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# The Effect of Deep Sea Bed Mining on Strategic Minerals and National Security

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THE EFFECT  
OF  
DEEP SEA BED MINING  
ON  
STRATEGIC MINERALS  
AND  
NATIONAL SECURITY

GARY R. HAMMOND  
APRIL 1981

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## INTRODUCTION

Deep Sea Bed Mining has been a topic of considerable debate since it became technically and economically viable as a mining venture in the mid 1960's. The availability of manganese nodules has been determined through costly "prospecting" operations and their existence in sufficient quantity and quality has been found to be adequate for the mining industry. The means by which the industry will recover the nodules has been limited to three current designs. A continuous line of buckets seems to be the simplest method in terms of capital outlay and ease of maintenance. The use of a suction lift seems to be the most widespread design due to its relative ease of operation; however, it requires a much larger capital investment and much higher maintenance costs. The newest design (touted by a French Consortium) has been one which employs remotely controlled drones. They are released on the surface, "swim" to the bottom, scoop up a load of nodules and return to the surface where their load is received by the parent vessel.

The processing of the nodules will be an expensive operation compared to processing costs of current ores obtained from the land sites. Recent developments and innovations in the leaching process have served to reduce the cost somewhat. The processing costs may be reduced by technological breakthrough in the future, but they cannot be predicted.

The capital outlays which must be made by industry in order to proceed with deep sea mining is staggering. Prior to moving ahead with their investment, members of the industry would like to ensure that they will in fact be allowed to capitalize on the harvesting of manganese nodules. This point is the subject of heated debate in the ongoing United Nations Convention for the Law of the Sea (UNCLOS) negotiations. One of the many points covered by UNCLOS is the ownership of the nodules and who will be allowed to exploit them. With this item undecided, industry has turned to the U.S. Government for assistance and has found some consolation in the form of the Hard Minerals Act (passed by the Carter administration) which is pushing the U.N. Negotiations towards a more timely settlement. In addition, the Reagan administration has instructed the U.S. delegation not to complete the treaty until a new policy review takes place to determine whether the new draft offers the industry access to the nodules on fair and reasonable terms.

In addition to its attractive appeal to the ocean mining industry, the processing of manganese nodules will offer the U.S. mineral independence in three of the four major metals found in the nodules. This will reduce the probability of economic action against the U.S. by mineral cartels similar to those actions taken by OPEC and Alumina/Bauxite producers. The minerals associated with manganese nodule mining are considered to be strategic minerals. They are used throughout

the defense industry and more alarmingly, with the exception of copper, we rely heavily on imports from politically unstable regions of the world.

Although deep sea bed mining has tremendous economic and political advantages, we must bear in mind that it is only part of the current UNCLOS negotiations and its merit must be weighed with other important issues. To sacrifice the negotiations for one issue alone would be tragic and could inflict irreparable damage upon the U.N. as a negotiating body and upon all countries depending on the freedom of the oceans for trade, transportation and resources.

"In the meantime, the new industry of deep ocean mining lands in a political limbo. It moves tentatively forward only on the strength of the new federal law, knowing that a U.N. treaty could later drive the business beyond hope of return. Whether nodules will ever be collected will likely remain unanswered for some time.

In a world of shortages and rising expectations, there will always be a new technological horizon. The history of nodule mining, however, shows that future industries must fit into an increasingly complex environmental and political order that is itself a frontier effort. Clever technology alone may no longer solve the world's problems."<sup>1</sup>

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<sup>1</sup>Janet L. Hopson, "Miners are Reaching for Metal Riches on the Ocean's Floor." Smithsonian, April 1981, p. 58.



Though the future of the nodule mining is undetermined, it is the purpose of this paper to determine its impact on the national management of its associated strategic minerals and national security.

