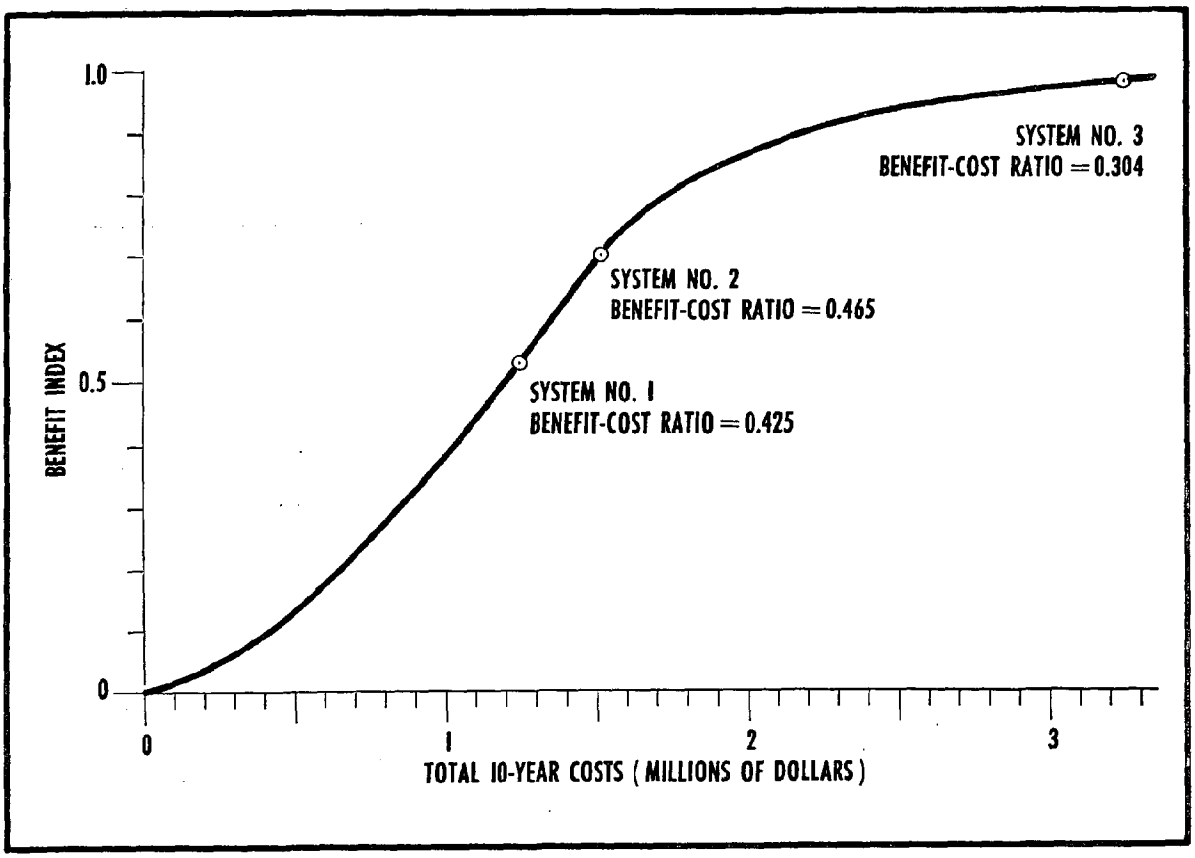

FIGURE 10. Cost/Benefit Curve

NOTES & REFERENCES

[1] D. Tucker, "Computers and Information Systems in Planning and Related Governmental Functions," Exchange Bibliography 42; R. A. Clark, "Data Bank or Information Systems Publications, with Emphasis on Land Use," Exchange Bibliography 59; and "Selected References on Land Use Inventory Methods," Exchange Bibliography 92 (Monticello, Illinois: Council of Planning Librarians, 1968). See also M. Clawson with C. L. Stewart, Land Use Information (Baltimore: Johns Hopkins Press, 1965), pp. 384 - 396.

[2] See publications of Governor's Advisory Commission on Ocean Resources (GACOR); University of California Institute of Marine Resources (IMR); Resources Agency Committee on Ocean Resources (RACOR); California Advisory Commission on Marine and Coastal Resources (CMC); and Interagency Council for Ocean Resources (ICOR).

[3] State of California Contract A30-3 with North American Rockwell Corporation for Study of a Coastal Zone Data Inventory and Information Systems, dated 30 June 1970.

[4] Alan A. Altshuler, The City Planning Process (Ithaca: Cornell University Press, 1965), p. 299.

[5] Louis A. Allen, The Management Profession (New York: McGraw-Hill Book Company, 1964), pp. 68 - 73.

[6] See Appendix E.

[7] See Appendices A and B.

[8] See Appendix B.

[9] See Appendix C.

[10] R. D. Campbell and H. L. LeBlanc, An Information System for Urban Planning (Washington: George Washington University, 1962), pp. 4 - 7.

[11] Soil Survey Staff, Soil Conservation Service, Soil Classification: A Comprehensive System -- 7th Approximation (Washington: Department of Agriculture, 1960).

[12] See, for example, Classification of Land Use (Los Angeles: Southern California Association of Governments, 1968).

[13] See Appendix D.

[14] F. Stuart Chapin, Jr., Urban Land Use Planning (Urbana: University of Illinois Press, 1965), pp. 266 - 269.

[15] Coast and Geodetic Survey, Plane Coordinate Intersection Tables (2-1/2 Minute) California, Special Publication No. 327 (Washington: Government Printing Office, 1954).

[16] See Appendix F.

[17] See Appendix G.

[18] Office of Management Services, Short-Range Plan for the Utilization of Electronic Data Processing in the State of California (Sacramento, 1968); Long-Range Master Plan for the Utilization of Electronic Data Processing in the State of California (Sacramento, 1970), and discussions with representatives of the Office of Management Services and the Intergovernmental Board on Electronic Data Processing.

[19] Bureau of the Budget, Standard Industrial Classification Manual (Washington: Government Printing Office, 1957).

APPENDIX A

RECOMMENDED DATA LIST: CLASSIFICATION AND CODING

The data items recommended for inclusion in the initial data inventory are classified and coded in the following lists. Classification provides a key to the orderly storage of data for a particular geographic location and coding provides a means of compacting the data. The first digit of a code indicates a land area observation, if 0, or a water area observation, if 1. Some phenomena occur either on land or water and are coded for both in those cases. According to the nature of the data and the scale adopted, the code may represent the data, but otherwise the code identifies the data that follows. Each code is to be accompanied by a "flag" in the data file indicating source, data, and reliability of the data entry. Translation of the codes to plain language descriptions of the observations is to be provided by the software of the system, so that there is no requirement for the user to become encumbered by the coding. The classification system may be expanded as necessary. The major classification headings and code groups are as follows:

Land	Water	
01	11	NATURAL QUALITIES
011 111	111	GEOLOGY
012	112	PHYSIOGRAPHY
	113	OCEANOGRAPHY
014		SOILS
015		CLIMATOLOGY
016		HYDROLOGY
017	117	VEGETATION
02	12	DATA BASES
021	121	TENURE
022		ECONOMIC
023		POPULATION
03	13	LAND/SEA USES
031	131	RESIDENTIAL
032		MANUFACTURING INDUSTRIES
033		
034	134	TRANSPORTATION, COMMUNICATIONS, AND UTILITIES
035		TRADE, WHOLESALE AND RETAIL
036	136	SERVICES
037	137	CULTURAL, ENTERTAINMENT, AND RECREATIONAL
038	138	RESOURCE PRODUCTION AND EXTRACTION
039	139	UNDEVELOPED LAND AND WATER

Land	Water	
04	14	CIRCULATION
041	141	
041	141	SURFACE TRANSPORT
042	142	SUBSURFACE TRANSPORT
043	143	AIR TRANSPORT
05	15	CONSERVATION (not an automated file)

Land	Water	
01	11	NATURAL QUALITIES
011	111	GEOLOGY
		Bedrock
0111	1111	Igneous; Intrusive
0112	1112	Igneous; Extrusive
0113	1113	Sedimentary; Clastic; Conglomerate
0114	1114	Sedimentary; Clastic; Sandstone
0115	1115	Sedimentary; Clastic; Siltstone
0116	1116	Sedimentary; Clastic; Shale
0117	1117	Sedimentary; Organic; Limestone
0118	1118	Sedimentary; NEC
0119	1119	Metamorphic
		Surface
----0	----0	(Bedrock outcrop)
----1		Residual soils
----2		Transported materials; Alluvium
	----3	Transported materials; Mud
----4	----4	Transported materials; Sand
----5	----5	Transported materials; Rock
	----6	Transported materials; Shell
----7	----7	Transported materials; Manmade fill
		Tectonics
-----1	-----1	Epicenter
-----2	-----2	Normal fault
-----3	-----3	Reverse fault
-----4	-----4	Overthrust fault
-----5	-----5	Strike-slip fault

NOTE: NEC means Not Elsewhere Classified.

Land	Water	
01	11	NATURAL QUALITIES
012	112	PHYSIOGRAPHY
		Coastal Type
0121		Straight coastline
----1		Landward slope flat
----2		Landward slope less than 5%
----3		Landward slope 5 to 30%
----4		Landward slope more than 30%
0122		Convex coastline
----1		Landward slope flat
----2		Landward slope less than 5%
----3		Landward slope 5 to 30%
----4		Landward slope more than 30%
0123		Concave coastline
----1		Landward slope flat
----2		Landward slope less than 5%
----3		Landward slope 5 to 30%
----4		Landward slope more than 30%
0124		Drainage Density
----1		Low less than 10 mi./sq. mi.
----2		Medium 10 to 25 mi./sq. mi.
----3		High 25 to 100 mi./sq. mi.
----4		Extremely high more than 100 mi./sq. mi.
0125	1125	Landforms
		Erosional
----11	----11	Peak
----12		Ridge, Spur
----13		Headland
----14		Cove, Bight
----15		Valley
----16	----16	Canyon
----17		Cliff, Bluff
----18		Sea cave, Arch
----19		Stack
	----20	Wave-cut bench
	----21	Abrasion platform
	----22	Trough
	----23	Tidal channel
		Depositional
----31		Alluvial fan
----32		Flood plain
----33		Beach

Land	Water	
01	11	NATURAL QUALITIES
012	112	PHYSIOGRAPHY (continued)
0125	1125	Landforms (continued)
----34		Shingle
----35		Spit, Hook
----36		Cuspate bar
----37		Tombolo
----38	----38	Offshore bar
		Mass Wastage
----41		Rock fall
----42		Rock slide
----43		Earth slump
----44		Soil creep
		Emergent
----51		Coastal plain
----52		Marine terrace
		Wind
----61		Active dunes
----62		Fixed dunes
----63		Sand sea
		Coastal Processes
0126		Retrograding
----1		Beach cycle
----2		Other
0127		Prograding
----1		Beach cycle
----2		Other
0128		Sand budget
----1		Sand transport
----2		Sand source
----3		Sand losses
0129	1129	Coastal Wetlands
		Estuarine
	----11	Open water
----12		Mudflat
----13		Salt marsh
----14		Freshwater marsh
----15		Maritime
		Lagoon
----21		Open water
----22		Mudflat
----23		Salt marsh

Land	Water	
01	11	NATURAL QUALITIES
012	112	PHYSIOGRAPHY (continued)
0129	1129	Coastal Wetlands (continued)
----24		Freshwater marsh
----25		Maritime
		Lakes and Ponds
----31		Salt water
----32		Fresh water
----33		Dry

Land	Water	
01	11	NATURAL QUALITIES
	113	OCEANOGRAPHY
		Physical
	11311	Waves
	-----1	Height
	-----2	Direction
	-----3	Period
	11312	Currents
	-----1	Speed
	-----2	Direction
	11313	Tides
	-----1	Height
	-----2	Range
	-----3	Period
	11314	Temperature
	-----1	Annual mean
	-----2	Seasonal mean
	-----3	Monthly means
	11315	Water turbidity
	11317	Tsunami occurrence
	-----1	Direction
	-----2	Effects
		Chemical
	11321	Salinity
	-----1	Annual mean
	-----2	Seasonal means
	-----3	Monthly means
	11322	Dissolved oxygen
	-----1	Annual mean
	-----2	Seasonal means
	-----3	Monthly means
	11323	Hydrocarbons
	-----1	Annual mean
	-----2	Seasonal means
	-----3	Monthly means
	11324	Nutrients
	-----1	Annual mean
	-----2	Seasonal means
	-----3	Monthly means
	11325	Pollutants
	-----1	Annual mean
	-----2	Seasonal means
	-----3	Monthly means

Land	Water	
01	11	NATURAL QUALITIES
	113	OCEANOGRAPHY (continued)
		Biological
	11331	Plankton
	-----1	Annual mean frequency
	-----2	Seasonal mean frequencies
	-----3	Monthly mean frequencies
	11332	Boring Organisms
	-----1	Annual mean frequency
	-----2	Seasonal mean frequencies
	-----3	Monthly mean frequencies
	11333	Fouling Organisms
	-----1	Annual mean frequency
	-----2	Seasonal mean frequencies
	-----3	Monthly mean frequencies

Land	Water	
01	11	NATURAL QUALITIES
014		SOILS
		Slope
0141		Level to gently undulating topography
0142		Hilly
0143		Steep
		Soil Drainage
----1		Poor
----2		Thorough
----3		Excessive
		Erosion
-----1		Little
-----2		Moderate
-----3		Excessive
		Erosion Type
------1		Sheet
------2		Rill
------3		Gully
------4		Mass wastage
------5		Wind
		Stoniness
-------1		Stone-free
-------2		Moderately stony
-------3		Excessively stony
		Rock Exposure
--------1		None
--------2		Considerable
--------3		Mostly bare rock
		Soil Depth (all horizons)
---------1		Shallow (less than 1 ft.)
---------2		Moderate (1 to 6 ft.)
---------3		Deep (more than 6 ft.)

