EVOLVING SYSTEM FOR UNIFIED BASIN PLANNING AND MANAGEMENT IN ALASKA

May, 1980

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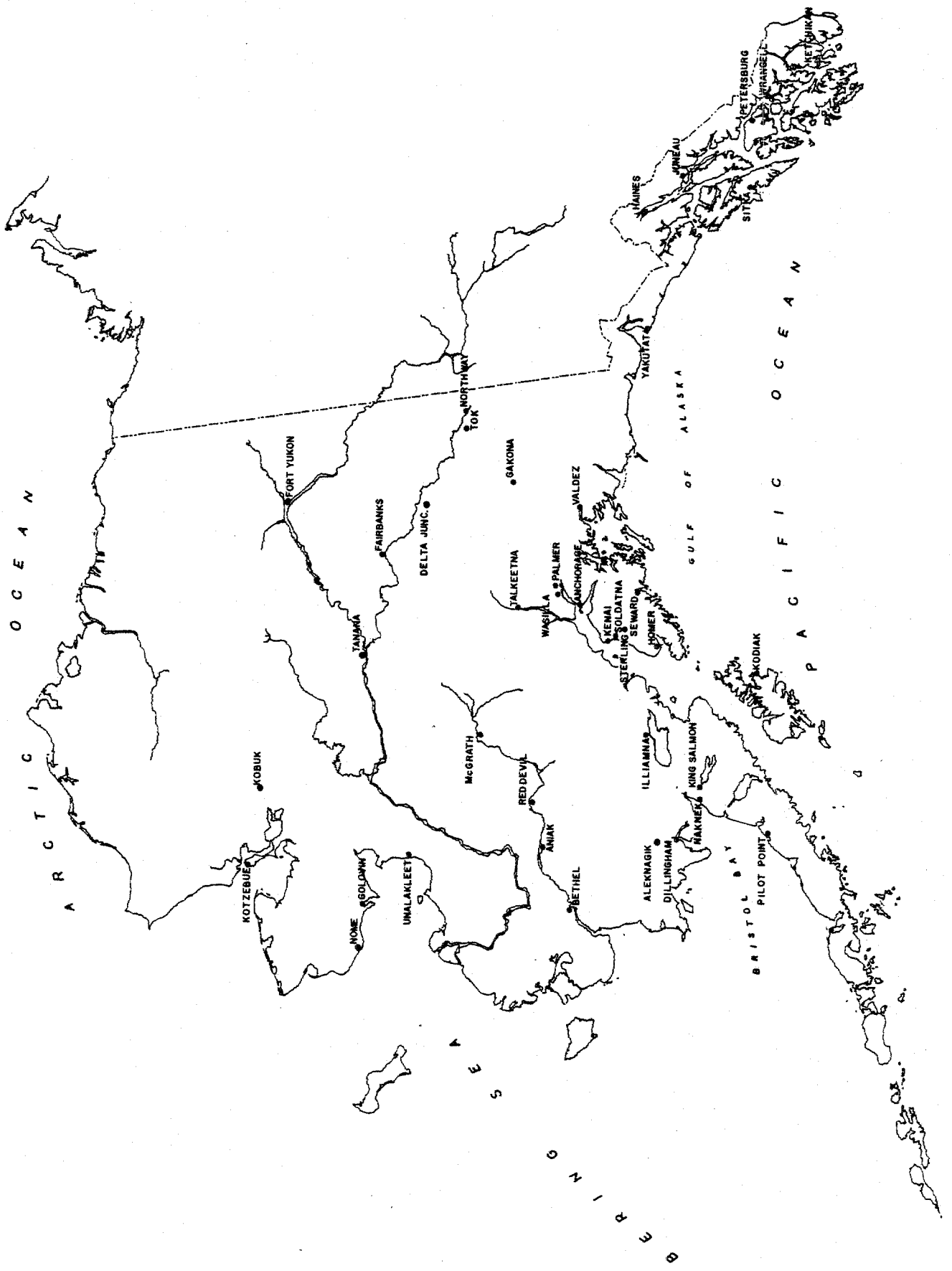
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KING SALMON
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DILLINGHAM
BETHEL
PILOT POINT
KOTZEBUE
NOME
GOLOVIN
UNALAKLEET