PART I

STRATEGIC MINERALS

## CHAPTER 1: STOCKPILING STRATEGIC MINERALS

Since 1946 the U.S. has maintained stockpiles of strategic materials sufficient in size to ensure the availability of essential minerals in the event of war. "Ostensibly limited to use during national wartime emergencies, the strategic stockpiles are intended to assure adequate critical mineral supplies during periods of stringencies. The very existence of the U.S. strategic stockpile program has also provided some preemptive protection against administered price increases and politically motivated shortages."<sup>1</sup>

The stockpile program originated in the Strategic and Critical Materials Stockpiling Act of 1946. The passage of this act seems to have been a direct result of shortages and severances of essential materials during World War II. With WWII fresh in everyone's mind, the act was written in an effort to reduce or prevent a reoccurrence of these shortages. The act, as it appears in 50 U.S.C. 98, says:

"That the natural resources of the United States in certain strategic and critical materials being deficient or insufficiently developed to supply the industrial, military and Naval needs of the country for common defense, it is the policy of the Congress

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<sup>1</sup>James A. Jordan and Robert A. Kilmarx, Strategic Mineral Dependence: The Stockpile Dilemma. The Washington Papers Volume VII No. 70 (Beverly Hills and London: Sage Publications, 1979), p. 39.

and the purpose and intent of this act to provide for the acquisition and retention of stocks of these materials and to encourage the conservation and development of sources of these materials within the United States, and thereby decrease and prevent wherever possible a dangerous and costly dependence of the United States upon foreign nations for supplies of these materials in times of national emergency (emphasis added).."

In 1950, the passage of the Defense Production Act was intended to provide wide ranging authority and definite powers for expanding the nations production capabilities. It includes arrangements for the purchase of strategic materials and supports the mining of essential minerals. The policy established by this act is stated in 50 U.S.C. 2062 and follows:

"In view of the present international situation and in order to provide for the national defense and national security, our mobilization effort continues to require some diversion of certain materials and facilities from civilian use to military and related purposes. It also requires the development of preparedness programs and the expansion of productive capacity and supply beyond the levels needed to meet the civilian demand, in order to reduce the time required for full mobilization in the event of an attack on the United States."

Stockpile objectives and actual levels were kept secret by the Executive Branch up until 1962. Since that time examinations by Congress have shown such irregular variations in the objective

levels that there appears to have been reasons other than national security for those changes. The period of 1963-1973 resulted in major fluctuations in the level of the stockpile due chiefly to the high usage rate of strategic minerals during the Vietnam War era.

In 1973, the stockpiles were in less than an ideal condition. Several minerals were liquidated and the administration decided to reduce the stockpile objectives to those necessary to support a one year military contingency, or rather, an orderly mobilization of the national economy for the duration of the conflict. With this in mind, it is easy to understand the complexity of factors which determine the size of each minerals stockpiles objective. Those minerals which have no substitutes or whose supply lines are less than dependable would require a much larger reserve than one which is easily and dependably obtained.

Due to a great deal of congressional criticism concerning the condition of the stockpile, the Ford administration initiated an extensive review of this policy in 1975. Based on the results of the inter-agency review, chaired by the Federal Preparedness Agency of the GSA, the stockpiles were returned to a 3 year contingency level and included both civilian and defense needs.

The Carter administration set an additional requirement that the U.S. must be able to support a 1 year NATO war in Europe on not more than a 30 day notice. This change has

caused an extensive review of current stores in the area of quality more than quantity. The short time frame required here demands an increased availability of finished metals rather than the availability of unprocessed ores.

Most recently, the national stockpiles have been the sources of considerable campaign rhetoric during the 1980 presidential campaign. The major focus was on the growing dependence of the United States on minerals supplied by small African countries whose reliability as a continuing source is questionable. This controversy resulted in the Materials Policy, Research and Development Act of 1979. "The bill requires the president to return to Congress ... a plan for implementing and establishing a national minerals policy and promoting industrial innovations in materials technology. The Defense Department within the same year must submit a list of critical materials needs related to national security."<sup>2</sup>

This most recent turn of events has expressed an undercurrent of tense awareness of the criticality of minerals supplied by foreign countries and our inability to control these supplies. This situation is supporting the call for increased stockpiles as we are trying to ensure against interruptions of critical supplies as a result of intentional or unintentional actions. The formation of OPEC as a viable oil cartel, the

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<sup>2</sup>"Minerals Emerge As Campaign Issue," Aviation Week & Space Technology, October 20, 1980, p. 115.

actions of aluminum producers imposing substantial export taxes and the political unrest in undeveloped countries have jointly undermined our confidence in maintaining an uninterrupted supply of critical/strategic minerals.