Land	Water	
01	11	NATURAL QUALITIES
014		SOILS (continued)
		Surface Form Origin
----------1		Erosion dominates
----------2		Deposition dominates
----------3		Human alteration

Land	Water	
01	11	NATURAL QUALITIES
015	115	CLIMATOLOGY
		Temperature (^{o}F)
0151YR--		Mean annual temperature
0151--,--		Mean monthly temperature (month, mean)
0151MIN---,---		Record minimum (temperature, month, day)
0151MAX---,---		Record maximum (temperature, month, day)
0151BF---		Mean annual number of days below freezing
		Precipitation (in)
0152YR--		Mean annual precipitation
0152--,--		Mean monthly precipitation (month, mean)
0152MAX--,---		Record maximum in 24 hours (month, day)
0152WO---		Mean annual number of days without precipitation
		Wind (mph)
0153--,--,--		Prevailing wind speed and direction (mo.)
		Sky Cover (n/10)
0154--,--		Mean monthly cloud cover in tenths (mo.)
0154YR---		Average number of clear days per year
		Visibility (mi)
0155--,--,--		Average number of days per month with visibility less than 1 mi., 1 to 3 mi., more than 3 mi.
0155YR---		Average number of days per year with unrestricted visibility

Land	Water	
01	11	NATURAL QUALITIES
016		HYDROLOGY
0161		Feature
----1		Lakes and ponds
----2		Reservoirs
----3		Rivers and streams
0162		Capacity/Discharge
----1		Annual mean
----2		Seasonal means
----3		Monthly means
0163		Drainage Basin Area

Land	Water		
01	11	NATURAL QUALITIES	
017	117	VEGETATION	
		Life Form	
0171		Broadleaf evergreen (1)	
0172		Broadleaf deciduous (2)	
0173		Needleleaf evergreen (3)	
0174		Needleleaf deciduous	
0175	1175	Aphyllos	
0176		Semideciduous (more than 25% of 1 and more than 25% of 2)	
0177		Mixed (more than 25% of 2 and more than 25% of 3)	
0178	1178	Graminoids	
0179		Forbs	
	1179	Algae	
		Height	
----1	----1	less than 0.1 m	
----2	----2	0.1 to 0.5 m	
----3	----3	0.5 to 2 m	
----4	----4	2 to 5 m	
----5	----5	5 to 10 m	
----6	----6	10 to 20 m	
----7	----7	20 to 35 m	
----8	----8	more than 35 m	
		Coverage	
-----1	-----1	more than 75%	continuous
-----2	-----2	50 to 75%	interrupted
-----3	-----3	25 to 50%	patchy
-----4	-----4	6 to 25%	rare but conspicuous
-----5	-----5	1 to 5%	sporadic
-----6	-----6	less than 1%	extremely scarce
-----7			riparian

Land	Water	
02	12	DATA BASES
021	121	TENURE
0211		Ownership
----1		Private
----11		Subdivided (parcels less than 2 acres)
----12		Small tracts (parcels more than 2 acres)
----13		Large tracts (parcels more than 1000 acres)
----15		Public utility
----2		Public
----21		Federal lands
----23		State lands
----25		County lands
----27		Municipality lands
		Jurisdiction
0213	1213	Federal
0214	1214	State
0215	1215	County
0216	1216	Municipality
0217	1217	Other

Land	Water	
02	12	DATA BASES
022		ECONOMIC
		All Land Uses
02211		Value of land
----2		Value of improvements
----3		Dollar volume of construction
----4		Tax rate
----5		Tax yield
		Labor Force
02221		Number of persons by economic activity (SIC)
----2		Skill level
----3		Education
----4		Wage rates
		Basic Industries
02231		Number of persons employed
----2		Capital investment
		Service Industries
02241		Number of persons employed
----2		Capital investment
----3		Service area
0225		Basic/Service Ratios

Land	Water	
02	12	DATA BASES
023		POPULATION
		Residential Land Uses
0231		Density (night time)
0232		Composition by age
0233		Composition by sex
		All Other Land Uses
0234		Density (day time)
		Economic Characteristics
0235		Income
0236		Expenditures
		Adjacent and Nearby Population Centers
0238		Size
0239		Distribution

Land	Water	
03	13	LAND/SEA USES
031	131	RESIDENTIAL
0311	1311	Household Units
03111	13111	Single family dwelling
031114	131114	Single family dwelling--Mobile home
03112		Two family dwelling
03113		Multiple family dwelling
0312		Group Quarters
03121		Rooming and boarding houses
03122		Membership lodging
03123		Residence halls or dormitories
03124		Retirement homes and orphanages
03125		Religious quarters
03129		Other group quarters, NEC
0313		Residential Hotels
0314		Mobile Home Parks or Trailer Courts
0315		Transient Lodgings
03151		Special transient lodgings
031511		Hotels
031512		Motels and motor hotels
031513		Tourist or cabin courts
031514	131514	Boatels
031515		Transient apartments
031519		Other transient lodgings, NEC
0318		Supplemental Residential
0319		Residential, NEC
032	132	MANUFACTURING INDUSTRIES
0321		Food and Kindred Products
03211		Meat products
03212		Dairy products
03213		Canning & preserving of fruits, vegetables, & seafoods
03214		Grain mill products
03215		Bakery products
03216		Sugar

Land	Water	
03	13	LAND/SEA USES
032	132	MANUFACTURING INDUSTRIES
0321		Food and Kindred Products (continued)
03217		Confectionary and related products
03218		Beverage
03219		Food preparation and kindred products, NEC
0322		Textile Mill Products
03221		Broad and narrow woven fabrics and other smallwares
03222		Knit goods
03223		Dyeing and finishing of textiles, except wool fabrics and knit goods
03224		Floor coverings
03225		Yarns and threads
03229		Other textile goods, NEC
0323		Apparel and Other Finished Products Made From Fabrics, Leather, and Similar Materials
03231		Apparel, except leather and fur goods
03235		Hats, caps, and millinery
03236		Leather and leather products
03237		Fur goods
03238		Miscellaneous apparel and accessories
03239		Fabricated textile products manufacturing, NEC
0324		Lumber and Wood Products, except Furniture
03241		Logging camps and logging contractors
03242		Sawmills and planing mills
03243		Millwork, veneer, plywood, and prefabricated structural wood products
03244		Wooden containers
03249		Other lumber and wood products, except furniture, NEC
0325		Furniture and Fixtures
03251		Household furniture
03252		Office furniture
03253		Public building and related furniture
03254		Partitions, shelving, lockers, and office and store fixtures
03259		Furniture and fixtures, NEC

Land	Water	
03	13	LAND/SEA USES
032	132	MANUFACTURING INDUSTRIES (continued)
0326		Paper and Allied Products
03261		Pulp
03262		Paper, except building paper
03263		Paperboard
03264		Converted paper and paperboard products, except containers and boxes
03265		Paperboard containers and boxes
03266		Building paper and building board
0327		Printing, Publishing, and Allied Industries
03271		Newspaper: publishing, publishing and printing
03272		Periodicals: publishing, publishing and printing
03273		Books: publishing, publishing and printing
03274		Commercial printing
03275		Manifold business forms
03276		Greeting cards
03277		Bookbinding and related industries
03278		Printing trade service industries
03279		Other printing and publishing, NEC
0328		Chemicals and Allied Products
03281		Industrial inorganic and organic chemicals
03282		Plastics materials and synthetic resins, synthetic rubber, synthetic and other manmade fibers, except glass
03283		Drugs
03284		Soap, detergents, and cleaning preparations, perfumes, cosmetics, and other toilet preparations
03285		Paints, varnishes, lacquers, enamels, and allied products
03286		Gum and wood chemicals
03287		Agricultural chemicals
03289		Other chemicals and allied products, NEC

Land	Water	
03	13	LAND/SEA USES
032	132	MANUFACTURING INDUSTRIES (continued)
0329		Petroleum Refining and Related Industries
03291		Petroleum refining
03292		Paving and roofing materials
03299		Other petroleum refining and related industries, NEC
0331		Rubber and Miscellaneous Plastic Products
03311		Tires and inner tubes
03312		Rubber footwear
03313		Reclaiming rubber
03314		Miscellaneous plastic products
03319		Other fabricated rubber products, NEC
0332		Stone, Clay, and Glass Products
03321		Flat glass
03322		Glass and glassware
03323		Cement, hydraulic
03324		Structural clay products
03325		Pottery and related products
03326		Concrete, gypsum, and plaster products
03327		Cut stone and stone products
03328		Abrasive, asbestos, and miscellaneous non-metallic mineral products
0333		Primary Metal Industries
03331		Blast furnaces, steel works, and the rolling and finishing of ferrous products
03332		Iron and steel foundries
03333		Primary smelting and refining of nonferrous metals
03334		Secondary smelting and refining of nonferrous metals and alloys
03335		Rolling, drawing, and extruding of nonferrous metals
03336		Nonferrous foundries
03339		Other primary metal industries, NEC

Land	Water	
03	13	LAND/SEA USES
032	132	MANUFACTURING INDUSTRIES (continued)
0334		Fabricated Metal Products
03341		Ordnance and accessories
03342		Machinery
03344		Transportation equipment
03346		Ship and boat building and repairing
03349		Fabricated metal products, NEC
0335		Professional, Scientific, and Controlling Instruments: Photographic and Optical Goods: Watches and Clocks
03351		Engineering, laboratory, and scientific and research instruments and associated equipment
03352		Instruments for measuring, controlling, and indicating physical characteristics
03353		Optical instruments and lenses
03354		Surgical, medical, and dental instruments and supplies
03355		Opthalmic goods
03356		Photographic equipment and supplies
03357		Watches, clocks, clockwork operated devices, and parts
0339		Miscellaneous Manufacturing
03391		Jewelry, silverware, and plated ware
03392		Musical instruments and parts
03393		Toys, amusement, sporting, and athletic goods
03394		Pens, pencils, and other office and artists' materials
03395		Costume jewelry, costume novelties, buttons, and miscellaneous notions, except precious metals
03396		Tobacco
03397		Motion picture production
03398		Audio products
03399		Miscellaneous manufacturing, NEC

Land	Water	
03	13	LAND/SEA USES
034	134	TRANSPORTATION, COMMUNICATIONS, & UTILITIES
0341		Railroad, Rapid Rail Transit, and Street Railway Transportation
03411		Railroad transportation
03412		Rapid rail transit and street railway transportation
0342		Motor Vehicle Transportation
03421		Bus transportation
03422		Motor freight transportation
03429		Motor vehicle transportation, NEC
0343		Aircraft Transportation
03431		Airports and flying fields
	134319	Seaplane operating areas (takeoff zones)
03439		Other air transportation, NEC
0344		Marine Craft Transportation
03441	13441	Marine craft transportation
034411	134411	Marine terminals and piers (passenger)
034412	134412	Marine terminals and piers (freight)
034413	134413	Marine terminals and piers (passenger and freight)
034414	134414	Marine terminals and piers (commercial fishing)
034415	134415	Miscellaneous marine facilities
034416	134416	Ship salvaging
034417	134417	Excursion boats and boat chartering facilities
034418		Steamship company offices not located at terminals
034419	134419	Other marine terminals, piers, and facilities, NEC
	13442	Submarine terminals
	134421	Submarine terminals for tanker loading and discharge
	13443	Marine craft anchorages
	134431	General anchorages (including temporary anchorages)
	134432	Quarantine anchorages
	134433	Government vessel anchorages
	134434	Explosives anchorages
	134435	Tanker anchorages

Land	Water	
03	13	LAND/SEA USES
034	134	TRANSPORTATION, COMMUNICATIONS, & UTILITIES
0344		Marine Craft Transportation (continued)
	134436	Commercial fishing vessel anchorages
	134437	Yacht and small craft anchorages
	13444	Marine traffic control and shipping lanes
	134441	Shipping lanes, NEC
	134442	Restricted harbor entrance area
	134443	Shipping safety fairway
	134444	Restricted speed area
	134445	Directed traffic area (includes inbound and outbound traffic lanes, separation zone, precautionary area, and pilot boat cruising area)
	13445	Marine traffic barriers, NEC
	134451	Naval danger zone
	134452	Naval operating area
	134453	Naval restricted area
	134454	Bridges
	134455	Causeways
	134456	Overhead cable crossings
0345		Highway and Street Right of Way
03451		Freeways
03452		Prime arterials
03453		Major roads
03454		Collector roads
03455		Local streets and roads
03456		Alleys
03459		Other highway and street right of way, NEC
0346		Automobile Parking
0347	1347	Communications
03471	13471	Telephone communication
03472	13472	Telegraph communication
03473		Radio communication
03474		Television communication
03475		Radio and television communication
03476		Recording and sound studios
03479	13479	Other communications, NEC

Land	Water	
03	13	LAND/SEA USES
034.	134	TRANSPORTATION, COMMUNICATIONS, & UTILITIES (continued)
0348		Utilities
03481	13481	Electric utility
03482	13482	Gas utility
03483	13483	Water utilities or irrigation
03484	13484	Sewage disposal
03485	13485	Solid waste disposal
03486		Combination utilities (gas and electric, water and electric, etc.)
03487		Flood control system
03488	13488	Coastal protection works
	134881	Breakwater
034882	134882	Sea wall
	134883	Groin
03489	134889	Other utilities, NEC
0349	1349	Transportation, Communications, and Utilities, NEC
03491	13491	Pipeline right of way and pressure control stations, NEC
03492		Transportation services and arrangements
03499	13499	Other transportation, communications, and utilities, NEC
035	135	TRADE, WHOLESALE AND RETAIL
0351		Wholesale Trade
03511		Motor vehicles and automotive equipment
03512		Drugs, chemicals, and allied products
03513		Dry goods and apparel
03514		Groceries and related products
03515		Farm products (raw materials)
03516		Electrical goods
03517		Hardware, plumbing, heating equipment, and supplies
03518		Machinery, equipment, and supplies
03519		Miscellaneous wholesale trade, NEC

Land	Water	
03	13	LAND/SEA USES
035	135	TRADE, WHOLESALE AND RETAIL (continued)
0352		Building Materials, Hardware, Farm Equipment, and Supplies
03521		Lumber and other building materials
03522		Heating and plumbing equipment
03523		Paint, glass, and wallpaper
03524		Electrical supplies, except appliances
03525		Hardware and supplies
0353		General Merchandise
03531		Department stores
03532		Mail order houses
03533		Variety stores, limited price
03534		Merchandise vending machine operators
03535		Direct selling organizations
03539		Other retail trade (general merchandise)
0354		Food
03541		Groceries
03542		Meats and fish
03543		Fruits and vegetables
03544		Candy, nut, and confectionary
03545		Dairy products
03546		Bakeries
03549		Retail trade -- food, NEC
0355		Automotive, Marine Craft, Aircraft and Accessories
03551		Motor vehicles
03552		Tires, batteries, and accessories
03553		Gasoline service stations
03559		Retail trade -- automotive, marine craft, aircraft, and accessories, NEC
0356		Apparel and Accessories
03561		Men's and boy's clothing and furnishings
03562		Women's ready to wear
03563		Women's accessories and specialties
03564		Children's and infant's wear
03565		Family clothing
03566		Shoes
03567		Custom tailoring