EVOLVING SYSTEM FOR UNIFIED BASIN PLANNING & MANAGEMENT IN ALASKA

Unified River Basin Management Symposium
Gatlinburg, Tennessee
May 4-7, 1980

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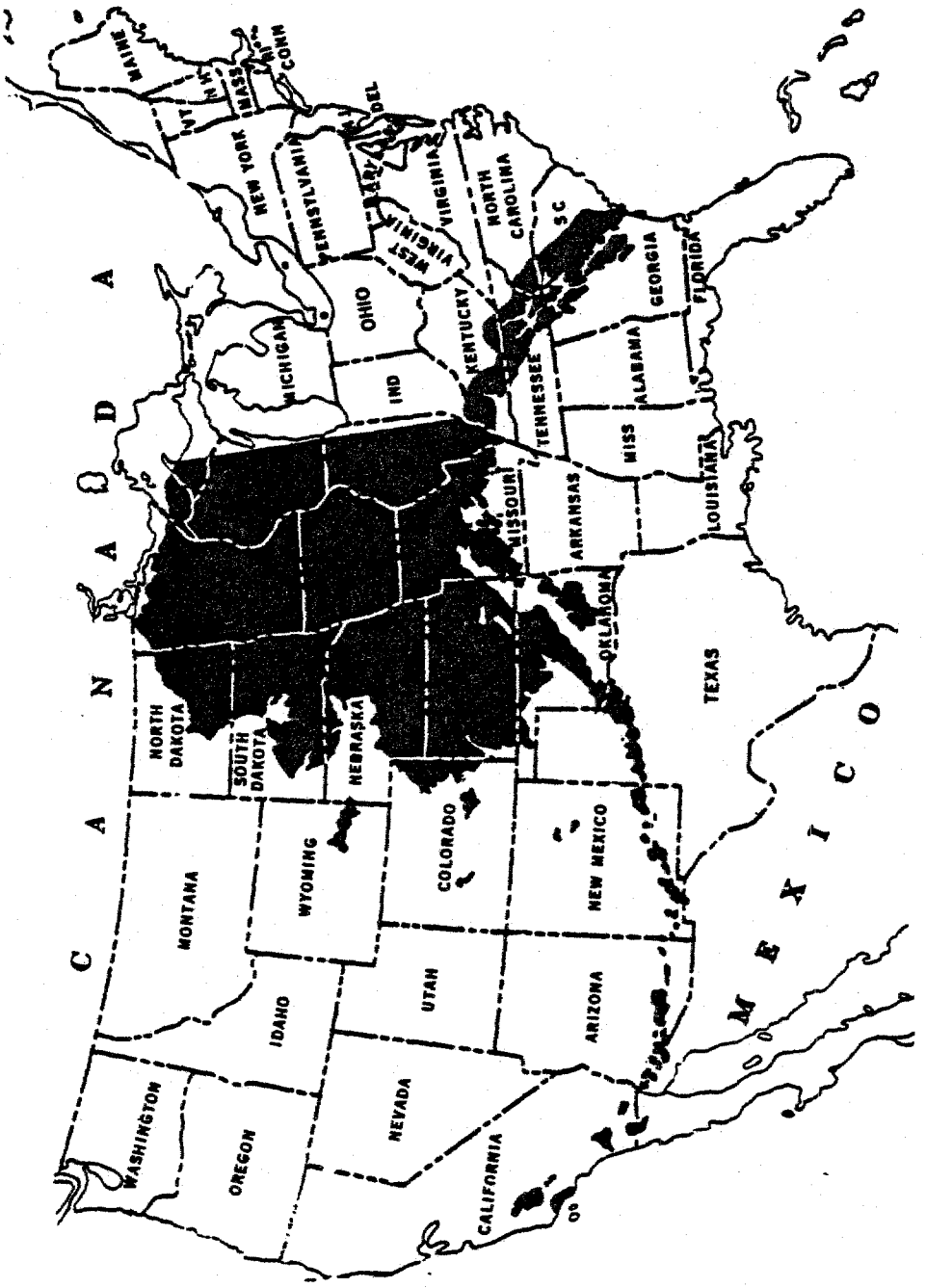
Geography

Alaska comprises approximately 586,000 square miles; an area roughly one-fifth of the entire land mass of the continental U.S., and larger than all the Atlantic Coast states combined. It is transected by vast mountain ranges and much of the land is covered with glaciers, or underlain with permanently frozen soil or a thick layer of peat-like tundra bog. The settlement pattern reflects the constraints of climate and topography; the majority of the State's small population and industry is situated on the more habitable southern coastal areas. Though most of the population is in concentrated urbanized centers, the balance is largely made up of small, widely dispersed settlements like Barrow (300 families) or Karluk (25 families).

The traditional approaches toward resource management as used in Alaska have all too often been guided by the letter rather than the spirit of national legislative objectives. Thus the State is often saddled with unimaginative bureaucratic interpretations which do not allow for the needed flexibility to manage the special water problems of Alaska. As a result, many water resource plans and projects have been failures, resulting in disillusionment to many of those who should have benefited.

Figure 2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NEBRASKA
KANSAS
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NEW MEXICO
WYOMING
MONTANA
IDAHO
UTAH
ARIZONA
NEVADA
WASHINGTON
OREGON
CALIFORNIA

To assume that the planning and management of Alaska's resources can best be accomplished by transplanting "lower 48" theory and technology is a serious mistake. In itself, the vast size of the State precludes subdivision for analytical and administrative purposes into river basins comparable in area to those in the eastern states. For example, the area of Southcentral Alaska, only one of Alaska's six major hydrologic regions, is over six times that of the Hudson River Basin (53 versus 8.5 million acres). The Susitna River Basin, only one of six major basins in Southcentral Alaska, is comparable in drainage area to the entire Hudson River Basin. In contrast, the 1975 population of Southcentral Alaska, the most populous area in the State, was approximately one-sixteenth that of the Hudson River Basin.