## CHAPTER 2: MINERAL DEPENDENCE

Of the 24 major non-fuel minerals required by industry, the U.S. is less than 30% self sufficient in 21 of them. Contrary to popular opinion the U.S. imports approximately two thirds of its minerals from industrialized countries. This number in itself is encouraging as the industrialized countries represent a stability and reliability of supply. Unfortunately, very few of the critical minerals are obtained from these dependable countries. Many of the more necessary minerals must be obtained from less reliable sources.

The reliability of the less developed countries varies a great deal and many are not very reliable at all. In 1976 there was a considerable number of problems experienced internally in Zaire and Zambia which resulted in a "cutoff" of approximately 8 percent of the world's cobalt supply and delayed ongoing improvements to their production capabilities. This resulted in less cobalt and increased prices. "The price rise in cobalt alone caused, for example, price increases for the F100 engine (jet) of almost \$18,000., the J79 engine, \$21,000., and TF39, \$21,000."<sup>1</sup>

This example encouraged a careful review of worldwide materials availability and vulnerability. A relatively small

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<sup>1</sup>Clarence A. Robinson, "Defense Science Board Urges Multi-year Contracts." Aviation Week & Space Technology, December 1, 1980, p. 132.



number of materials emerged on "most vulnerable" lists produced by several independent studies. "In nine such surveys, aluminum, chromium and manganese appeared on seven lists. Cobalt, nickel, tin and titanium appeared on six lists."<sup>2</sup> From these surveys, nine non-fuel minerals were identified as being most critical. They are: manganese, aluminum, nickel, tungsten, copper, cobalt, platinum, chromium and tin, and their sources are illustrated in Figure 1.

"The U.S. problem ... is intensified by the fact that world reserves are highly concentrated in key cases. Only 3 countries control over two thirds of five of the key minerals: 96.5% of chromium, 90.5% of manganese, 99.7% of platinum, 74.6% of tungsten, 69.4% of nickel, and 69% of cobalt. Only two ... South Africa and the USSR have ... dominance in platinum and manganese ... it is noteworthy that for these ... key minerals dominated by two suppliers, the U.S. has extremely high import dependence, 95% for platinum and 98% for manganese..."<sup>3</sup>

The substitutability of minerals is not always an option and certainly not a possibility in a short time frame notification of massive requirements from industry. With growing concern over political stability of mineral rich countries and possible

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<sup>2</sup>James A. Jordan and Robert A. Kilmarx, Strategic Mineral Dependence: The Stockpile Dilemma. The Washington Papers, Volume VII No. 70, (Beverly Hills and London: Sage Publications, 1979), p. 20.

<sup>3</sup>Ibid., p. 17.