Land	Water	
03	13	LAND/SEA USES
035	135	TRADE, WHOLESALE AND RETAIL
0356		Apparel and Accessories (continued)
03568		Furriers and fur apparel
03569		Retail trade -- apparel and accessories, NEC
0357		Furniture, Home Furnishings, and Equipment
03571		Furniture, home furnishings, and equipment
03572		Household appliances
03573		Radios, televisions, and music sound systems and supplies
03574		Office equipment, furniture, machines, and supplies
0358		Eating and Drinking Places
03581		Eating places
03582		Drinking places -- alcoholic beverages
0359		Miscellaneous Retail Trade
03591		Drug and pharmacy
03592		Liquor, package
03593		Antiques and secondhand merchandise
03594		Books, stationary, art, and hobby supplies
03595		Sporting goods, bicycles, and toys
03596		Farm and garden supplies
03597		Jewelry
03598		Fuel and ice
03599		Miscellaneous retail trade, NEC
036	136	SERVICES
0361		Finance, Insurance, and Real Estate Services
03611		Banking and bank-related functions
03612		Credit services
03613		Security and commodity brokers, dealers, exchanges, and services
03614		Insurance carriers, agents, brokers, and services
03615		Real estate and related services
03616		Holding and investment services
03619		Other finance, insurance, and real estate services, NEC

Land	Water	
03	13	LAND/SEA USES
036	136	SERVICES
0362		Personal Services
03621		Laundering, dry cleaning, and dyeing
03622		Photographic services
03623		Beauty and barber services
03624		Funeral parlor, cemetaries, and crematory services
03625		Apparel repair, alteration, and cleaning pickup services, shoe repair services
03629		Personal services, NEC
0363		Business Services
03631		Advertising services
03632		Consumer and mercantile credit reporting services, adjustment, and collection services
03633		Duplicating, mailing, stenographic, and office services
03634		Dwelling and other building services
03635		News syndicate services
03636		Employment services
03637		Warehousing or storage services
03638		Auction services
03639		Business services, NEC
0364		Repair Services
03641		Automobile repair and related services
03642		Electrical appliance repair and services
03649		Repair shops and related services, NEC
0365		Professional Services
03651		Medical and other health services
03652		Legal services
03653		Engineering, architectural, and planning services
03654		Research services
03655		Data processing services
03659		Professional services, NEC

Land	Water	
03	13	LAND/SEA USES
036	136	SERVICES (continued)
0366		Contract Construction Services
03661		General contract construction
03662		Building construction trade services
03663		Specialized construction trade services, NEC
0367		Governmental Services (all levels of government)
03671		Executive, legislative, and judicial functions, except military
03672		Protective functions and related activities
03673		Postal services
03674		Correctional institutions
03675		Military bases and reservations (facilities used by regular military units, Reserves, and National Guard)
03676		Military operations and related activities (areas permanently identified for military use)
036761		Military training areas (includes bombing, gunnery, small arms firing, and practice firing ranges; and shore bombardment and target practice areas)
036762		Military operating areas (includes missile firing ranges and submarine transit lanes)
036763		Military storage depot areas (includes naval magazine restricted areas)
036764		Military maintenance areas (includes degaussing ranges and submarine operating areas associated with repair yards)
036768		Military aircraft operating areas (includes seaplane restricted areas and seaplane takeoff zones
03677		Indian reservations
0368		Educational Services
03681		Nursery, primary, and secondary education
03682		University, college, junior college, and professional school education
03683		Special training and schooling

Land	Water	
03	13	LAND/SEA USES
036	136	SERVICES (continued)
0369		Miscellaneous Service Organizations
03691		Religious activities
03692		Welfare and charitable services
03693		Business, professional, and labor organizations and services
03694		Social, fraternal, and youth organizations and services
03695		Political, civic, and veterans organizations
03696		Organizations and clubs, NEC
03699		Miscellaneous services, NEC
037	137	CULTURAL, ENTERTAINMENT, AND RECREATIONAL
0371		Cultural Activities and Nature Exhibitions
03711		Cultural activities
03712		Nature exhibitions
03719		Cultural activities and nature exhibitions, NEC
0372		Public Assembly
03721		Entertainment assembly
03722		Sports assembly
03723		Public assembly, miscellaneous purposes
0373		Amusements
03731		Fairgrounds and amusement parks
03739		Amusements, NEC
0374		Recreational Activities
03741		Sport activities
03742		Playgrounds and athletic areas
03743	13743	Swimming areas
03744	13744	Marinas
03745		Firearms and archery
	13746	Water activities
	137461	Surfing
	137462	Water skiing
	137463	Recreational boating
	137464	Sportfishing (includes surf fishing)
03749		Recreation, NEC

Land	Water	
03	13	LAND/SEA USES
037	137	CULTURAL, ENTERTAINMENT, AND RECREATIONAL (continued)
0375		Resorts and Group Camps
03751		Resorts
03752		Group or organized camps
0376		Parks
03761		Parks (may include, but not limited to, camping, picnic areas, playfields, and any other active or passive recreational facilities)
03762		Parks, leisure and ornamental
03769		Parks, NEC
	137693	Underwater parks
0379		Other Cultural, Entertainment, and Recreational Activities, NEC
03791		Other cultural, entertainment, and recreational activities, NEC
038	138	RESOURCE PRODUCTION AND EXTRACTION
0381		Agriculture
03811		Field and seed crops
03812		Truck crops
03813		Orchards and vineyards
03814		Livestock
03815		Animal specialties
03816		Pasture and rangeland
03817		Horticulture specialties
03818		Fallow
03819		Agriculture, NEC
0382		Agricultural Related Activities
03821		Agricultural processing
03822		Animal husbandry services
03829		Other forestry activities and related services, NEC

Land	Water	
03	13	LAND/SEA USES
038	138	RESOURCE PRODUCTION AND EXTRACTION (continued)
0383		Forestry
03831		Commercial forestry production
03832		Forestry services
03839		Other forestry activities and related services, NEC
0384	1384	Fishing Activities and Related Services
	13841	Fisheries and marine products
	138411	Finfish fisheries
	138412	Shellfish fisheries
	138413	Sea life fishing piers
	138414	Shellfish farming
03842		Fishery services
03849	13849	Other fishery activities and related services, NEC
0385	1385	Mining Activities and Related Services
03851	13851	Metal ore mining
03852		Coal mining
03853	13853	Crude petroleum and natural gas
03854	13854	Mining and quarrying of nonmetallic minerals (except fuels)
03855		Mining services
0389	1389	Other Resource Production and Extraction, NEC
03891	13891	Other resource production and extraction, NEC
039	139	UNDEVELOPED LAND AND WATER AREAS
0391		Undeveloped and Unused Land Area, Except Forests
0391		Undeveloped and unused land areas, except forests
0392		Noncommercial Forests
03921		Forest reserves
03922		Nonreserve forests (undeveloped)

Land	Water	
03	13	LAND/SEA USES
039	139	UNDEVELOPED LAND AND WATER AREAS (continued)
0393	1393	Water Areas
03931		Rivers, streams, or creeks
03932		Lakes, reservoirs, and dams (not part of a utility system
03933	13933	Bays and lagoons
039331	139331	Wildlife reserves and sanctuaries
03934	13934	Oceans and seas
039341	139341	Wildlife reserves and sanctuaries (includes fish havens
03939	13939	Other water areas, NEC
0394		Vacant Floor Area and Buildings
03941		Vacant floor area, vacant buildings

Land	Water	
04	14	CIRCULATION
041	141	SURFACE TRANSPORT
0411		Automobile Traffic
04111		Controlled access road
04112		Arterial road
04113		Collector road
04114		Surface intersection
04115		Grade separation
04116		Bridge
04117		Parking area
-----C		Traffic count (direction, date, day, hour
0412		Railroad Traffic
04121		Mainline right of way
04122		Branchline right of way
04123		Siding
04124		Surface intersection
04125		Grade separation
04126		Bridge
04127		Terminal
04128		Yard
-----C		Traffic count (direction, date, day, hour)
	1413	Vessel Traffic
	14131	Sea/Port lanes
	14132	Anchorages
	14133	Terminals
	14134	Restricted areas
	-----C	Traffic count (direction, date, day, hour)
0414	1414	Utilities
04141	14141	Pipeline (size, commodity, easement)
04142	14142	Cableway (service, class, easement)
0415	1415	Barriers, including obstructions (type, alignment, dimensions)

Land	Water	
04	14	CIRCULATION
042	142	SUBSURFACE TRANSPORT
	1421	Vessel Traffic
	14211	Transit lanes
	14212	Operating areas
0424	1424	Utilities
04241	14241	Pipelines (size, commodity, easement)
04242	14242	Cableways (service, class, easement)
0425	1425	Barriers, includes obstructions (type, alignment, dimensions)
043	143	AIR TRANSPORT
0431	1431	Aircraft Traffic
04311	14311	Airways
04312	14312	Terminals
-----C	-----C	Traffic count (direction, date, day, hour)
0435	1435	Barriers, includes obstructions (type, alignment, dimensions)

APPENDIX B

RECOMMENDED DATA LIST: DATA CHARACTERISTICS

The tables on the following pages summarize some of the characteristics of the data recommended for the initial inventory. The scale and measurement units of each data entry has been given when it was possible to do so, the frequencies of data collection and update are noted, and the form in which the data is likely to be acquired is shown.

LEGEND FOR DATA CHARACTERISTICS SHEETS

Scale	Frequency of Data Collection
N - Nominal	O - One Time
O - Ordinal	M - Monthly
I - Interval	S - Seasonally
	Y - Yearly

Form of Available Data	Frequency of Data Updates
D - Digital	M - Monthly
M - Map or Chart	S - Seasonally
P - Air Photo	Y - Yearly
F - Collected in Field	X - Periods Longer than One Year

Data Categories	Code	Scale	Measurement Units	Frequency of Data Collection	Frequency of Data Updates	Form of Available Data
NATURAL QUALITIES						
GEOLOGY						
Bedrock	011-	N - -	class	0 - - -	- - - -	- M P R F
	111-	N - -	class	0 - - -	- - - -	- M - R -
Surface	011-	N - -	class	0 - - -	- - - -	- M P R F
	111-	N - -	class	0 - - -	- - - -	- M - R F
Tectonics	011-	N - -	class	0 - - -	- - - -	- M P R F
	111-	N - -	class	0 - - -	- - - -	- M - R -
PHYSIOGRAPHY						
Coastal Type	012-	N O I	ft.	0 - - -	- - - -	- M - - -
Drainage Density	012-	- O -	mi./sq. mi.	0 - - -	- - - -	- M P - -
Landforms	012-	N - -	class	0 - - -	- - - -	- M P R F
	112-	N - -	class	0 - - -	- - - -	- M - R -
Coastal Processes	112-	N - I	cu. ft./day	- - S Y	- S Y Z	D M P R -
OCEANOGRAPHY						
Waves	113-	- - I	ft.; dir.; sec.	- M S -	M S - -	D - - R F
Currents	113-	- - I	kts.; dir.	- M S -	M S - -	D - - R -
Tides	113-	- - I	ft.; min.	- M S -	M S - -	D - - R -
Temperature	113-	- - I	^{o}F.	- M S Y	M S Y -	D M - R -
Turbidity	113-	- O -	turb. units	- - S -	- S - -	D - - R -
Tsunami Occurrence	113-	N - -	dir.	occurrence	occurrence	D - - R -
Salinity	113-	- O -	g/kg	- - S -	- S - -	D - - R -
Dissolved Oxygen	113-	- O -	mg/l	- - S -	- S - -	D - - R -
Hydrocarbons	113-	- O -		- - S -	- S - -	D - - R -
Nutrients	113-	- O -		- - S -	- S - -	D - - R -
Pollutants	113-	- O -		- - S -	- S - -	D - - R -
Plankton	113-	- O -		- - S -	- S - -	D - - R -
Boring Organisms	113-	- O -		- - S -	- S - -	- - - R -
Fouling Organisms	113-	- O -		- - S -	- S - -	- - - R -

Data Categories	Code	Scale	Measurement Units	Frequency of Data Collection	Frequency of Data Updates	Form of Available Data
SOILS						
Slope	014-	- O -		O - - -	- - - -	- M - - F
Drainage	014-	- O -		O - - -	- - - -	- - - R F
Erosion	014-	- O -		O - - -	- - - -	- - P - F
Erosion Type	014-	N - -		O - - -	- - - -	- - P - F
Stoniness	014-	- O -		O - - -	- - - -	- - - R F
Rock Exposure	014-	- O -		O - - -	- - - -	- - P R F
Depth	014-	- O -		O - - -	- - - -	- - - R F
Surface From Origin	014-	N - -	class	O - - -	- - - -	- - P R F
CLIMATOLOGY						
Temperature	015-	- - I	^{o}F.	- M S Y	M - - -	D - - R -
Precipitation	015-	- - I	in.	- M S Y	M - - -	D - - R -
Wind	015-	- - I	mph	- M S Y	M - - -	D - - R -
Sky Cover	015-	- - I	percent	- M S Y	M - - -	D - - R -
Visibility	015-	- O -	mi.	- M S Y	M - - -	D - - R -
HYDROLOGY						
Feature	016-	N - -	class	O - - -	- - - -	- M P R F
Capacity/Discharge	016-	- - I		- - S -	- S - -	D - - R -
Drainage Basin Area	016-	- - I	sq. mi.	O - - -	- - - -	- M - R -
VEGETATION						
Life Form	017-	N - -	class	O - - -	- - - X	- M P R F
	117-	N - -	class	O - - -	- - - X	- M P R F
Height	017-	- O -	ft.	O - - -	- - - X	- - - - F
	117-	- O -	ft.	O - - -	- - - X	- - - - F
Coverage	017	- O -	percent	O - - -	- - - X	- M P R F
	117-	- O -	percent	O - - -	- - - X	- M P R F