Alaska's water resources are, if anything, more impressive than the size of her land. While accurate data does not exist, it is estimated that the State contains roughly one-third of the nation's fresh water supply--Alaska's portion of the mean annual outflow being between 800 and 900 billion gallons per day. Total withdrawals are estimated at 345 million gallons per day. These fresh water resources are not distributed evenly throughout the State, the Arctic Region receives only 3½ percent of the outflow, while Southeast Alaska receives over 36 percent. As well, the discharge is so seasonally variable in some drainages that they are virtually dry in winter, yet can reach flood proportions in spring and fall. Similarly, water quality is highly variable throughout the State, and seasonally for many surface sources. Suspended sediment is perhaps the most obvious example, many rivers are virtually clear in winter, yet so high in suspended load and turbidity in summer that they are almost useless as a source. Others may change in concentrations of iron, manganese and other trace constituents by an order of magnitude in a few days, making the design and operation of treatment facilities extremely difficult.

Technology Transfer

Alaska is replete with examples of failures in technology transfer which illustrate the great difficulties Alaska resource managers have in adapting to national water resource programs. Water resource standards, as well as structural and nonstructural solutions, must be developed with a sensitivity and understanding of the unique constraints Alaska presents to water resources development. These constraints certainly derive from the geographic conditions mentioned above, but, perhaps more importantly, also are the result of a lack of access and infrastructure. This latter often precludes management solutions which have been found cost effective in the contiguous states.

Construction in the far north is often subject to problems of frost heave, permanently frozen ground and the phenomenon known as "aufeis" or glaciering. These are particularly troublesome in developing transportation systems--without proper Alaskan-based design, roads may sink into the quagmire of melted permafrost, ice-filled culverts may cause spring washouts, or frost heaving make them impassable. To illustrate the cost differential, highway construction in Alaska averages about $1 million per mile as compared to per mile construction costs in the contiguous states ranging from $100 to $500 thousand. Operation and maintenance, as well as construction and design, are also subject to higher costs and technological innovation. Often, these higher costs can change relative costs of alternatives so that a non-traditional form becomes more cost effective. For example, the State is seriously experimenting with air cushion vehicles for overland transportation in rural areas, and has used ice-bound rivers as road systems in winter, thus creating an almost year-round transportation system from a river--boats in summer, authomobiles in winter. Southeast Alaska's transportation system is almost exclusively by air and ship. The Alaska State ferry system--America's largest fleet of ocean-going passenger vessels--provides the equivalent of a highway system in other states. As such, it is subsidized by Federal Aid Highway funds.

In both urban and rural areas, water quality control and water development projects suffer from the same constraints that transportation systems do. Dams, reservoirs, piping systems and treatment facilities all must be designed with the peculiar Alaska situation in mind. Permanently frozen ground often prohibits burial of water and sewerage lines. In many remote villages, they have to be built above ground with specially insulated piping. In some villages, traditional piped water and sewer systems are not cost effective; centralized facilities for water treatment and supply, sewage treatment, bathing and laundry, combined with a truck haul "honey bucket" system may be the only option. To illustrate the costs of doing business, the North Slope Borough submitted a proposal for a sewer and water system for which the structural costs alone amounted to about $35,000 per person. On the other hand, in areas of intermittent permafrost, water and sewer lines may be subject to freezing only in winter. In such areas, special engineering techniques must be used to protect these systems. In Fairbanks, for example, the entire buried municipal water supply system, which serves approximately 30,000 people, is designed to constantly circulate. Water is slightly heated to prevent freezing, and special devices--called pitorifices--cause water to continually flow from street mains through service connections to homes, and back to the street main. Water is metered as it is drawn from this constantly flowing stream for home use. Sewerage systems can be designed for rapid flow and minimal pooling to prevent freezing, and electric thaw wires installed to thaw frozen piping. In institutional settings, such as military bases or universities, buried utilidors or utiliducts are used to contain all utilities. These can be heated to prevent freezing and also provide ready access for repairs or modifications. However the high cost for such facilities is prohibitive for general urban use.

The energy shortage is especially acute in rural Alaska, where energy needs for human health and safety is often greatest. In many villages, the only supply of outside energy resources is from 55 gal. fuel drums flown in by air, which is used for home heating

and generation of 37-50 cents per kilowatt hour electricity. These enormous costs, coupled with the low per capita income of village residents, means that the every day necessities of urban residents in the contiguous states become unaffordable luxuries in Alaska's villages. Such common municipal operations as wastewater treatment, solid waste collection and disposal, and piped public water systems are not easily afforded. As a result, systems must be designed to minimize energy use, and operating costs. As well, it must be recognized that high technology systems cannot easily be maintained at the end of supply lines, where operator experience and training is very basic. Therefore, the best systems often are those which are very simply designed, and use village labor for construction and operation.

As mentioned earlier, while Alaska in general is blessed with abundant supplies of fresh water, many areas, particularly in the Arctic and in some western coastal areas, suffer from low runoff, seasonal restrictions, or high salinity. In some rural villages, water must, essentially, be hoarded to prevent possible thirst-related illness. Water must be collected during a short span when it is not frozen, yet still pure, and stored for as much as eight months. Underground aquifers, which act as storage reservoirs for water supplies in so many areas of the nation, are not available throughout much of Alaska. Often, thin top soil overlays thick bedrock, or permafrost, which reaches over one thousand feed deep in the far Arctic. In other areas, a thin layer of underground fresh water overlays salt water. Thus, residents often must turn to seasonally available surface freshwater sources. These are subject to climatic extremes of low seasonal runoff and intermittent freezing. High tides and storms can drive salt water into lakes and streams, making traditional sources virtually unusable.