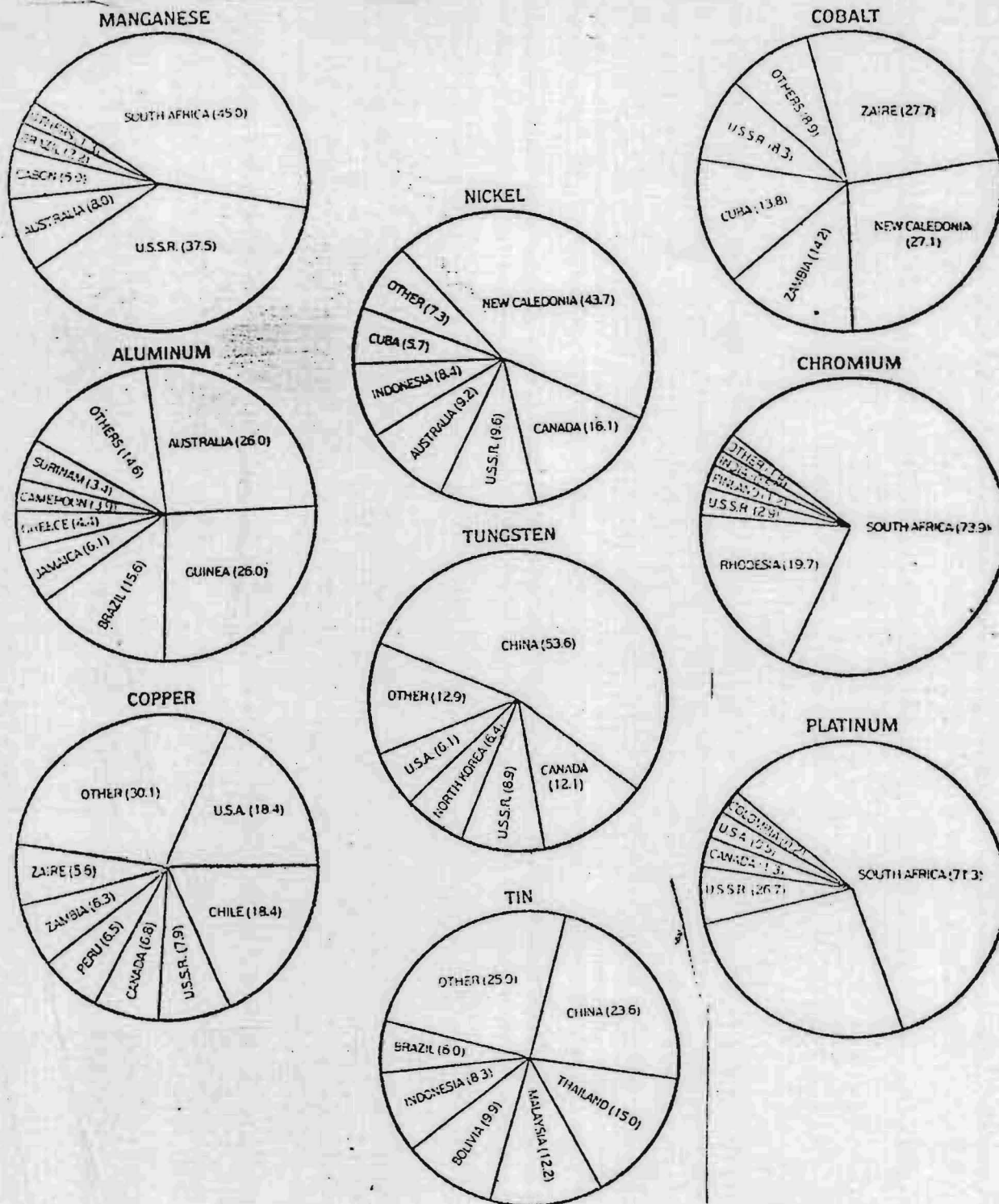


FIGURE 1: PERCENTAGE DISTRIBUTION OF MINERAL RESOURCES

SOURCE: AMOS A. JORDAN AND ROBERT A. KILMARX, STRATEGIC MINERAL DEPENDENCE: THE STOCKPILE DILEMMA. THE WASHINGTON PAPERS VOL VII, NO. 70, (BEVERLY HILLS AND LONDON: SAGE PUBLICATIONS, 1979),\* pp. 21-22.

cartel action by 3rd world countries, the industrialized countries are searching for new sources of minerals.

Political conflict in Zaire and Zambia (combined they control 42% of the world's cobalt) reduced the world's cobalt supply temporarily. Political upheaval or sanctions imposed on South Africa could seriously reduce the supply of manganese (45%), platinum (71%) or chromium (74%), to name only the more critical of their resources. One of the more right wing approaches also addresses the U.S.S.R's long term plan to gain control of the world's minerals through political upheaval or armed conflict in an effort to control the industrial capabilities of the west.