Data Categories	Code	Scale	Measurement Units	Frequency of Data Collection	Frequency of Data Updates	Form of Available Data
DATA BASES						
TENURE						
Ownership	021-	N - -	class	- - - Y	- - Y -	D M - R -
Jurisdiction	022-	N - -	class	- - - Y	- - Y -	- M - R -
	122-	N - -	class	- - - Y	- - Y -	- M - R -
ECONOMIC						
Value of Land	023-	- - I	$1000	- - - Y	- - Y -	D - - R -
Value of Improvements	023-	- - I	$1000	- - - Y	- - Y -	D - - R -
$ Volume of Constr.	023-	- - I	$1000	- - - Y	- - Y -	- - - R -
Tax Rate	023-	- - I	$/$100	- - - Y	- - Y -	D - - R -
Tax Yield	023-	- - I	$/$100	- - - Y	- - Y -	- - - R -
LABOR FORCE						
Number Persons (SIC)	023-	- - I	count	decennial	decennial	D - - R -
Skill Level	023-	- 0 -		decennial	decennial	D - - R -
Education	023-	- 0 -		decennial	decennial	D - - R -
Wage Rates	023-	- 0 -		decennial	decennial	D - - R -
BASIC INDUSTRIES						
Number Persons Empl.	023-	- - I	count	decennial	decennial	D - - R -
Capital Investment	023-	- - I	$1000	decennial	decennial	D - - R -
SERVICE INDUSTRIES						
Number Persons Empl.	023-	- - I	count	decennial	decennial	D - - R -
Capital Investment	023-	- - I	$1000	decennial	decennial	D - - R -
Service Area	-23-	- - I	sq. mi.	decennial	decennial	- M - R -
Basic/Service Ratios	023-	- - I		decennial	decennial	- calculate -

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Data Categories	Code	Scale	Measurement Units	Frequency of Data Collection	Frequency of Data Updates	Form of Available Data
POPULATION						
Residential Land Uses						
Density (night time)	024-	- - I	pers./sq. mi.	decennial	decennial	D M - R -
Composition by Age	024-	- O -	count	decennial	decennial	D - - R -
Composition by Sex	024-	- O -	count	decennial	decennial	D - - R -
Income	024-	- O -	$	decennial	decennial	D - - R -
Expenditures	024-	N O -	$	decennial	decennial	D - - R -
Other Land Uses						
Density (day time)	024-	- - I	pers./sq. mil	- - - Y	- - Y -	- - - R -
LAND/SEA USES	03--	N - -	class	- - - Y	- - Y -	D M P R F
	13--	N - -	class	- - - Y	- - Y -	D M P R F
CIRCULATION						
SURFACE TRANSPORT						
Automobile Traffic						
Routes	041-	N - I	line; mi.	- - - Y	- - Y -	- M P R -
Parking Areas	041-	- - I	no. vehicles	- - - Y	- - Y -	- M P R -
Traffic Counts	041-	- - I	vehicles/day	- - S Y	- S Y -	D - P R F
Railroad Traffic						
Routes	041-	- O I	line; mi.	- - - Y	- - - X	- M - - -
Terminals	041-	N - -	class	- - - Y	- - - X	- - - R -
Yards	041-	- O -	capacity	- - - Y	- - - X	- M P R -
Traffic Counts	041-	- - I	cars/day	- - - Y	- - - X	- - - R F

Data Categories	Code	Scale	Measurement Units	Frequency of Data Collection	Frequency of Data Updates	Form of Available Data
Utilities						
Pipelines	041-	- - I	line; mi.	- - - Y	- - Y -	- M P R -
Cableways	041-	- - I	line; mi.	- - - Y	- - Y -	- M P R -
Barriers	041-	- - I	line; mi.	- - - Y	- - Y -	- M P R F
Vessel Traffic						
Sea/Port Lanes	141-	- - I	line; mi.	- - - Y	- - - X	- M - R -
Anchorages	141-	- O -	sq. mi.	- - - Y	- - - X	- M - R -
Terminals	141-	- O -	ships/yr.	- - - Y	- - - X	- M - R -
Restricted Areas	141-	- O -	sq. mi.	- - - Y	- - - X	- M - R -
Traffic Counts	141-	- - I	ships/day	- - S Y	- S - -	- - - R -
Utilities						
Pipelines	141-	- - I	line; mi.	- - - Y	- - Y -	- M - R F
Cableways	141-	- - I	line/mi.	- - - Y	- - Y -	- M - R F
Barriers	141-	- - I	line; mi.	- - - Y	- - Y -	- M - R F
SUBSURFACE TRANSPORT						
Utilities						
Pipelines	042-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
Cableways	042-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
Barriers	042-	- - I		- - - Y	- - Y -	- M - R -
Vessel Transport						
Submarine Transit Lane	142-	- - I	line; mi.	- - - Y	- - Y -	- M - R -
Submarine Oper. Areas	142-	- - I	sq. mi.	- - - Y	- - Y -	- M - R -

Data Categories	Code	Scale	Measurement Units	Frequency of Data Collection	Frequency of Data Updates	Form of Available Data
Utilities						
Pipelines	142-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
Cableways	142-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
Barriers	142-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
AIR TRANSPORT						
Aircraft Traffic						
Airways	043-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
	143-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
Terminals	043	- 0 -	aircraft/yr.	- - - Y	- - Y -	- M - R -
	143-	- 0 -	aircraft/yr.	- - - Y	- - Y -	- M - R -
Traffic Counts	043-	- - I	aircraft/day	- - - Y	- - Y -	- - - R -
	143-	- - I	aircraft/day	- - - Y	- - Y -	- - - R -
Barriers	043-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -
	143-	- - I	line; mi.; ft.	- - - Y	- - Y -	- M - R -

APPENDIX C

DATA SOURCES

The following tables list some of the sources of data recommended for inclusion in the initial data inventory. The frequency of data collection is noted and data retention practices of the several agencies are stated concerning the length of data storage, place of storage, availability, and the differences between temporary and permanent storage. The form in which the data can be acquired is identified.

LEGEND FOR DATA SOURCE SHEETS

Frequency of Data Collection

D - Daily
W - Weekly
M - Monthly
Y - Yearly (approximately)
Y+ - Several year interval
C - Continuously
I - Intermittently

Data Form

M - Map or chart
R - Report
D - Digital

Data Retention -- Temporary Storage

(Length of Storage)

O - None
M - Month to year
Y - Year to several years
P - Permanent

(Place of Storage)

L - Stored locally (within the State)
R - Stored regionally (within the western states)
N - Stored in centralized national repository

(Availability)

A - Available
N - Not available

Data Retention -- Permanent Storage

(Length of Storage)

O - None
P - Permanent

(Place of Storage)

L - Stored locally (within the State)
R - Stored regionally (within the western states)
N - Stored in centralized national repository

(Availability)

A - Available
N - Not available

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
U.S. COAST AND GEODETIC SURVEY					
Marine Navigation and Transport					
Bathymetry	Y+	Y N A	P N A	M	
Traffic Lanes	Y	Y N A	P N A	M	
Harbors and Anchorages	Y	Y N A	P N A	M R	
Navigation Aids	W	Y N A	P N A	M R	
Hazards	W	Y N A	P N A	M R	
Restricted Areas	W	Y N A	P N A	M R	
Terminals	Y	Y N A	P N A	M R	
Pipelines and Cableways					
Routing	Y	Y N A	P N A	M	
Bathymetry	Y+	Y N A	P N A	M	
Sea Floor Characteristics	Y+	Y N A	P N A	M	
Coastal Topography	Y+	Y N A	P N A	M	
Navigable Waterways Data	W	Y N A	P N A	M R	
Tides and Currents Data	M	Y N A	P N A	R	
U.S. GEOLOGICAL SURVEY					
Geological and Geophysical Data					
Topography, limited Bathymetry	Y+	Y R A	P N A	M	
Rock and Soil Types Distribution	Y+	Y R A	P N A	M R	
Faulting	Y+	Y R A	P N A	M	
Folding	Y+	Y R A	P N A	M	
Erosion, Deposition, Sedimentation	Y	Y L A	P N A	M	
Bay and Estuarine Processes	Y	Y L A	P L A	M R	

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
U.S. GEOLOGICAL SURVEY (continued)					
Geographic Data					
Survey and Mapping Grids	Y+	Y R A	P N A	M	
Shoreline Detail Mapping	Y+	Y R A	P N A	M	
Vegetation	Y+	Y R A	P N A	M	
Highways, Roads	Y+	Y R A	P N A	M	
Land Use	Y+	Y R A	P N A	M	
Hydrologic Data					
Watercourse Mapping	Y+	Y R A	P N A	M	
Bay and Estuarine Mapping	Y+	Y L A	P L A	M	1
Water Quality Monitoring	C	Y L A	P L A	R	2
U.S. NAVAL OCEANOGRAPHIC OFFICE					
Coastal Oceanographic Data					
Bathymetry	Y+	Y N A	P N A	M	
Sea Floor Characteristics	Y+	Y N A	P N A	M R	
Geology and Geophysics	Y+	Y N A	P N A	M R	
Marine Biology	Y+	Y N A	P N A	M R	
Physical Oceanography	Y+	Y N A	P N A	M R	
Chemical Oceanography	Y+	Y N A	P N A	R	
Navigation and Transport Data					
Traffic Lanes	M	Y N A	P N A	M	
Navigation Aids	M	Y N A	P N A	M	
Harbors and Anchorages	M	Y N A	P N A	M	
Terminals	M	Y N A	P N A	M	
Restricted Areas	M	Y N A	P N A	M	
Hazards	M	Y N A	P N A	M	

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
U.S. OCEANOGRAPHIC OFFICE (continued)					
Pipelines and Cableways					
Bathymetry	Y+	Y N A	P N A	M	
Coastal Topography	Y+	Y N A	P N A	M	
Sea Floor Characteristics	Y+	Y N A	P N A	M R	
Routing	Y+	Y N A	P N A	M	
Geology and Geophysics					
Rock Type Distribution	Y+	Y N A	P N A	M R	
Faulting	Y+	Y N A	P N A	M	
Folding	Y+	Y N A	P N A	M	
Subsurface Geology	Y+	Y N A	P N A	M R	
NATIONAL OCEANOGRAPHIC DATA CENTER					
Physical-Chemical Oceanographic Data					3, 4
Bathythermograph	C	M N N	P N A	D	
Salinity	C	M N N	P N A	D	
Sound Velocity	C	M N N	P N A	D	
Geologic Data (Sea Floor)	C	M N N	P N A	D	3, 4
Biologic Data	C	M N N	P N A	D	3, 4

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
U.S. ARMY CORPS OF ENGINEERS					
Navigation and Transport Data					
Shoreline Detail					
Harbor Detail					
Current and Tide Data					
Shoreline Protection					
Wave, Current, and Tide Data					
Geodetic Data					
Erosion and Deposition					
Sea Floor Data					
Breakwater Data					
Flood Control					
Hydrologic Data					
Erosion and Deposition Data					
Surface Geology					
Subsurface Geology					
U.S. COAST GUARD					
Navigation and Transport Data					
Shipping Lanes	C	Y L A	P N A	M	
Harbors and Anchorages	C	Y L A	P N A	M	R
Hazards	C	Y L A	P N A	M	
Restricted Areas	W	Y L A	P N A	M	

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
U.S. COAST GUARD (continued)					
Physical Oceanographic Data					5
Wind Speed and Direction	D	Y L A	P N A	M D	
Current Speed and Direction	D	Y L A	P N A		
Wave Heights, Periods, Lengths	D	Y L A	P N A		
Water Temperatures	D	Y L A	P N A		
Tidal Data	D	Y L A	P N A		
Physical-Chemical Oceanographic Data					5
Salinity	D	Y N N	P N A	D	
Temperature	D	Y N N	P N A	D	
Biological Oceanographic Data					5
Marine Animal Life, Abundance and Distribution	D	Y N N	P N A	R	6
Marine Plant Life, Abundance and Distribution	D	Y N N	P N A	R	6
Meteorological Data	D	Y L A	O N	D	7
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION					
Hydrologic Data					
Stream Runoff					
Pollution Monitoring					
Waste Discharges					
Water Quality					

Agency and Data Categories	Frequency of Data Collection	Data Retnetion: Temporary Storage	Data Retnetion: Permanent Storage	Data Form	Notes
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION (continued)					
Oceanographic Data					
Pollution Detection Monitoring (Chiefly biological data)	I	P L A?	P N A	R	9
BUREAU OF COMMERCIAL FISHERIES					
Biological Oceanographic Data					
Marine Animal Life, Abundance and Distribution	C	Y L A	P N A	R M	
Marine Plant Life, Abundance and Distribution	C	Y L A	P N A	R M	
Physical Oceanographic Data					
Water Temperatures	I	Y L A	P N A	R M	
Current Speed and Direction	I	Y L A	P N A	R M	
Chemical Oceanographic Data					
Salinity	I	Y L A	P N A	R M	
Nutrient Concentrations	I	Y L A	P N A	R M	
FISH AND WILDLIFE SERVICE					
Biological Oceanographic Data					10
Marine Animal Life, Abundance and Distribution	C	Y L A	P L A	M R	
Marine Plant Life, Abundance and Distribution	C	Y L A	P L A	M R	

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
ATOMIC ENERGY COMMISSION					
Physical-Chemical Oceanographic Data	I	Y N N	P N N	M R	
Geological-Geophysical Oceanographic Data	I	Y N N	P N N	M R	
U.S. WEATHER BUREAU					
Synoptic Meteorological Data					
Temperature (including gradients)	C	M L A	P N A	M D	
Wind Direction and Speed	C	M L A	P N A	M D	
Precipitation, Amount and Type	C	M L A	P N A	M D	
Cloud Cover, Percent and Type	C	M L A	P N A	M D	
Barometric Pressure	C	M L A	P N A	M D	
Fog, Density and Distribution	C	M L A	P N A	M D	
Storm Intensity and Extent	C	M L A	P N A	M D	
Predictive Meteorological Data					
Daily Weather Predictions	O				
Long-Range Weather Forecasts	O				
Climatological Data	C	Y N A	P N A	R	
NATIONAL METEOROLOGICAL CENTER					
Data Collection	C	Y N A	O	M D	11
Predictions and Forecasts	D		P N A	R D	12

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
NATIONAL WEATHER RECORDS CENTER					
Synoptic Meteorological Data	C	O	P N A	M D	
Predictive Meteorological Data	C	O	P N A	M D	
Climatological Data	C	O	P N A	R	13
FLEET NUMERICAL WEATHER CONTROL					
Current Weather Data					
Wind Speed and Direction	C	Y L A	P L A	M D	
Temperature	C	Y L A	P L A	M D	
Cloud Cover, Percent and Type	C	Y L A	P L A	M D	
Precipitation, Amount and Type	C	Y L A	P L A	M D	
Fog, Density and Distribution	C	Y L A	P L A	M D	
Climatological Data					
Wind	C	Y L A	P L A	M D	
Temperature	C	Y L A	P L A	M D	
Cloud Cover	C	Y L A	P L A	M D	
Precipitation	C	Y L A	P L A	M D	
Fog	C	Y L A	P L A	M D	
Synoptic Oceanographical Data					
Salinity Profiles	C	Y L A	P L A	M D	
Temperature Profiles	C	Y L A	P L A	M D	
Surface Temperature	C	Y L A	P L A	M D	
Storm Surge	C	Y L A	P L A	M D	
Pollution	C	Y L A	P L A	M D	

Agency and Data Categories	Frequency of Data Collection	Data Retention: Temporary Storage	Data Retention: Permanent Storage	Data Form	Notes
BUREAU OF THE CENSUS					
Population Data					
Number of Persons	Y I	N N	P N A	R D	
Number of Families	Y I	N N	P N A	R D	
Age and Sex	Y I	N N	P N A	R D	
Color or Race	Y I	N N	P N A	R D	
Years of School Completed	Y I	N N	P N A	R D	
Employment Status	Y I	N N	P N A	R D	
Occupations	Y I	N N	P N A	R D	
Incomes	Y I	N N	P N A	R D	
Place of Work	Y I	N N	P N A	R D	
Economic Data					
Civilian Labor Force	Y I	N N	P N A	R D	
Number of Persons Employed by Major Industries (sic)	Y I	N N	P N A	R D	
Capital Expenditures	Y I	N N	P N A	R D	
Payroll	Y I	N N	P N A	R D	
Sales	Y I	N N	P N A	R D	

N O T E S

1. Data is stored at FWPCA California-Nevada Basin Office, Alameda, California.
2. USGS is soon to assume responsibility for collecting and processing the data.
3. Data in temporary storage (i.e., prior to processing) is not usually available for distribution.
4. The data is available as machine printout, punched cards, or magnetic tape.
5. Limited data are locally available.
6. Unusual occurrences only.
7. Data provided to processing agencies.
8. Low-level effort; data are now being collected by USGS and stored in Storette form in Washington, D.C.
9. Minor amounts of data.
10. Little or no direct data collection. The agency maintains data files (maps, charts, reports) compiled from other data collection sources.
11. No direct data collection; collects, plots, and analyzes meteorological data from many sources on a world-wide basis.
12. Major center for forecasting activities.
13. Permanent archival storage of all types of meteorological data.