Water resources planning and management is especially complicated by peculiarly Alaskan conditions, particularly in determining and allocating in-stream flow and water quality needs. Individual stream

channels and small lakes are subject to freezing completely in winter, limiting the available flow needed to maintain fish and their eggs, to assimilate wastes, or to provide water for community and industry use. In many areas, natural background concentrations of contaminants such as suspended sediment, turbidity, arsenic and nitrate frequently exceed water quality standards for drinking or protection of fish and wildlife. Cost and technology preclude the cleanup of such waters to meet these standards, thus making the control of wastewater discharges, particularly from municipal waste treatment plants and placer mining operations, a difficult task. The collection of water data, essential to any water management scheme, is almost prohibitive in cost. Access to the tens of thousands of needed data collection points is often possible only by helicopter, boat, or snowmachine. Further, Alaska's resource development pace occurs so rapidly that even if we could affort to collect data when a particular resource development project is in the early planning stages, by the time meaningful data is collected, the project will often be too far along to use it. This is particularly true when designing transportation systems--often long-term discharge and periodic flood data is not available for bridge and highway design, thus designing for flood projection is not feasible.

The traditional programs and tools developed nationally to be applied in the field to achieve river basin management objectives have to be substantially modified for Alaska. Part of the problem certainly is the basic lack of usable land and water data, collected in an integrated manner so as to be useful to the planning and management decision making process. Although investigations of Alaska's water resources have been undertaken for many years, national water resource management objectives have changed during that time with little attention being given to developing programs which can be successfully applied in Alaska. We now recognize that considerable flexibility must be provided in the development and application of river basin management and planning, and that resource managers need substantial latitude to develop innovative implementation methods.

Management History

Although both State and Federal agencies have been charged with management of the resources, they are operating from a relatively brief history and with a limited staff. In this far-flung region, the resource managers can't simply drive out to survey their jurisdiction; for much of it there isn't even a set of detailed maps. It has only been in recent years that resource agencies have begun to develop a general understanding as to the extent or location of various resources. As an illustration it has only been with the advent of the Alaska Native Claims Settlement Act, and the Southcentral Water Resources Study, that techniques such as Landsat photography have been utilized as an applied mapping technique. In reality, before Alaska became a state in 1959, much of the Territory was virtually unknown. However, with the advent of the Alyeska pipeline, the Alaska Native Claims Settlement Act, the Fisheries Conservation and Management Act, and the proposed Alaska highway gas line project project, national attention has been focused on the enormity and sensitivity to development of Alaska's natural resources, emphasizing the need for well-reasoned management processes.

This is not to say that consideration hasn't been given to Alaska's unique resource management needs and problems. There is, in fact, a considerable history relating to efforts focusing on resource management in Alaska. The Reconnaissance Reports on the Potential Development of Water Resources in the Territory of Alaska produced in 1948 and 1952 by the Bureau of Reclamation represent perhaps the first major investigations of water resources in Alaska. The Kerr Commission report, published in January 1960, was perhaps the first major summary of the State's water resource needs and problems after statehood. Also in the early 60's the State commissioned Frank Trelease, well known authority on western law, to develop a water resources study. That report was subsequently updated by Trelease during the mid 70's. The most comprehensive interagency analysis of the State's water resource needs and problems is the Alaska Water Assessment by the Alaska Water Study Committee as a part of the Water Resources Council 1975 National Water Assessment.