Regardless of the method used, the possibility of reduced supply of essential minerals exists. One source of minerals which is available to the industrialized nations is the sea beds of the world's oceans. The availability of manganese nodules is still politically debatable but the economic opportunities are enormous. Considering that the U.S. is self sufficient in copper, the possibility of reducing our mineral dependence in manganese, nickel and cobalt is encouraging indeed. Without even mentioning the effect on our balance of payments, the mere fact that we can become independent in 3 of the remaining 8 critical minerals is a cause for celebration.

The remainder of this report will concentrate on the capabilities of the proposed ocean mining industry and the effects which it will have on strategic minerals and national defense.

Several assumptions must necessarily be made. The first is that manganese nodule mining operation is limited by the sheer complexity of its apparatus and resulting restrictions on maneuverability to being a peacetime industry only. It would be impossible to defend a mining vessel against attack. This leads to the second assumption. In that this source would only be viable during peacetime, the stockpiles would necessarily have to remain at a high level, but a defense against cartel action could be assumed. The third assumption to be considered is the relative unimportance of copper in this study as the U.S. is close to self sufficiency in this mineral. This yields a fourth assumption that seems to be somewhat of a reversal of the intentions of the manganese nodule miners. Although nickel seems to be driving the economic intentions of the industry, the greatest advantage nationally appears to be the alleviation of import dependence in cobalt, manganese and nickel. While the miners have expressed little interest in processing the large amounts of manganese, the loss of this import would in effect shut down the U.S. steel industry.

PART II

UNITED STATES' MINERAL POSTURE

OF

NICKEL

COPPER

COBALT

AND

MANGANESE

## CHAPTER 1: CURRENT CONSUMPTION

The industries of the United States have relied heavily on raw materials since their inception. The demand for resources has been increasing at a varying rate since the industrial revolution established this country as a major producer of fabricated goods. As technology increased we found ourselves searching for specialized resources which would enable us to provide better quality products. The four major manganese nodule metals are relied on heavily by manufacturers of specialized products. Manganese, for example, is used in the manufacture of iron and steel. It is used in the smelting process to remove sulfur and maintain the purity of the product. Nickel is used in steel alloys requiring corrosion resistance and high strength. Cobalt is used in jet engine parts required to withstand high temperature and to make machine tools due to its extreme hardness when alloyed. Copper is used in practically all things electrical and in low temperature piping systems requiring corrosion resistant properties.

Due to the specialized nature of the products in which these minerals are used, it is not practicable to find substitutes for these minerals. As shown in Table 1, the consumption rate of nickel is projected to increase at a rate of 3% annually through the turn of the century. This would increase our consumption of nickel from a 1970 level of 311 million pounds per year to 770 million pounds per year in the year 2000. Although a great

TABLE 1

CURRENT AND PROJECTED CONSUMPTION OF MINERALS BY THE U.S.

	<u>CONSUMPTION</u>
NICKEL (1970)	311,400,000 LBS
(2000)	770,000,000 LBS
COPPER (1970)	1,572,000 SHORT TONS
(2000)	5,400,000 SHORT TONS
COBALT (1970)	16,140,000 LBS
(2000)	24,700,000 LBS
MANGANESE (1970)	1,327,000 SHORT TONS
(2000)	2,360,000 SHORT TONS

SOURCE: U.S. DEPARTMENT OF THE INTERIOR, FIRST ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR UNDER THE MINING AND MINERALS POLICY ACT OF 1970. (P.L. 91-631), (WASHINGTON D.C.: U.S. GOVERNMENT PRINTING OFFICE, 1972).

deal of current imports are obtained from Canada, the increased consumption levels are expected to be met in part by imports from newly found deposits of higher grade ore in Australia and several other South Pacific island nations.