APPENDIX D

SYSTEM USERS AND DATA USES

The discussion of the report concerns the needs and uses of information by a coastal zone authority, or an interim organization charged with similar responsibilities, such as the COAP Planning Staff. Beyond the specific requirements of this agency there are many other users that will desire access to the coastal zone data inventory and information system. The potential users having particular interests in the coastal zone can be expected to include organizations or individuals concerned with shore activities that can only occur in the coastal zone and uses of the sea itself. These activities encompass a wide range of uses that may be categorized under the general headings of Residential; Transportation, Communications, and Utilities; Government and Professional Services; Cultural, Entertainment, and Recreational; Resource Production and Extraction; and Undeveloped Land and Water. By kind, other users of the information produced for coastal zone planning and management will include:

In the public sector
- State of California
  - Departments and agencies
  - Commissions and committees
  - Legislature
  - Regional planning jurisdictions
  - University and college systems
- Other states
- County governments and agencies
- Municipal governments and agencies
- Federal government
  - Departments and agencies
  - Commissions and committees
  - Regional planning jurisdictions
- International organizations
- Other nations

In the private sector
- Management and planning consultants
- Commercial firms
- Special-interest organizations
- Individuals

The information requirements of these secondary users of the system will vary according to their particular objectives, and the variety of topics to be included in the data inventory makes it possible to provide information on a great number of topics other than those which support the objectives of the coastal zone authority. Also to be considered, of course, is the fact that

users may frequently desire access to the raw data, which can be provided. No class of data will be acquired in the inventory for the specific and sole use of any secondary user, however. As a public agency, the coastal zone authority will provide access to the data that it collects for its own purposes, and the data processing capabilities of the system will permit supplying the data as information according to the requirements of the user.

One approach to the identification of potential users and their information and data needs is to conduct a survey. The survey may employ interviews or questionnaires to learn what information outputs potential users would desire from the system. The number of topics requiring investigation under the study imposed a limitation on the extent to which such a survey could be conducted, and indeed on the depth to which any single topic could be explored. Some interviews were conducted for the purpose of eliciting the data and information needs of county planning agencies inasmuch as these agencies would appear to be potential users whose requirements may have been already formulated. The results of the interviews indicated that the questions could not be answered except after prolonged study. Moreover, other studies on user information requirements have indicated the likelihood of falsely establishing the necessity for a massive data bank without adequate consideration of the uses to which the data will be put.

An alternative approach to solving the problem of potential user requirements was adopted. The data use matrices on the following pages show the broad uses to which the data compiled in the inventory can be put by users other than the coastal zone authority. National as well as State policy is to encourage the development of resources through private investment, and prospective developers can make good use of the data and information that the system is capable of supplying.

Considering that the Land/Sea Uses category represents the complete range of human activities occurring in the coastal zone, the data items of other categories were examined against each of these uses to determine what demands may be made on the data inventory and information system by prospective developers and other potential users. Potential users were considered to be primarily concerned with planning for some activity in the coastal zone or interested in the operational aspects of some proposed activity. These interests were categorized as planning for site or route locations and structural design implications, the operational requirements that may be imposed by a particular situation or environment, or the ecological effects resulting from some planned or operational activity. Thirty-one possible combinations of five categories of interest were considered but not all were used.

NOTES FOR DATA USE MATRICES

PLANNING			OPERATIONS			
SITE OR ROUTE LOCATION	STRUCTURAL DESIGN	ECOLOGICAL EFFECTS	ECOLOGICAL EFFECTS	OPERATIONAL REQUIREMENTS	NOTE
X	-	-	-	-	1
-	X	-	-	-	2
-	-	X	-	-	3
-	-	-	X	-	4
-	-	-	-	X	5
X	X	-	-	-	6
X	-	X	-	-	7
X	-	-	X	-	8
X	-	-	-	X	9
-	X	X	-	-	10
-	X	-	X	-	11
-	X	-	-	X	12
-	-	X	X	-	13
-	-	X	-	X	14
-	-	-	X	X	15
X	X	X	-	-	16
X	X	-	X	-	17
X	X	-	-	X	18
X	-	X	X	-	19
X	-	X	-	X	20
-	X	X	-	X	21
X	-	-	X	X	22
-	X	-	X	X	23
-	-	X	X	X	24
-	X	X	X	-	25
X	X	X	X	-	26
X	X	X	-	X	27
X	X	-	X	X	28
X	-	X	X	X	29
-	X	X	X	X	30
X	X	X	X	X	31

	LAND/SEA USE CATEGORIES													
	031	131	032	034	134	035	036	136	037	137	038	138	039	139
GEOLOGY														
Bedrock	--	--	--	6	--	--	18	--	18	18	18	5	29	29
Surface	18	1	--	6	--	6	18	--	18	18	18	5	29	29
Tectonics	6	--	6	6	--	6	18	--	18	18	18	18	29	29
PHYSIOGRAPHY														
Coastal Type	1	1	6	31	31	--	31	31	31	31	29	31	29	29
Landforms	6	--	18	18	18	--	31	31	31	--	29	--	29	--
Drainage Density	9	--	--	9	--	--	31	--	31	--	29	--	29	--
Coastal Processes	1	--	6	18	18	--	31	31	31	31	29	31	29	29
OCEANOGRAPHY														
Waves	--	--	--	18	18	--	31	31	31	31	9	31	--	29
Currents	--	--	18	18	18	--	31	31	31	31	9	31	--	29
Tides	--	--	18	18	18	--	31	31	31	31	9	31	--	29
Temperature	--	--	31	31	31	--	31	31	31	31	--	31	--	29
Clarity	--	--	31	31	31	--	31	31	31	31	--	31	--	29
Tsunami Occurrence	1	1	1	6	6	1	31	31	31	31	1	31	--	29
Salinity	--	--	31	31	31	--	31	31	31	31	5	31	--	29
Dissolved Oxygen	--	--	31	31	31	--	31	31	--	31	5	31	--	29
Hydrocarbons	--	--	31	31	31	--	31	31	--	31	5	31	--	29
Nutrients	--	--	13	13	13	--	31	31	--	31	5	31	--	29
Pollutants	1	1	31	31	31	--	31	31	31	31	5	31	--	29
Plankton	--	--	13	13	13	--	31	31	--	31	5	31	--	29
Boring Organisms	--	1	31	31	31	--	31	31	31	31	5	31	--	29
Fouling Organisms	--	1	31	31	31	--	31	31	31	31	5	31	--	29

	LAND/SEA USE CATEGORIES													
	031	131	032	034	134	035	036	136	037	137	038	138	039	139
SOILS														
Slope	18	--	18	18	--	18	31	--	31	--	9	--	31	--
Amount of Erosion	9	--	9	9	--	9	31	--	31	--	9	--	31	--
Erosion Type	1	--	1	1	--	1	31	--	31	--	9	--	31	--
Depth	9	--	--	18	--	--	31	--	31	--	9	--	31	--
Drainage	18	--	6	19	--	6	31	--	31	--	9	--	31	--
Stoniness	9	--	--	--	--	--	31	--	31	--	9	--	31	--
Rock Exposure	1	--	1	1	--	1	31	--	31	--	9	--	31	--
Surface Type	9	--	9	9	--	9	31	--	31	--	9	--	31	--
Surface Origin	9	--	9	9	--	9	31	--	31	--	9	--	31	--
CLIMATOLOGY														
Temperature	18	1	--	9	--	--	29	29	29	29	5	--	4	4
Precipitation	18	1	--	18	--	--	29	29	29	29	12	--	4	4
Wind	18	18	9	18	18	--	31	31	31	31	12	5	4	4
Sky Cover	1	1	--	--	--	--	29	29	29	29	--	--	4	4
Visibility	1	1	--	--	--	--	29	29	29	29	--	--	--	--
HYDROLOGY														
Feature	--	--	--	31	--	--	31	--	31	--	5	--	31	--
Capacity/Discharge	--	--	--	31	--	--	31	--	31	--	5	--	31	--
Drainage Basin Area	--	--	--	29	--	--	29	--	29	--	5	--	29	--
VEGETATION														
Life Form	29	--	--	29	29	--	29	29	29	29	29	29	29	29
Height	29	--	--	29	29	--	29	29	29	29	29	29	29	29
Coverage	29	--	--	29	29	--	29	29	29	29	29	29	29	29
TENURE														
Ownership	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Jurisdiction	5	5	5	5	5	5	5	5	5	5	5	5	5	5

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	LAND/SEA USE CATEGORIES													
	031	131	032	034	134	035	036	136	037	137	038	138	039	139
ECONOMIC														
All Land Uses														
Value/Land	1	--	1	1	--	1	1	--	1	--	1	--	1	--
Value/Improvements	1	1	1	1	1	1	1	1	1	1	1	1	--	--
$ Volume/Construction	1	1	1	1	1	1	1	1	1	1	1	1	--	--
Tax Rate	5	5	5	5	5	5	5	5	5	5	5	5	5	--
Tax Yield	5	5	5	5	5	5	5	5	5	5	5	5	5	--
Labor Force														
Number/Persons (SIC)	1	--	9	9	9	9	9	9	9	9	9	9	--	--
Skill Level	--	--	9	9	9	9	9	9	9	9	9	9	--	--
Education	--	--	9	9	9	--	9	9	9	9	--	--	--	--
Wage Rates	1	--	9	9	9	9	9	9	9	9	9	9	--	--
Basic Industries														
Capital Investment	1	--	1	9	9	9	9	9	9	9	9	9	--	--
Number/Persons Employed	1	--	1	9	9	9	9	9	9	9	9	9	--	--
Service Industries														
Capital Investment	1	--	1	9	9	9	9	9	9	9	9	9	--	--
Number/Persons Employed	1	--	1	9	9	9	9	9	9	9	9	9	--	--
Service Area	1	--	1	9	9	9	9	9	9	9	9	9	--	--
Basic/Service Ratio	1	--	--	--	--	--	--	--	--	--	--	--	--	--
POPULATION														
Residential Land Uses														
Density	1	--	--	9	9	9	9	9	9	9	--	--	--	--
Composition by Age	--	--	9	--	--	9	9	9	9	9	--	--	--	--
Composition by Sex	--	--	9	--	--	9	9	9	9	9	--	--	--	--

	LAND/SEA USE CATEGORIES													
	031	131	032	034	134	035	036	136	037	137	038	138	039	139
POPULATION (continued)														
Economic Characteristics														
Income	9	--	--	9	9	9	9	9	9	9	--	--	--	--
Expenditures	9	--	--	9	9	9	9	9	9	9	--	--	--	--
Other Land Uses														
Density	--	--	--	9	9	9	9	9	--	--	--	--	--	--
Adjacent and Nearby Population Centers														
Size	--	--	9	9	9	9	9	9	9	9	--	--	--	--
Distribution	--	--	9	9	9	9	9	9	9	9	--	--	--	--
SURFACE TRANSPORT														
Automobile Traffic														
Controlled Access Rds.	9	--	9	9	--	9	9	--	9	--	9	--	--	--
Arterial Roads	9	--	9	9	--	9	9	--	9	--	9	--	--	--
Collector Roads	9	--	9	9	--	9	9	--	9	--	9	--	--	--
Parking Areas	--	--	9	9	--	9	9	--	9	--	9	--	--	--
Railroad Traffic														
Rights of Way	--	--	9	9	--	--	--	--	--	--	9	--	--	--
Terminals	--	--	9	9	--	--	--	--	--	--	9	--	--	--
Yards	--	--	9	9	--	--	--	--	--	--	--	--	--	--
Vessel Traffic														
Sea/Port Lanes	--	--	--	9	9	--	--	--	--	9	--	--	--	--
Anchorages	--	--	--	9	9	--	--	9	--	9	--	--	--	--
Terminals	--	--	9	9	9	9	9	9	--	--	9	9	--	--

	LAND/SEA USE CATEGORIES													
	031	131	032	034	134	035	036	136	037	137	038	138	039	139
SURFACE TRANSPORT (continued)														
Utilities														
Pipelines	--	--	--	1	1	--	--	--	--	--	1	1	--	--
Cableways	--	--	--	1	1	--	--	--	--	--	1	1	--	--
Barriers														
Obstructions	--	--	--	1	1	--	--	1	--	1	1	1	--	--
Restricted Areas	--	--	--	1	1	--	--	1	--	1	--	1	--	--
SUBSURFACE TRANSPORT														
Vessel Traffic														
Transit Lanes	--	--	--	--	9	--	--	9	--	9	--	1	--	--
Operating Areas	--	--	--	--	9	--	--	9	--	9	--	1	--	--
Utilities														
Pipelines	--	--	--	1	1	--	--	--	--	--	1	1	--	--
Cableways	--	--	--	1	1	--	--	--	--	--	1	1	--	--
Barriers														
Obstructions	--	--	--	1	1	--	--	1	--	1	1	1	--	--
Restricted Areas	--	--	--	1	1	--	--	1	-	1	--	1	--	--

	LAND/SEA USE CATEGORIES													
	031	131	032	034	134	035	036	136	037	137	038	138	039	139
AIR TRANSPORT														
Aircraft Traffic														
Airways	1	--	--	9	9	--	--	--	1	1	--	--	--	--
Terminals	1	--	--	9	--	--	--	--	--	--	--	--	--	--
Operating Areas	--	--	--	--	9	--	--	--	--	9	--	1	--	--
Barriers														
Obstructions	--	--	--	9	9	--	--	--	--	--	--	--	--	--
Restricted Areas	--	--	--	9	9	--	--	--	--	--	--	--	--	--
CONSERVATION	19	19	19	19	19	19	19	19	19	19	19	19	19	19

APPENDIX E

TYPICAL TASK ANALYSIS

In order to approximate the information and data requirements of the system, typical tasks a coastal zone authority might be expected to perform were analyzed. The tasks, listed on page 11, are related to the planning and management functions and activities shown in Figures 2 and 3 on pages 10 and 13 respectively. Some additional tasks have been included.