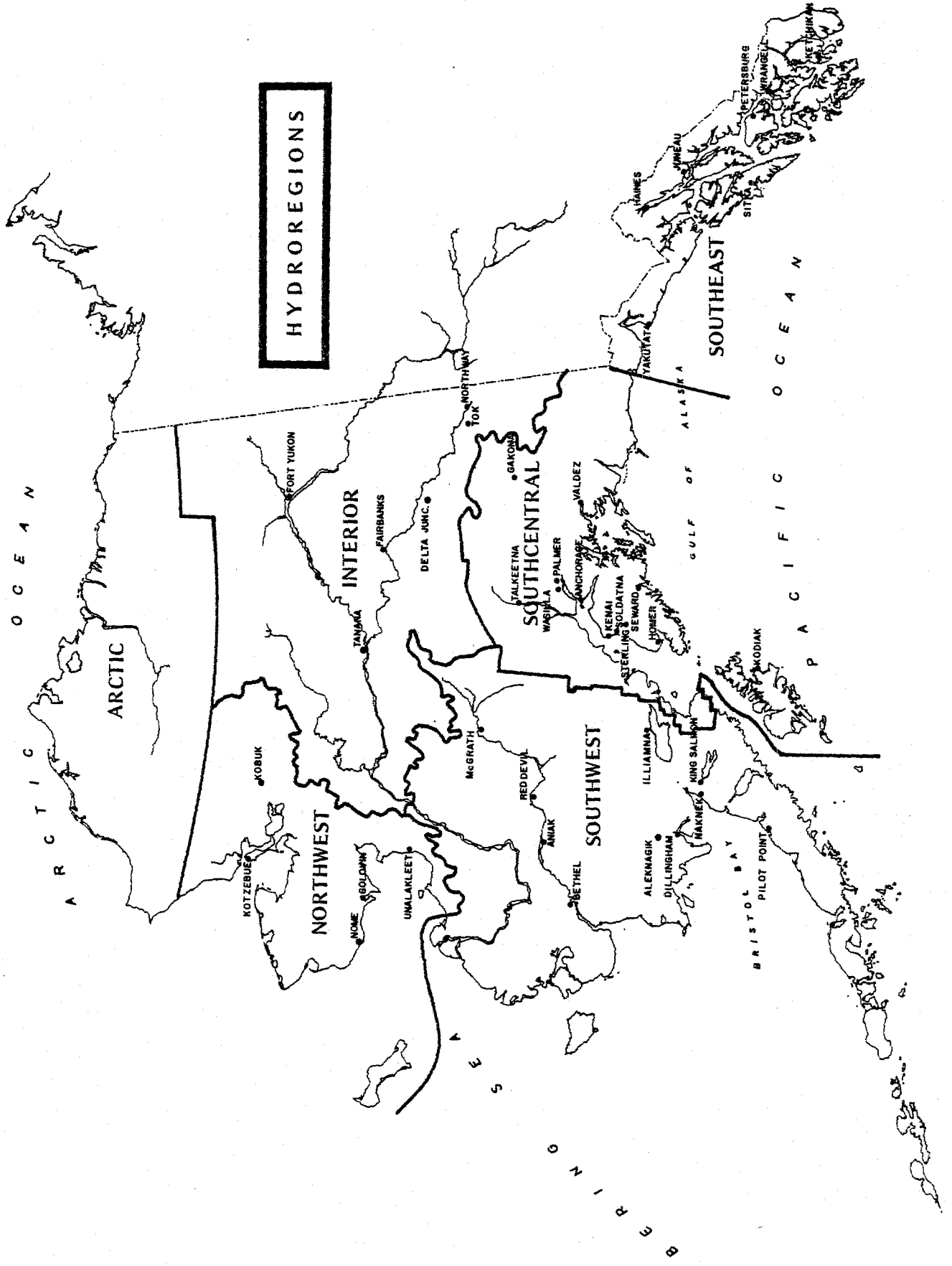
There have also been a number of technical and political institutions attempting to coordinate responses to a wide variety of resource management problems. These include the interagency hydrology committee, active since the early 60's, the Federal Field Committee which came into existence after the 1964 earthquake, the Federal-State Land Use Planning Commission, established after the Alaska Native Claims Settlement Act and now expired, the Alaska Land Managers Cooperative Task Force, which is an ad hoc group operating through the Federal and State Land Management agencies, and the Alaska Water Study Committee, active since the late 60's and currently a field committee cooperating with the U.S. Water Resource Council. The Alaska Water Resource Board was established as a result of the Trelease Study to advise State government on water resources management functions and activities.

From this history of resources investigations and institutional or coordinating forums, there are a variety of concerns which need to be answered regarding the future of water resources management in Alaska. A statement is needed to indicate what positive steps the State has taken to achieve competency and accountability in its water resource management planning. More importantly what Alaska is or should be doing to provide water and related land management should be spelled out. While the State has some major decisions to make as regards its long range management approach, it has already utilized the forum provided through the Alaska Water Study Committee to address a number of specific inter-agency planning efforts.

Initial Water Resource Study Format

The Alaska Water Study Committee, which was formed less than a decade after Statehood, came into being to develop a coordinated management approach to Alaska's water needs and problems. For the 1975 National Assessment the Committee developed an abbreviated methodology for

Figure 3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STERLING
SEWARD
HOMER
YAKUTAT
HAINES
JUNEAU
PETERSBURG
WRANGELL
KETCHIKAN
SITKA
KODIAK
McGRATH
RED DEVIL
ANIAK
BETHEL
ILLIAMNA
KING SALMON
NAKNEK
ALEKNAGIK
DILLINGHAM
PILOT POINT

addressing the State's regional water resource needs. The State was divided into six major hydrologic subregions and, rather than doing a myriad of specific basin studies, chose to apply the Level B regional planning process to these individual areas. The current "Southcentral Alaska Level B" is serving as a pilot study to establish a process for comprehensive assessments of water resource management needs for each of the subregions. While at first this might seem to be a straightforward assignment, the region comprises 53 million acres with half a dozen major river basins (Susitna, Copper, Matanuska, Knik, Chakachatna, and Kenai Rivers). Although this region is the most densely settled in the State and includes the Anchorage Municipality, water resource management is so new to the area that the State water resources management system is only just beginning to evolve, the current practice is to respond on a case-by-case basis.

The Southcentral Level B provided the first opportunity for many agencies, particularly those within State government, to take a long-range look at their own management responsibilities. It has provided an excellent test case, though the process has been too long and frequently frustrating for the participants. A clasic debate has occurred over the applicability of the term "comprehensive" as applied to Level B studies. The initial approach taken followed the concept that the study should be developed on the basis of a complete application of the WRC Principles and Standards. However, after the first two phases, needs assessment and alternatives solutions, were drafted, it was abundantly clear that the disparities between each of the six resource analyses could not be readily reconciled. The variability, limited accuracy and incompatibility of data used to forecast future resource management scenarios was just too great. When it was realized that our original approach was far too ambitious, the methodology was subsequently modified to the judgmental approach originally described in the WRC Draft Guidelines for the Principles and Standards. While this dilemma isn't necessarily unique to Alaska (ref. the R.M. Fields Report, Aug., 1979 to WRC), it served to clarify

the blurred distinctions often made between Level B and Level C studies. It also proved the usefulness of a "pilot project" assessment in Alaska at these early stages of resource development.