The annual consumption of copper as of 1970 was 1,572,000 short tons and is expected to increase at an annual rate of 3% also. By the year 2000 this represents a total consumption of 5,400,000 short tons of copper per year. Although we are practically self sufficient in copper production, we are increasing our imports due to lower grade ore in the U.S. as compared to available imports, high labor costs and increasing anti-pollution standards (estimated by the bureau of mines to have increased the price of U.S. copper by 10%).<sup>1</sup>

The annual consumption of cobalt, estimated to be increasing at an annual rate of 2.9%, was 16,190 thousand pounds in 1970 and will increase to 24,700 thousand pounds in the year 2000. Although the total amount of cobalt used annually is somewhat less than nickel and copper, it plays a very important part in the U.S. efforts in technology. Cobalt is used in many new alloys required to provide higher strength metals under high temperatures and pressures. Efforts to increase production of cobalt are complicated by the fact that cobalt is a by-product of nickel and copper. It is a very small percentage of these

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<sup>1</sup>Minerals Yearbook, U.S. Bureau of Mines, Department of the Interior, (Washington, 1973).



deposits, the richest (found in Zaire) contain a high of 2% cobalt and average much less.

Manganese is an essential metal to the iron and steel industry. It is used to extract impurities from iron and steel. U.S. consumption of manganese was 1,327,000 short tons in 1970 and is estimated to increase at a rate of 1.7% annually, resulting in a consumption of 2,360,000 short tons by the year 2000. A future increased availability of manganese is not expected unless a discovery of a large deposit is made. The U.S. is extremely dependent on this resource and it is supplied to us from six different countries. Since South Africa and the USSR hold 82% of the world reserves, the dependability of future supplies is questionable.

The trend towards future increases in consumption yields the need to obtain increased supplies. As technology continues to increase, more advanced alloys will be required to satisfy increasing performance parameters as strengths, temperatures and pressures increase in advanced systems. As these alloys are created, the current relative importance between minerals may change to increase or decrease our dependence on foreign sources; however, based on our best look into the future, cobalt, manganese, nickel and copper will remain on the list of critical minerals.