MANAGEMENT PLANNING TASKS

Management/Planning/Policies: Establish policies for coastal zone planning and management based on interpretation of decisions that apply to repetitive questions and significant problems anticipating and providing for action in the public interest.

Decision alternatives

Policies may be expected to include conservation and development of resources; expanding knowledge of the marine environment; encouragement of private investment; improvement of the position of the State as a leader in marine sciences; advancement of education, research, and training in marine sciences; development and improvement of vehicles, equipment, and instruments; effective utilization of scientific and engineering resources; cooperation with other States, federal government, and other nations; and similar topics.

Information and data requirements

Information on marine environment knowledge requirements; trend data on tenure/population/economic and land/sea use changes; knowledge of advances in coastal zone topics.

Frequency

Continuing.

Management/Planning/Objectives: Identify major objectives consonant with State policy and the public interest for orderly development of the coastal zone, specifying the goals and tasks necessary to accomplishment of the objectives.

Decision alternatives

Major objective: Allocation of current land/sea resources to projected use categories for development and conservation. Goals: Establishment

of land/sea use category allocations and distributions. Tasks: Inventory of current land/sea uses including undeveloped resources; definition of economic regions; tenure/population/economic studies of individual regions; resources analyses of individual regions; projected land/sea use allocations of individual regions.

Information and data requirements

Current land/sea uses, trends in land use change; development planning proposals; coastal zone resources and natural qualities; tenure/population/economic data; circulation data.

Frequency

One time, with probability of subsequent modifications.

Management/Planning/Forecasts: Prepare a long-range forecast to estimate conditions, problems, and opportunities to be confronted in development of the coastal zone.

Decision alternatives

Effects of former resource allocation decisions, deterioration of environmental quality state of flow and fund resources with respect to current and projected demands for their utilization, etc.

Information and data requirements

Information on trends encompassing tenure, economic, and population data; natural qualities of the coastal zone; past, current, and projected land/sea uses and circulation data; and reports on efficacy of existing conservation measures.

Frequency

Once yearly, but forecasts subsequent to the initial one will probably be updates.

Management/Planning/Programs: Establish a sequence and priority of tasks and goals to be followed in accomplishing the major objectives of coastal zone planning and management.

Decision alternatives

Priority allocation of objectives, goals, and tasks as probably influenced by development or conservation projects already underway or planned for imminent start.

Information and data requirements

Knowledge of current and contemplated projects; urgency for action to prevent or ameliorate undesirable conditions resulting from induced

changes in the coastal zone; and information based on data concerning natural qualities, land/sea uses, tenure/population/economic, and circulation data.

Frequency

Once a year.

Management/Planning Schedules: Establish the time sequence for performance of work leading to accomplishment of tasks, goals, and objectives of coastal zone planning and management.

Decision alternatives

Urgency of individual projects with respect to accomplishment of State policy objectives.

Information and data requirements

Knowledge of long-range forecasts; current and planned project schedules and priority allocations; task, goal, and objective sequences and time spans for accomplishment of work associated with each; and availability of appropriate personnel for assignment to the work.

Frequency

Once a year.

COMPREHENSIVE PLANNING TASKS

Comprehensive Planning/Plan Preparation/Projected Uses: Prepare a plan showing the projected land/sea uses in the coastal zone.

Decision alternatives

The allocation of land/sea areas suitable for the intended uses and appropriate to the development and conservation policies of the State and the public interest; making considered reservations for adequate public recreation areas and wildlife preserves, open space for agriculture and public purposes, and lands for housing, ocean industrial parks, and commercial activities; providing for the development of ports, water and energy resources, and transportation facilities; and providing for improved beach conservation, commercial and sport fishing, waste management, and water quality.

Information and data requirements

Data on the geology, physiography, oceanography, soils, climatology, hydrology, and vegetation of the areas under consideration. Data on existing land/sea uses, ownership, jurisdiction, population, and

economic characteristics of the areas together with trend data for each. Data on existing and proposed circulation facilities. Information on applicable conservation programs.

Frequency

One time, with the possibility of subsequent modifications.

Comprehensive Planning/Plan Preparation/Circulation: Prepare a plan showing the projected circulation in the coastal zone.

Decision alternatives

Master planning for circulation to support the projected land/sea uses allocations to include arteries, collector roads, and other transportation routes with reservation of areas necessary for terminals, moorings, anchorages, etc.

Information and data requirements

Data on the natural qualities of the areas under consideration. Data on existing and projected land/sea uses. Data on ownership, jurisdiction, and land value in sufficient detail to plan the acquisition of necessary rights of way. Trend data on land values. Data on existing circulation, utilities, and barriers constraining the selection of new transportation routes. Knowledge of applicable State regulations concerning the proposed mode of circulation.

Frequency

One time, with possibility of subsequent modifications.

Comprehensive Planning/Plan Preparation/Conservation: Prepare a plan describing projected conservation measures necessary to accomplishment of the objectives of the coastal zone authority.

Decision alternatives

Definition of coastal zone authority conservation goals and tasks accommodating the conservation measures planned or implemented by other agencies having jurisdiction in the coastal zone.

Information and data requirements

Knowledge of the conservation measures planned and implemented by other agencies having jurisdiction in the coastal zone. Environmental quality trend data showing degradation and threatened species of plant or animal life that are desirable to preserve. Multiple uses of the land or sea that are compatible or incompatible with the proposed conservation measures. Knowledge of land/sea uses that are detrimental to the preservation of established standards of environmental quality.

Frequency

Probably on a project basis, but a continuing effort.

Comprehensive Planning/Plan Preparation/Criteria: Provide criteria for improved water quality in the coastal zone.

Decision alternatives

Major decisions will be established by State agency having responsibility for assuring improved water quality. Additional criteria will be necessary for integration of coastal zone planning.

Information and data requirements

Knowledge of State water quality standards and any implications of the standards that may be peculiar to the coastal zone.

Frequency

One time, with possibility of modifications.

Comprehensive Planning/Plan Preparation/Criteria: Provide criteria for improved waste management in the coastal zone.

Decision alternatives

Major decisions will be established by State agency having responsibility for assuring improved waste management. Additional criteria will be necessary for integration of coastal zone planning.

Information and data requirements

Knowledge of State waste management standards and any implications of the standards that may be peculiar to the coastal zone.

Frequency

One time, with possibility of modifications.

Comprehensive Planning/Plan Preparation/Criteria: Provide criteria for improved commercial and sport fisheries.

Decision alternatives

Major decisions will be established by State agency having responsibility for assuring improved commercial and sport fisheries. Additional criteria will be necessary for integration of coastal zone planning.

Information and data requirements

Knowledge of State commercial and sport fisheries and any implications of the standards that may be peculiar to the coastal zone.

Frequency

One time, with possibility of modifications.

Comprehensive Planning/Plan Preparation/Criteria: Provide criteria for improved beach conservation.

Decision alternatives

Installation of structures intended to accelerate aggardation of sand or decrease wave erosion or to exercise regulatory powers where beach degradation can be attributed to certain land uses or human activities.

Information and data requirements

Physical data on the natural qualities of the sites including shore processes, currents, wave characteristics, and sediment transport measurements. Land use data on parcels adjacent to the beaches under consideration. Additional data may include maps and photographic coverage, historical records of earlier studies, and recommended engineering solutions to the problem.

Frequency

One time, with possibility of subsequent modifications.

Comprehensive Planning/Plan Preparation/Standards and Formats: Establish standards and formats for display of data in plan proposals for development of the coastal zone by county planning agencies.

Decision alternatives

Selection of common practice standards for display of data, uniform units of measurement, standard ratios or other derived information, standard color schemes, and similar topics to be employed by all county planning agencies in the preparation of plan proposals of the coastal zone to the end that the plans are uniform and comparable and can be assembled to provide an integrated plan of the coastal zone of the State.

Information and data requirements

Requires consultation with the planning agencies of all coastal counties and agreement on common practice standards and formats to be used in the State coastal zone plan.

Frequency

One time, with possibility of subsequent modifications.

Comprehensive Planning/Plan Effectuation/Zoning: Provide criteria for increased beach access.

Decision alternatives

Exercise of regulatory or eminent domain powers to provide public access through or around private property barriers to public beaches.

Information and data requirements

Tenure information on ownership and jurisdiction in areas where restricted beach access exists. Economic data on value of land and improvements that are involved in the provision of adequate beach access in such areas. Information on potential demand for beach use, depending on local population densities and the pressures of adjacent and nearby population centers. Circulation data on adequacy of existing and proposed transportation routes, terminals, and vehicle parking facilities for visitor use. Physical data on the natural qualities of the sites indicating the uses that may be made of the beach area by the public and the hazards requiring public safety measures.

Frequency

One time, with possibility of subsequent modifications.

Comprehensive Planning/Plan Effectuation/Zoning: Provide criteria for prohibited uses in the coastal zone.

Decision alternatives

Compatibility or incompatibility of specified uses with the objectives of State policy and the public interest in conservation and development of the coastal zone.

Information and data requirements

To be determined by the nature of the specified uses.

Frequency

One time, with possibility of subsequent modifications.

Comprehensive Planning/Plan Effectuation/Zoning: Provide criteria for permitted uses that do not comply with established zoning regulations.

Decision alternatives

Standards for determining, on the merits of individual cases, whether proposed variances and conditional uses may be permitted. Covers permits to be granted on authority of county planning agencies where such proposed uses conflict but do not have a detrimental effect on the accomplishment of long-range objectives of the State in the coastal zone.

Information and data requirements

To be determined by the nature of the proposed use.

Frequency

Continuing and possibly of daily occurrence, probably indicating that a review board should be set up to consider the applications on a monthly basis.

Comprehensive Planning/Plan Effectuation/Zoning: Make resource allocation decisions regarding proposed non-conforming or conditional uses when such uses are in conflict with established long-range policy of the State for development of the coastal zone.

Decision alternatives

To act, in conjunction with county planning agencies or other State agencies, on applications for proposed nonconforming or conditional uses which do not fall within the scope of criteria for permitted conditional uses and variances.

Information and data requirements

To be determined by the nature of the proposed use.

Frequency

Continuing, and possibly expressive of a higher use of land than permitted by zoning regulations, indicating a need to re-examine State policy.

APPENDIX F

FUNCTIONAL REQUIREMENTS OF THE SYSTEM

The functional requirements of the system are considered to establish the basis for the conceptual design, and identification of the particular functions of each major component of the system makes it possible to project, in some detail, the equipment, programs, procedures, facilities, and personnel necessary for support of system operations.

Information transmission and dissemination system. This system incorporates procedures for communicating, reporting, and displaying information or raw data from the inventory for use by a variety of interests that may be widely separated geographically. The filling of requests for information is handled by this system. This may involve the use of remote terminals for rapid communication or the routing of printed matter, microfilm, duplicate tapes, etc., for less urgent requests. User requests of two types must be handled; (1) those of the primary users that are addressed directly to the data inventory and information system, and (2) those of secondary users that must be processed to system language and format requirements. The system must be capable of reproducing data and information outputs for internal use and in response to user requests.

Four methods of information presentation have been considered as desirable for planning and management purposes:

(1) data and information tabulations in which the raw data or derived information are printed;

(2) statistical analyses which may be printed in tabular or graphic form, such as histograms, scatter diagrams, tables of statistical values, etc.;

(3) maps or other graphical displays that permit the study of spatial distributions and the production of illustrative material for reports; and

(4) the presentation of maps, photographs, and document material for support of specific task inquiries or other studies the organization may undertake.

Data processing system. This system consists of procedures for operating on the data retrieved from the inventory in order to generate information which is more directly related to the objectives of coastal zone planning and management. Data processing includes, but is not restricted to, computer processing.

The data processing for printing data or information in tabular form requires that the system be capable of finding the necessary data by location coordinates, manipulating it to provide summations by geographical areas of a specified size or performing some other operation with the data, decoding it to provide plain language descriptions, and printing it. Alternatively, the system should be able to find data by topic and list the locations of occurrence. This form of presentation would also include a requirement of the system to generate a catalog of the data contained in the system, and possibly of standard information topics that are frequently requested. The catalog would be available to users that may request the data or information listed or some special processing, within the capability of the system to provide it, of the data. The catalog, or some special version of it, will provide a means of periodically reviewing the data in the inventory for the purpose of removing unused data or inserting data required by demands for information.

The data processing capability for statistical analyses is one of the major functions that comprise the core of information generation by the system. It enables the operator to interact with the system while he is performing statistical analyses. Problem parameters and variables may be entered into the system or drawn from the data inventory with instructions for the necessary operations. The operator will guide the analyses by entering decisions at critical points, communicating with the computer in plain language. It is a requirement that the system be capable of performing these analytical operations for an operator having no knowledge of computers or programming. Most frequently the output of statistical analyses will be in a tabular form, but the requirement includes a capability for graphical output of histograms, scatter diagrams, etc., and working in conjunction with the data processing requirements for maps or other graphical displays.

Data storage and retrieval system. This system handles the data inventory, and employs manual as well as automated methods. The data storage and retrieval system incorporates procedures for storing, updating, editing, and enlarging the data bank and for gaining access to selected portions of the inventory for subsequent processing or dissemination. The way in which the data is used determines the way it is put into the system. The frequency with which data is needed determines its accessibility in the inventory.