With this experience, it soon became apparent to the Committee that there is a need to develop a "Short-hand" method for drawing up a State Water Resources Plan, thus the Southcentral Level B is becoming a major element toward devising such a strategy. While it obviously represents the region with the more imminent needs and problems, there is still a need for an overall statewide framework through which priorities assessment can be part of a continuing process. The State Plan which eventually results from this strategy will focus on high activity areas where obvious resource demands and problems can be anticipated. The Level B assessments then will simply serve as screening devices to determine priorities in general detail and to identify specific follow-up actions, such as data gathering, research, or project feasibility investigations.

Management Status

Whereas both the State Water Resources Board and AWSC have been "chartered" for some time, it has only been since about 1977 that staffing support has been available to enable either body to begin to evaluate and act on the Trelease Report or the Alaska Water Assessment. Also in the early days of these advisory bodies there was a much larger Federal role which, with implementation of the Alaska Native Claims Settlement Act and the transfer of lands from Federal to State and Native ownership, is shifting to the State leadership. At the conclusion of the transfers, Federal land ownership will involve approximately 60 percent, the State 28 percent, and Native organizations 12 percent. This flux in land status has clouded water resource management policy with considerable uncertainty; with the, hopefully soon, resolution of land status the State and Federal Governments will be moving toward a more traditional water resource management relationship. However, there are still vestiges of the