## CHAPTER 2: PRODUCTION AND IMPORTATION

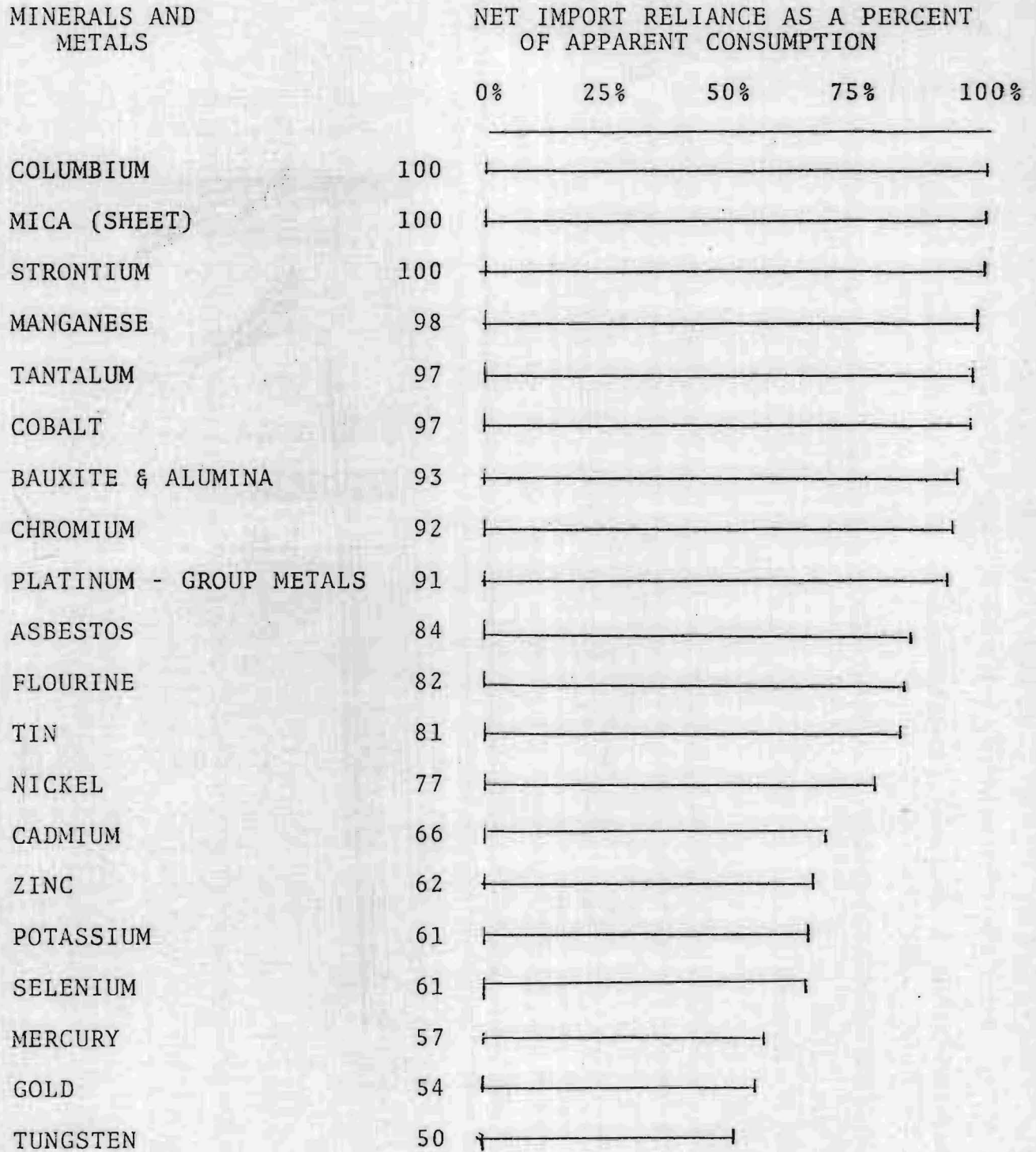
In a report by the Commander of the Air Force Systems Command, made to the House Armed Services Committee Industrial Preparedness Panel, General Slay addressed U.S. dependence on foreign mineral sources. He said that "the country is more than 50% dependent on overseas sources for more than half of approximately 40 minerals described as most essential to the \$2.3 trillion U.S. economy. Some of these raw materials come from highly unstable areas of the world."<sup>1</sup> Of the nine most critical minerals, four of them may be obtained in varying amounts by mining of manganese nodules from the deep sea bed. The degree to which this new source is needed may best be presented in a comparison of mineral imports versus domestic production as a percentage of consumption.

As shown in Figure 2, the U.S. is totally dependent on foreign supplies of cobalt and manganese. The sources of these two minerals are various. Manganese comes from Brazil, Gabon, South Africa and Zaire. Cobalt is received from Zaire, Belgium, Luxembourg, Finland, Canada and Norway. Of these sources, 53% of the world's manganese and 52% of the world's cobalt come from states in southern Africa. This emphasizes the question of reliability of resources.