Data inventory. The central component of the system is the data inventory, conceived here as the repository of all facts of observation or measurement pertinent to the objectives of the system. A data inventory may require multiple files utilizing different file structures and storage media balanced in such a way that all forms of data are systematically ordered to achieve the highest efficiency of retrieval. Two possible methods of data storage and retrieval are considered; automated data files with automated retrieval, and manual data files with manual retrieval. In the first method, data are converted to a numerical form, recorded on magnetic tape or some other storage device, and retrieved automatically on demand. A large quantity of material necessary to the data inventory will be accumulated in the form of reports, maps, photographs, etc., that will be wanted for use in their original form. This material will be maintained in manual files such as book shelves, file cabinets, and map drawers.

In addition to the data categories earlier identified as necessary to the objectives of the system, it is suggested that the inventory should also contain data to assist in a search for data not included in the inventory. This material would consist of a listing, by specific topics, of the file holdings of organizations active in coastal zone research and development.

Data collection system. Input to the data inventory is provided by the data collection system which encompasses all procedures for acquiring the initial data and for ensuring the continual flow of data into the inventory.

The commonest sources of data will be Federal, State, regional, county, and municipal agencies that have acquired data for their own purposes. It can be anticipated that most of the data acquired from other agencies will be in the form useful to that agency but not necessarily useful for coastal zone planning and management purposes. The data may be acquired through the use of duplicate tapes, for example, establishing a requirement for initial processing to prepare the data for entry into the inventory. This will require finding the wanted data on the tape, and it is likely that it will be scattered among unwanted data. The wanted data may be expressed in measurement units that are not the same as those used in the coastal zone data inventory, so that provision must be made for converting the measurement units or otherwise changing the data to a form consistent with system format requirements. There is little likelihood that all, or even an appreciable part of the data collected by these agencies will be wanted for the data inventory. The data will be available in machine-readable and other forms, but it is unlikely that the data from these sources is usable in the exact form or in the order in which it is made available.

Data acquired for the inventory that is not machine-readable and possibly some machine-readable data, must be processed manually. Manual processing involves converting the data to format and measurement units standards, assigning it to its proper place in the classification and encoding it; punching and sorting cards and recording them on tape preparatory to placing it in the data files.

Maintainence and improvement system. This system consists of routine operations designed to assure the continual efficiency of the coastal zone data inventory and information system, and it requires a number of activities seeking to improve the complete system or any of its parts. Maintenance functions include: (1) editing and updating the data at scheduled intervals so that the entire contents of the inventory will be reviewed at least once a year; (2) provision for recovery from system malfunction, a matter of the greatest importance for unless measures are taken to prevent catastrophic loss of records, neither automated or manual methods would permit the coastal zone authority to fulfill its responsibilities for an extensive period of time; (3) compilation of statistics to provide periodic analyses of retrieval time, user request trends, utilization of processing options to determine whether the services being provided are adequate or whether new capabilities should be added; (4) compilation of a system validity audit to provide for an accounting of data source, age, and reliability; and (5) the processing of plain language user requests to system language and format.

System improvement functions seek to improve data handling functions and facilities, to determine new applications of the data and information, to reveal new information needs, to investigate new processing techniques, and otherwise enhance the efficiency and utility of the system. Also included as an improvement function is consultation with users to better satisfy their needs and the training of users to make the best possible use of the system.

APPENDIX G

SYSTEM DESCRIPTION

The material in this appendix derives from the establishment of system requirements. After describing the recommended system, some of the major operational procedures necessary to making the system work are dischssed, and organizational relationships within the coastal zone authority and with other agencies are commented upon.

Physical Description

The six major components of the system furnish convenient groupings for the discussion of the hardware and software necessary to satisfy the functional requirements of the system. The descriptions in this section are intentionally general as the selection of specific equipment items is premature at this time.

The data collection system hardware will include, in addition to ordinary office furnishings, equipment for the interpretation of maps and aerial photographs and equipment for preparing data for insertion into the inventory. In the former group of equipment, a large map table and a light table are basic necessities. Several stereo-viewers are needed; a folding pocket-type stereoscope is adequate for most work, but a mirror stereoscope should also be acquired. A parallax bar or stereometer is necessary for determining heights from stereo-pairs of aerial photographs. The equipment for interpretation of aerial photographs should also include such items as scales, proportional dividers, and a set of transparent dot grids for area determination. At least two slide projectors and a projection screen are needed for the study of 35 mm and 70 mm ground and aerial photography. Cameras and some other equipment should be provided for field work. In the latter of the two groups of data collection system equipment are a desk-top calculator, a card key-punch, a card verifier and magnetic tape and card storage racks or cabinets.

Software of the data collection system consists of a generalized interface program that works in conjunction with interface description subroutines to convert machine-readable data tapes obtained from another agency to the form specified for the coastal zone data inventory. When data is acquired in the form of a duplicate tape and it is anticipated that additional data will be acquired from the same source, or if there are many such tapes from a common source, the structure of the data file should be studied to determine what data on the tape is wanted for the inventory, how it is organized and coded, and what measurement units have been used. A subroutine is then written to describe the interface between the foreign agency tape and the data inventory. The interface description subroutine instructs the generalized interface program on how to find the desired data and how to convert, code, and reorganize it for insertion into the inventory. Unless some continuing use is to be made of the interface description subroutine, the data on a foreign agency tape will be

extracted and processed manually. It is expected, however, that a number of agencies will become continuing suppliers of data from their files and employ duplicate tapes as the means of data transmission.

The only hardware associated with the data storage and retrieval system is card catalog equipment indexing the holdings of the manual files. The requirement for a card catalog arises when manual file holdings increase to the point that subject content of the various documents becomes difficult to retain without such an index.

The hardware of the data inventory is of two types, consistent with the two types of data files; automated files and manual files. Of the first type, the primary storage media will be a direct-access device, such as a magnetic disc or drum. Estimates of the data volume added to the requirements for storing index files, programs, and subsidiary files indicate that an initial storage capacity of 20-million characters will be ample. This capacity can be accommodated in a single removable-disc unit with twenty recording surfaces. The secondary storage media for maintenance of historical records and a backup to the primary file, the latter discussed in relation to the maintenance and improvement system, is magnetic tapes. Equipment for the manual files includes book shelving, file cabinets, and map drawers. There is no software in this system.

The data processing system hardware consists of a general purpose digital computer and articles of peripheral equipment. The principal parts of the computer are a central processing unit and core storage, or memory. The capacity of a computer is determined by the speed at which the processing unit executes instructions and the number of core storage cells available. For the coastal zone data inventory and information system the controlling factor is core storage. Sufficient core storage to accommodate the computer control programs, the data inventory and information system control program, and the largest data processing option program are required. Previous experience with such systems indicates that this will require space for a minimum of 50,000 computer instructions. There does not appear to be any requirement for processing speed that is not commonly available. The desired computer would be of second or third generation equipment and this is based on the evolutionary improvements in software and operations. The data inventory and information system should be designed to utilize those more recent developments. The computer is operated by use of a control panel or a keyboard console. Input is facilitated by a card reader and output is by means of a line printer. Alternative means for producing computer-printed maps include a line printer, an incremental plotter, or a microfilm recorder. For the initial stages of system operation a line printer is recommended as adequate. This device will print up to 132 characters across a page at speeds ranging from 100 lines a minute to as much as 1,200 lines a minute. The selection of computer equipment must give consideration to such factors as reliability, operating costs, and equipment maintenance.

The equipment needed to support the function of the information transmission and dissemination system includes office furnishings and reproduction equipment. Depending on the reproduction services to be provided in response to user requests, the equipment could consist of an electrostatic machine

capable of large-quantity production, photocopy and microfilm equipment, and a blue-line printer for reproduction of tracings. Some of these services may be available from other State agencies or commercial organizations depending on the location of the coastal zone authority offices. If the equipment is to be acquired by the coastal zone authority, supply cabinets of considerable capacity are also required. Software requirements are user request forms and the maintenance of permanent request files.

The hardware requirements of the maintenance and improvement system can be satisfied by a shared use of conference room equipment for the training of users and office furnishings for the accommodation of people engaged in the work of this system. The software of this system includes a master file of all of the data inventory and information system data and program files to be maintained in a current status as a back-up in the event of catastrophic loss of the working files due to system malfunction. Also included are programs for the data file updating and editing, system validity audit, and system utilization. The editing process requires that a new inventory tape, combining that which was already in inventory and the new data, be made at each periodic update. The most recent of the old data files and a copy of the updated version are retained in the master file until replaced by newer tapes. It is estimated that 20 reels of magnetic tape will be sufficient to serve these purposes. A file of permanent user requests will be worked in conjunction with the updating process to provide notice that specific classes of data for particular locations is currently on order.

Most of the equipment of the automated portion of the system can be made available to the coastal zone authority through existing State computing centers, and it has been recommended that the coastal zone data inventory and information system operate as a remote access terminal connected to an existing computer installation.

System Operations

This section describes the handling of user requests, the entry of data into the inventory, and the dissimination of information, other elements of system operating having been covered.

The operations described here are those from which personnel requirements can be determined. The description includes comments that relate to the time spans for initiating operations as well as routine operations after the system is fully implemented, so that this section, to some extent, provides a prologue to the topic of system implementation which follows.

The operations of data collection, as has been noted, include both manual and automated methods. The initial input to the data inventory and subsequent updating are performed by the same process. Figure 11 is a flow diagram of the process showing receipt of the data at a control desk and finally entry into the inventory. It is essential that management control establish rigorous standards for the handling of data, applying even to the collection of data in the field, but the process described here starts at the control desk. The figure indicates data coming to the control desk as paper or magnetic tape. The control function requires an audit of the incoming data to verify, in the case

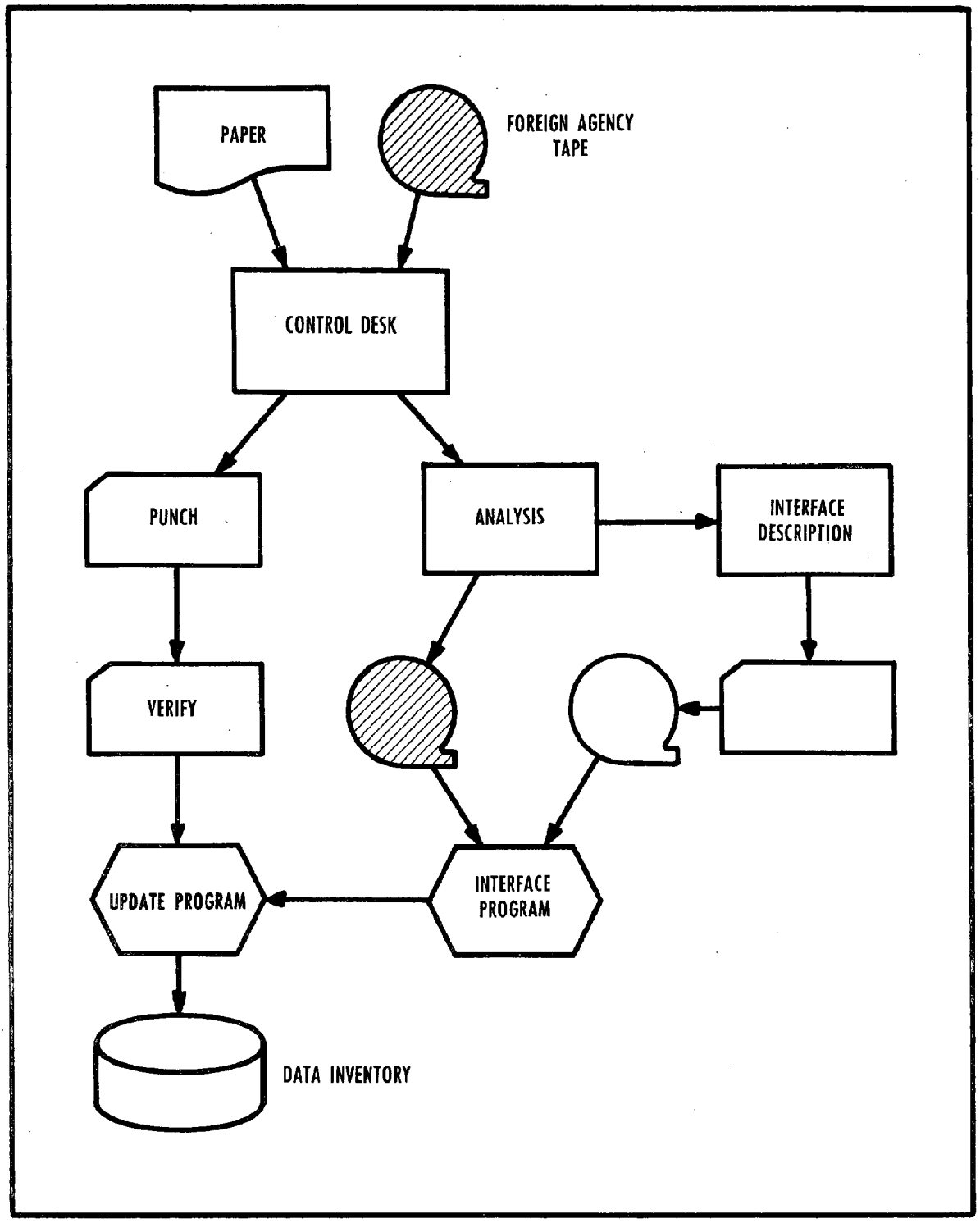

Figure 11. Data Inventory Update Process.

of paper, that it is in an acceptable form for subsequent operations. The data sheets are then dispatched for encoding, following which cards are punched and verified as correct. The cards are then set aside to await the next update. Tape must be verified as to correct labelling, that it was received in protective packaging designed to shield the tape from stray radiation and that a description of file format and content are available. The tape and description are then submitted for analysis and interface description. A subroutine is selected for use and modified as required by use of punched cards. A request is then filed for the necessary processing at the next scheduled inventory update.

No requirement has been identified for a high rate of data transfer between the coastal zone authority and other State agencies, and there is, therefore, no necessity for direct linkage with any of these agencies. It has been suggested elsewhere that data acquired from other agencies be in the form of duplicate tapes that can be interfaced with the coastal zone system. Should it become advisable to gain direct-access to the data files of other State agencies, the possibility of accomplishing this through a State computing center would be preferable to an interagency link. Specific inquiry has been direct to the advisability of linking the system with the Federal Storet Program. The data of the Storet Program appears to be useful for water management, and as such should be of value to State agencies charged with responsibilities in that area. The usefulness of the data for the purposes of coastal zone planning and management has not yet been identified.