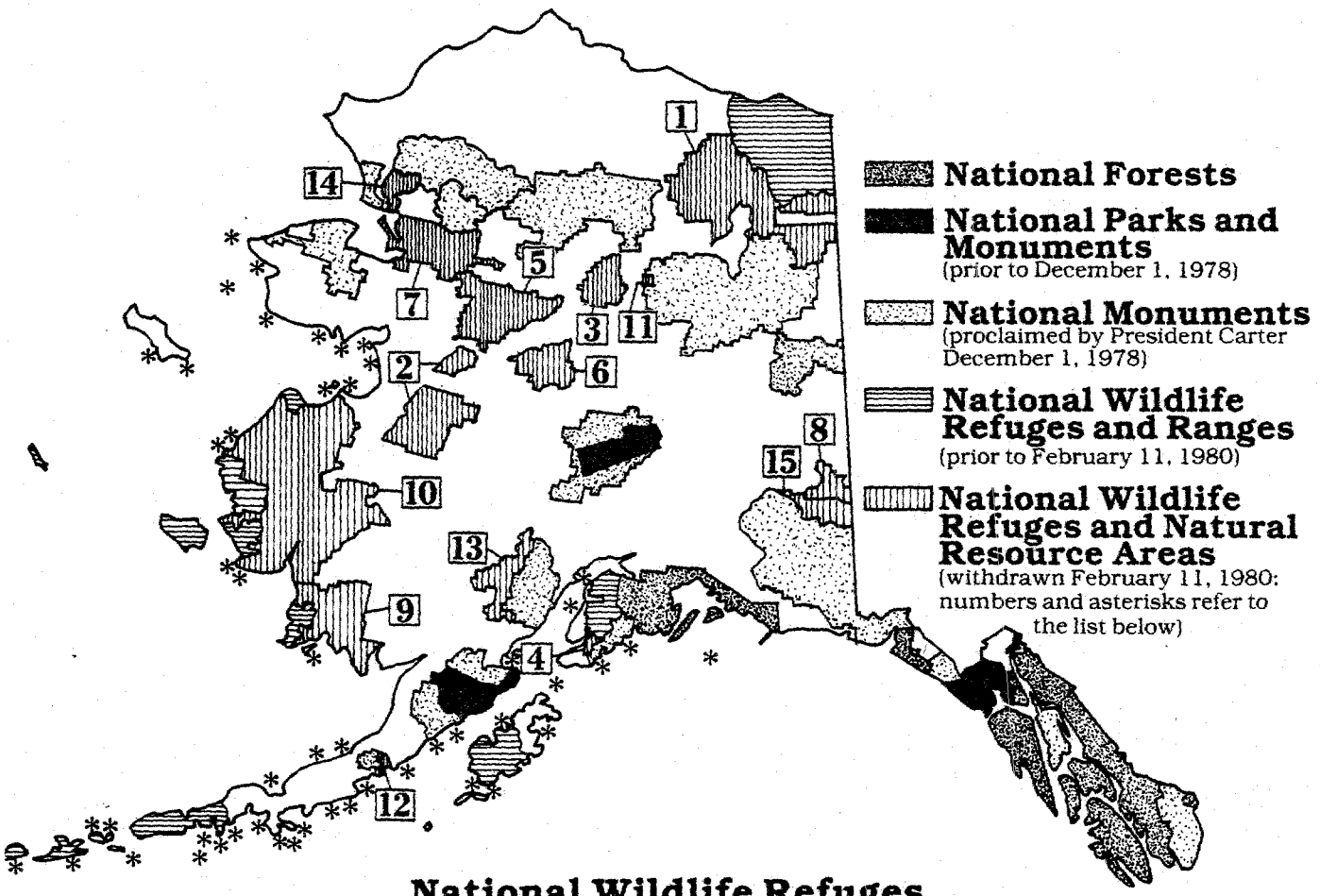
Table 1

ALLOCATION OF LANDS IN ALASKA

December 1978

General Ownership Categories	Approximate Area in Millions of Acres			Percent
Area within State Boundaries Including Inland Waters			375.3	100.00
State Lands (entitlement)				
Statehood Act Grants				
General Grant	102.5			
Community Grant	.4			
Community Grant from National Forests	.4			
Mental Health Grant	1.0			
University Grant	.1			
Total State Lands		104.4		27.8
Native Corporation Lands				
Village and Regional Lands, ANCSA		43.7		11.6
Other Private Lands		1.0		.3
Total State, Native Corporation, and Private Lands			149.1	39.7
Federal Lands, Designated				
Existing Conservation Systems	46.5			
Park System	6.9			
Forest System	19.7			
Refuge System	19.9			
Wildlife Refuges in Process of Creation	38.9			
National Monuments Created December 1, 1978 (56.0)	52.6			
Total Conservation Systems		138.0		36.8
Other Reserves and Withdrawals	25.3			
Petroleum Reserve-Alaska	22.8			
Military Reserves	2.4			
Department of Transportation	.1			
Total Federal Lands Designated		166.7		43.5
Total Federal Lands Undesignated		62.9		16.8
Total Federal Lands			226.2	60.3
GRAND TOTAL			375.3	

Figure 4



National Wildlife Refuges

* Alaska Marine Resources ..... 460,000 acres
1. Arctic ..... 9.5 million acres
2. Innoko ..... 2.85 million acres
3. Kanuti ..... 1.2 million acres
4. Kenai ..... 170,000 acres
5. Koyukuk ..... 3.33 million acres
6. Nowitna ..... 1.72 million acres
7. Selawik ..... 2.39 million acres
8. Tetlin ..... 770,000 acres
9. Togiak ..... 3.84 million acres
10. Yukon Delta ..... 10.6 million acres
11. Yukon Flats ..... 80,000 acres

Natural Resource Areas

12. Aniakchak ..... 160,000 acres
13. Lake Clark ..... 1.15 million acres
14. Noatak ..... 660,000 acres
15. Wrangell-St. Elias ... 1.24 million acres

territorial relationships in that there are frequent unilateral actions taken by Federal agencies, initiating uncoordinated water resource-related investigations out of context with the actions of AWSC and the State. Recognizing that old habits are hard to break, AWSC has been moving toward devising a "decision tree" to guide both State and Federal actions in water resource management. This includes the development of a priorities system and the integration and consolidation of interagency planning efforts.

Emerging Management Process

Under the present non-Title II Management Process study authorization, AWSC is evaluating the long-term linkages and actions that are needed to establish the decision tree. A proposal has also been submitted to WRC to conduct an "Implementation Level B" which would consolidate the management initiatives and implementation recommendations of all prior studies and investigations into a State action plan. As an adjunct to these efforts AWSC is moving to support the State in developing a State Water Resources Plan. However, neither a State Water Resource Plan nor the Management Study document will serve as, or call for, a "Comprehensive Water Plan" in the traditional sense. Rather, the direction taken will be toward providing a planning framework or strategy to use as a tactical management guide for coping with key managment issues.

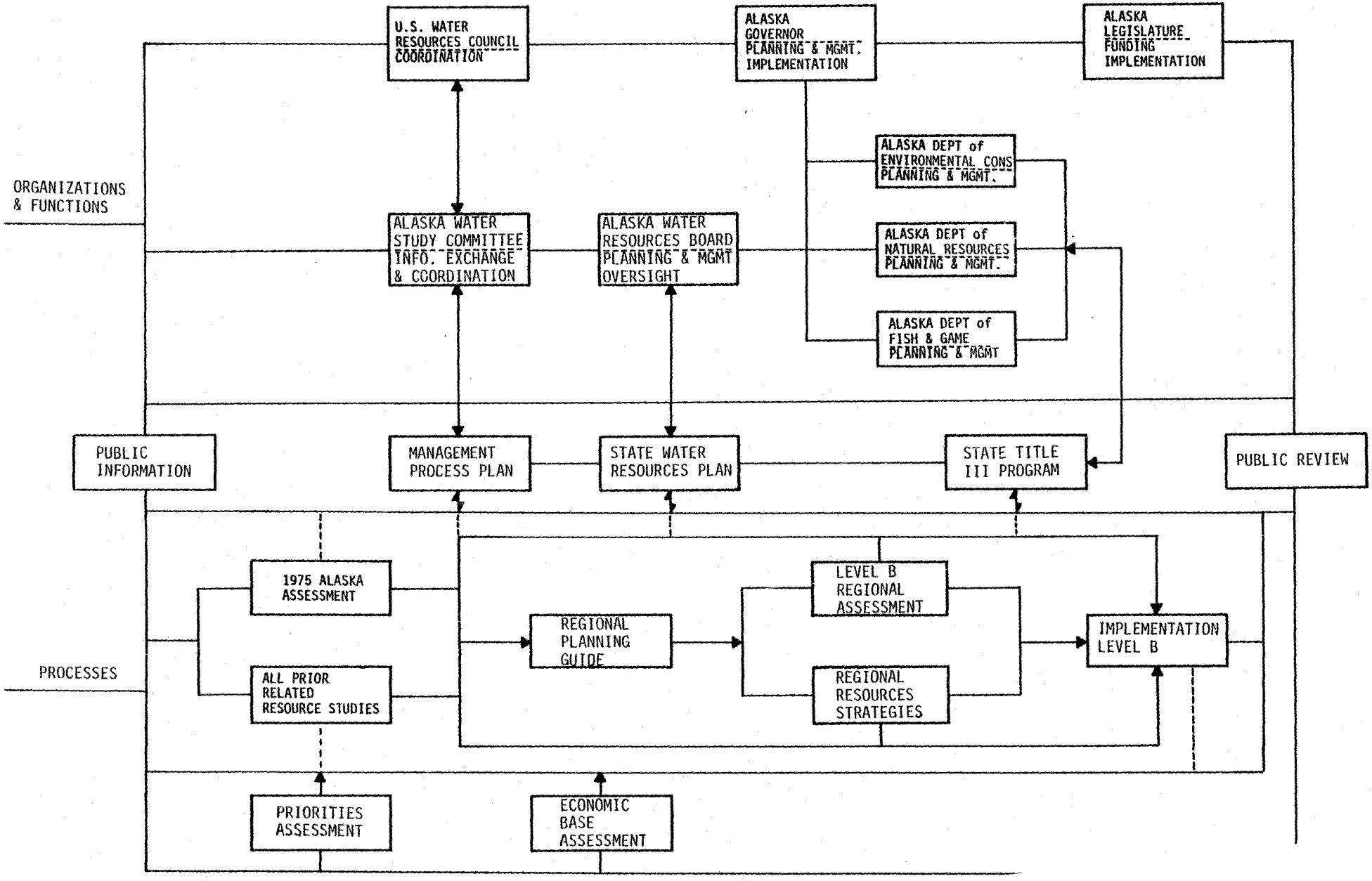
Subsequent to the Southcentral Level B, for each of the remaining hydrologic regions a "planning guide" should be completed identifying key issues, needs, and problems as an initial focus for subsequent study actions. Thereafter, if the issues, needs and problems are of sufficient complexity to warrant a broader study, a Level B-type screening assessment will be proposed.

Assuming that only a small number of items are identified, specialized studies would then be developed which would serve as regional water resource strategy plans. In total, then, the planning guides, the Level B Assessment, the Regional Resource Strategies, the Management

Figure 5

ALASKA WATER RESOURCES COORDINATION
& PLANNING INFORMATION DECISION TREE

LINKAGE NETWORK



Process Plan, the State Water Resources Plan, and the Implementation Level B coupled with the priorities assessment process and economic base analyses, would become the "whole cloth" for Unified Basin Planning and Management in Alaska. Each of the individual elements of the plan would feed into the priorities process and in total become the "Alaska Water Resources Decision Tree." However, with this system design, the lack of one or more of these elements at any point in time is not intended to preclude implementation actions from taking place on completed elements. Certainly, that fine day when the "whole cloth" is complete, the decision-making process for water resources management will be greatly enhanced. The real function of the "Unified Basin Planning and Management System for Alaska" is to assure accountability; that, in fact, progress is being made and can be measured relative to managing Alaska's water resources. Accountability includes responding to the Governor, to the responsible advisory bodies, to a remote village on the Aleutian chain, and to the individual protecting his water rights.

Conclusion

Although this paper is intended to demonstrate that a clear course of action has begun to evolve, Alaska is having the same problems as everyone else. Talking about coordination and integrated planning is one thing; accomplishment isn't all that easy. Also, while we are attempting to develop a program for statewide consistency in water resources management, we receive inconsistent signals and funding from the Water Resources Council. Further, efforts to achieve integrated planning, management objectives are hindered by certain institutional realities as follows:

** While agencies are functionally oriented, problems are becoming more complex, more inter-active, more inter-disciplinary.

** While managers may be "traditionalists" in performing functional roles, management problems are overlapping.

** While budgets are single purpose, strategies are multipurpose.

It would seem obvious a totally comprehensive program for water and related land resources planning and management is unrealistic and overly ambitious. However, it does seem possible that a comprehensive framework and management strategy can be developed both for Alaska and the nation. Using such an approach, Alaska needs to focus its energies on developing a program to set priorities; a framework to implement programs and projects; and an agency integration of planning and management activities. To achieve these elements of a comprehensive strategy, we suspect that not only Alaska, but all states need the following:

** better education and training, emphasizing generalists with a broad background of education and experience;

** better guidelines from Federal Government, including the Congress;

** better integration of fiscal responsibilities.

Finally, efforts such as this American Water Resoruces Association Conference are extremely useful in educating managers and planners and focusing the collective expertise of the nation's water resources managers on our common objective.

ACKNOWLEDGEMENTS

Graphic materials utilized for purposes of presenting this paper were drawn from the files of Alaska Northwest Publishing Co., Northwest Alaska Pipeline Co., the Anchorage offices of the U.S. Geological Survey, Bureau of Land Management, U.S. Public Health Service, and the Alaska Dept. of Transportation and Public Facilities representative, Jay Bergstrand, as well as from the offices of the Alaska Water Study Committee. Art and camera work, along with printing was provided by the Bureau of Land Management.

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