It is expected that little difficulty will be encountered in gaining the cooperation of agencies or other organizations in obtaining data inputs to the system. With respect to private organizations, some acquisitions may require execution of exchange agreements or purchase, but most often it should be available at the costs of tape duplication. It is recommended that no duplicate tapes are acquired until the classifications, coding, and file structure of the data have been ascertained and some judgment made of the ratio of wanted to unwanted data in the file.

Other functions of the control desk include maintenance of an update file consisting of the original update request cards, and a request record file consisting of cards generated by the update program that provide data wanted for statistical purposes. When a sufficient number of cards have been accumulated in these files, they may be transferred to tape and the cards destroyed. The control desk will also maintain a file of permanent requests from users to provide a means of identifying new data for which requests have already been filed. Simultaneously with the output of requested data or information, a verification of system response or notification of system non-response, and manual file search keys are reported to the control desk. These functions are shown in Figure 12.

A number of self-generated reports are required for system maintenance, and the programs producing these reports are activated by requests placed by the control desk at periodic intervals. Three of such reports are shown in Figure 13. The system utilization report makes use of the request record file and other data to provide a summary of operations for a period, say a year. The report should note the number, type, and distribution of users making

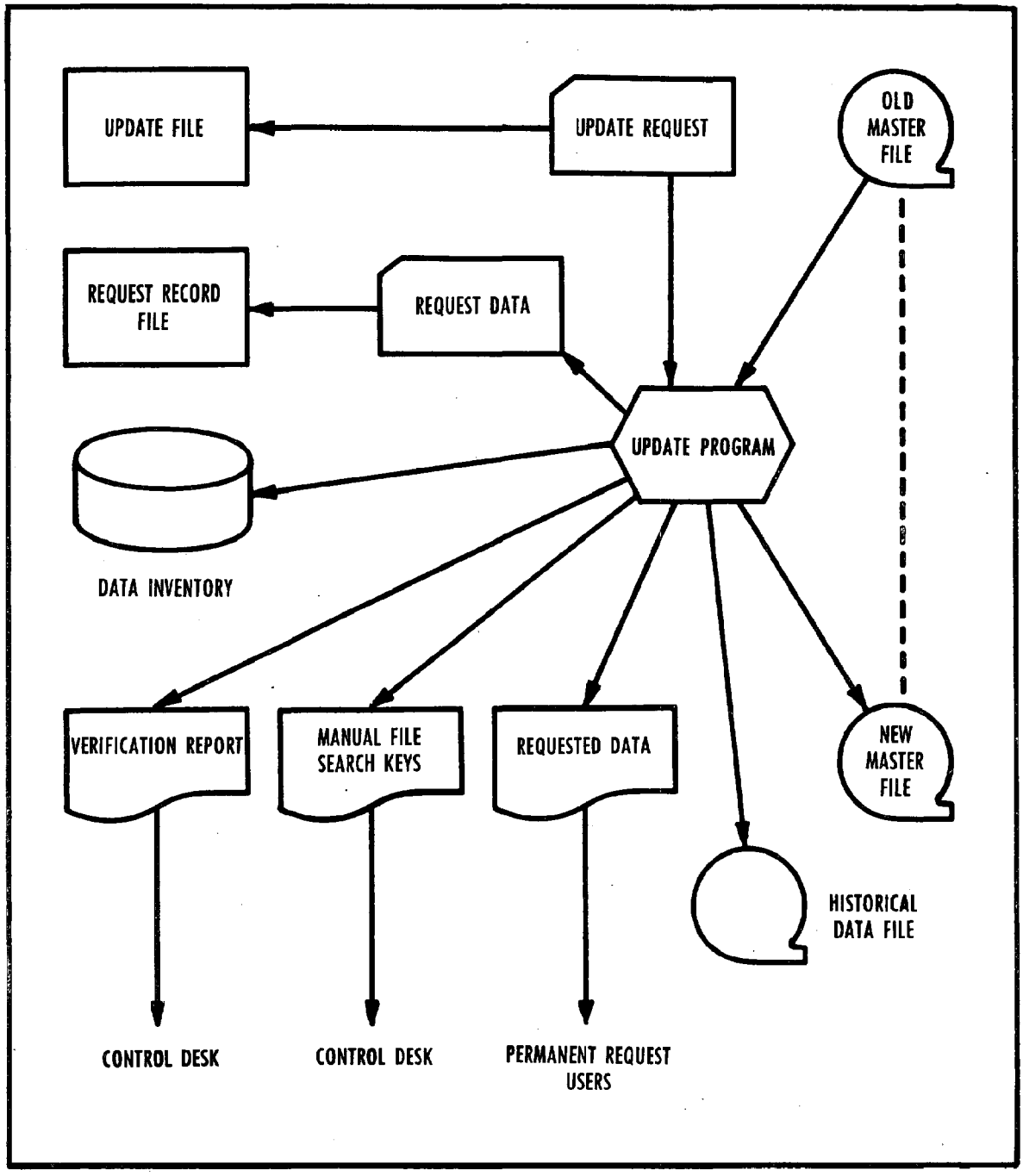

Figure 12. Inventory Update Program Functions.

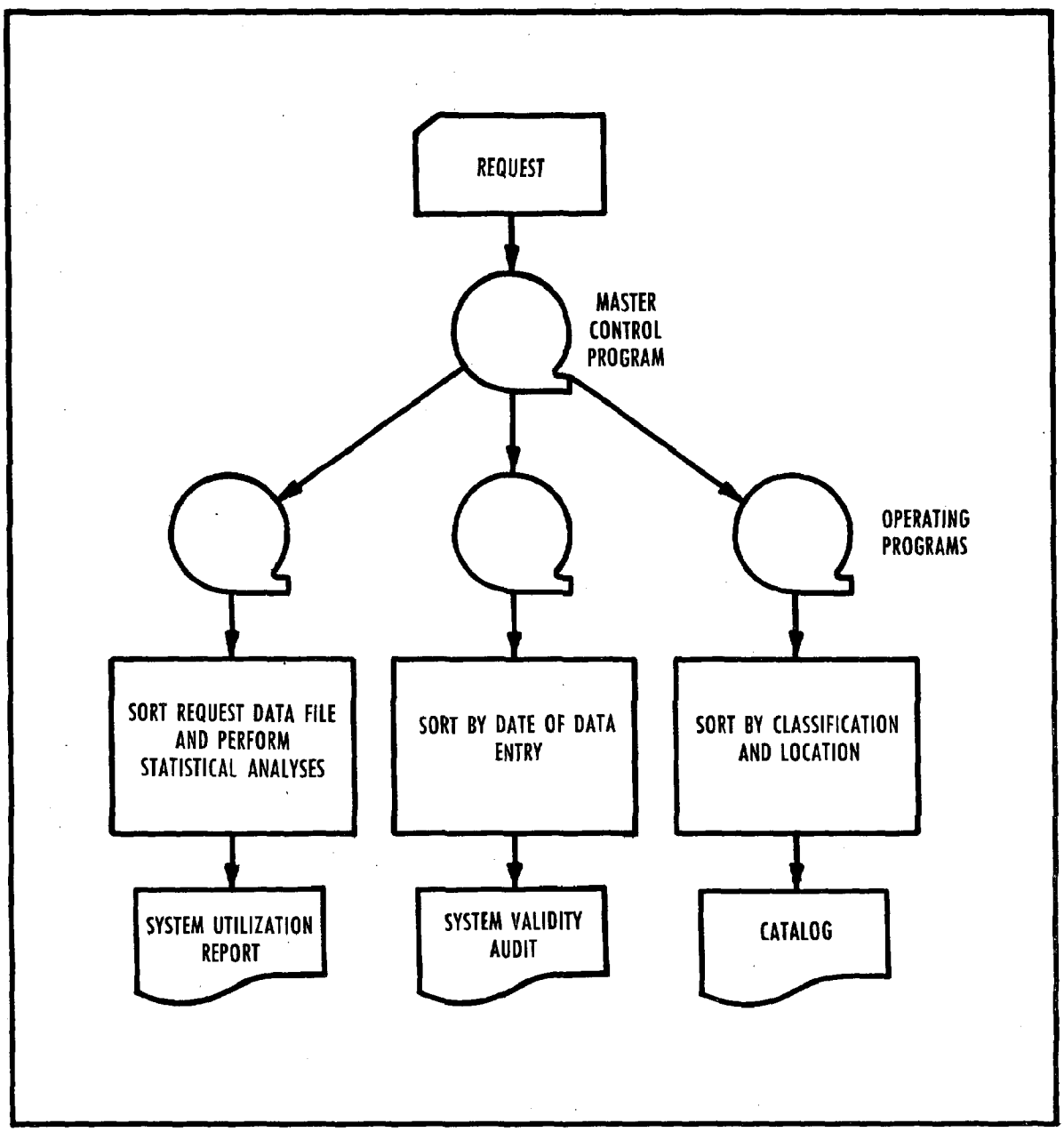

Figure 13. Self-generated System Maintenance Reports.

requests, whether or not their requests were satisfactorily fulfilled, how often processing options were used, and other statistical measures on the use of the system for management consideration as to necessary improvements in the service, correctness of pricing for services, etc. The system validity audit sorts the data by age to provide an indication that new data is wanting for update in certain categories. The report is to be used as a measure of inventory reliability. The third output shown is a catalog to let users know what data is in the inventory and the operations that can be performed by the system. Catalog entries are by data category and location. The catalog should also list the statistical operations and output options that are available to users. Reports such as these are produced according to a management schedule.

Control desk responsibilities extend to the search of manual files for requested data and the delivery of material for reproduction, packaging, or mailing.

Standard operating procedures should be developed for the collection and handling of data prior to insertion into the inventory, for the handling of user requests and dissemination of information, for the interactive use of the system by persons not trained in computer languages and operation, and for measures protecting the inventory and program library in the event of system malfunction. These standard procedures are likely to be voluminous. Additionally, special procedures, not having a general or enduring application, are needed for matters concerning the continuance of data flow from specific sources, the handling of particular data from a specific source, etc. It may be advisable to prepare a users' manual.

From the foregoing, an estimate of personnel requirements can be made. These comments are limited to personnel directly related to the operation of the system. The labor effort associated with the control desk operation will require a senior clerk competent to make routine decisions concerning whether or not the incoming data are what they purport to be, the adequacy of request fulfillment, and matters of encoding. A second clerk, working under the supervision of the senior clerk, will be required. A key-punch operator will be needed for at least two days a week during the period that the initial inventory is being established and for lesser periods thereafter. The key-punch operator can be usefully employed in other system operations for the balance of the work week. The work of these three employees during a week can be identified as follows:

16 hours	Preparing inventory update
16 hours	Key punch
8 hours	Handling user requests, up to 300/day
8 hours	Output verification
8 hours	Update audit
8 hours	Manual file search
8 hours	Handling reproduction requests
8 hours	Handling shipping requests

Periodic reports will require their attention for the balance of the time. Mail room and reproduction equipment operation will each require one person

with appropriate skills.

It has been estimated that it will require about 500 man-days (roughly two man-years) to encode the data of the initial inventory. One key-punch operator should be able to keep up with the encoding by working two days a week. It is suggested that the encoding would provide an excellent knowledge of the data inventory and that the work should be performed by persons it is intended to keep on the coastal zone authority staff. This work could be handled by two junior planners during the first year, assuming that each would be capable of handling an average of 200 codes per day.

Maintenance and improvement operation will require the full-time employment of a full-time programmer. Preferably, he will have had about six years of experience that includes working in a small computer operation where a wide range of activities are performed by a small staff. He should also be competent in statistical analysis. It is expected that State computing centers or the Office of Management Services can provide technical guidance on matters beyond the capabilities of the programmer.

APPENDIX H

COMPUTER MAPPING

The data processing capability for production of thematic maps as a computer output is one of the major functions of the system for generation of information. Computer-printed maps, often unfavorably compared with the more artistic productions of the competent cartographer, can be favorably judged on the basis of time required for preparation, information content, and their utility as analytical tools. It is virtually impossible for the planner or manager to grasp the spatial implications of distributions by any means other than maps. Some notion of the spatial implications that will be of concern in planning and managing a large region can be gained from the following outline of possibilities taken from Peter Haggett's Locational Analysis in Human Geography (New York: St. Martin's Press, 1966).

(1) Movement

- (a) movement and morphology
- (b) interaction (movement and distance)
- (c) "field" and "territory" (movement and area)
- (d) diffusions (movement and time)

(2) Networks

- (a) location of routes
- (b) density pattern of route networks
- (c) models of network change

(3) Nodes

- (a) morphology of settlement patterns
- (b) population clusters: the size continuum
- (c) size and spacing of clusters

(4) Hierarchies

- (a) functional hierarchies of settlements
- (b) specialized centers within the hierarchy
- (c) distortion due to agglomeration
- (d) distortion due to resource localization

(5) Surfaces

- (a) surfaces and gradients
- (b) minimum-movement models
- (c) distortion of regular gradients

Three methods of computer mapping have been suggested for use with the coastal zone data inventory and information system; line printer maps, incremental plotter maps, and CRT (cathode ray tube) maps. Maps produced by a line printer are perhaps the first step in computer mapping. They can be produced with the line printer used for standard computer output tabulations. Map symbolism employs standard printer characters, and contrast can be enhanced by the use of overprinting techniques. A simple mapping program, such as SYMAP (available from the Laboratory for Computer Graphics, Harvard University), provides an extremely useful tool for the study of spatial distributions. Three types of maps are produced by the SYMAP program: (1) isopleth maps in which lines of uniform value are generated by computer interpolation between data points; (2) choropleth maps in which statistical values are considered to be uniform within known boundaries; and (3) proximal maps that are usually based on qualitative data and proximity to a data point. The program also produces histograms of the mapped distributions, legends, titles, scales, etc.

Maps produced by incremental plotters are made by a pen, or stylus, moving in response to point coordinate directions from the computer. These maps more nearly resemble those made by manual methods than do the line printer maps. Contour or other isopleth maps are the most common product of this method of computer mapping.

Maps are generated on a CRT by displaying point coordinate data to produce the desired line elements. Two major disadvantages can be cited; the size of the map is usually limited by the size of the CRT and it is usually necessary to photograph the CRT to get a hard copy map for subsequent use. A major advantage of the method lies in the capability for operator interaction in which human judgment can introduce changes to the map as it is being displayed on the CRT.

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