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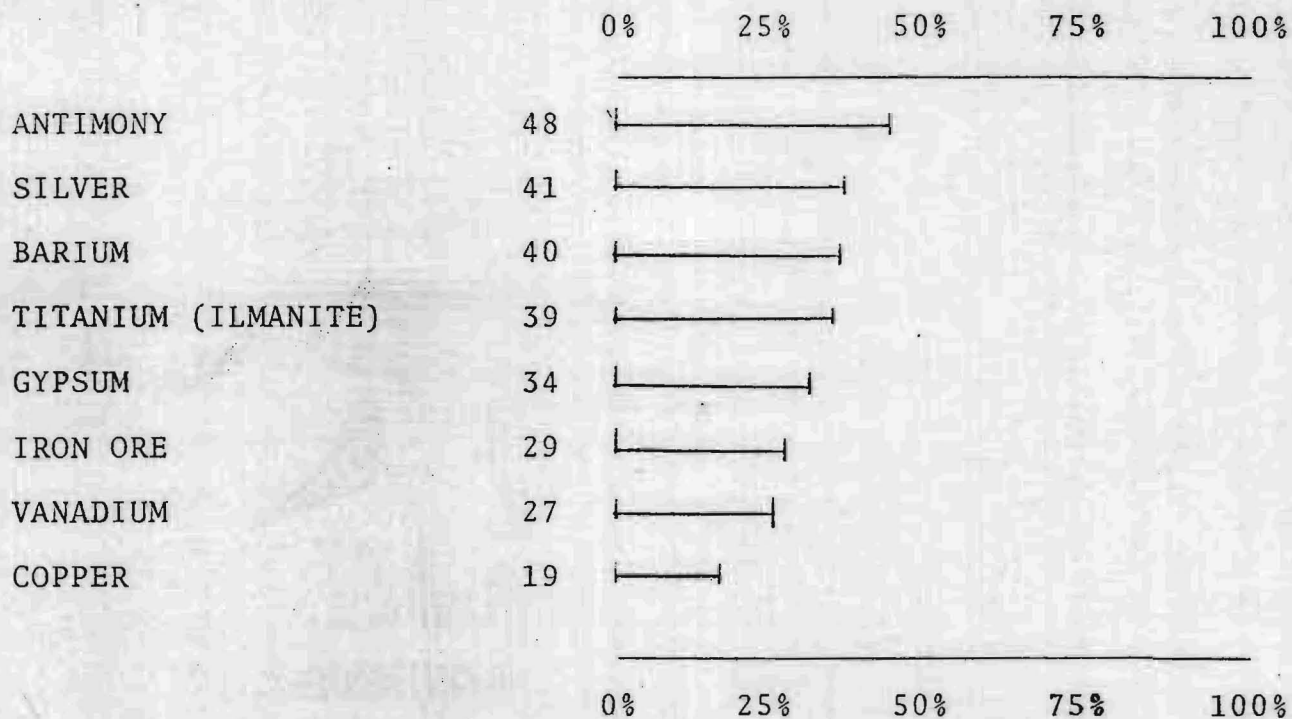
<sup>1</sup>Clarence A. Robinson, "Defense Science Board Urges Multi-Year Contracts." Aviation Week & Space Technology, December 1, 1980, pp. 130-133.

FIGURE 2  
 U.S. NET IMPORT RELIANCE OF SELECTED MINERALS AND METALS  
 AS A PERCENT OF CONSUMPTION IN 1977



MINERALS AND METALS

NET IMPORT RELIANCE AS A PERCENT OF APPARENT CONSUMPTION



SOURCE: AMOS A. JORDAN AND ROBERT A. KILMARX, STRATEGIC MINERAL DEPENDENCE: THE STOCKPILE DILEMMA. THE WASHINGTON PAPERS VOL VII, NO. 70, (BEVERLY HILLS AND LONDON: SAGE PUBLICATIONS, 1979), pp. 21-22.

The U.S. has historically been self sufficient in copper resources. As shown in Table 2, we are projecting a much greater usage than we will be able to supply. This is due primarily to escalating production costs in the U.S. As a result, we will be importing 65% of our copper in 1985 and 55% in the year 2000. This represents 3,990,000 short tons in 1985 and 3,020,000 short tons in 2000. We are currently relying on Canada, Peru and Chile for the small amount of copper which we import. As our consumption grows we will be able to make up the majority of the difference with the neighbors in this hemisphere, but an increasing amount will have to come from other sources.

Nickel is available in U.S. deposits also but our available reserves are quite small. We imported 90% of our consumption of this mineral in 1970, project an importation of 87% in 1985 and 88% in the year 2000. Our primary sources of nickel are Canada and Norway. As our imports increase we can expect to receive greater quantities from southern Africa and the South Pacific islands. The increases represent a yearly import of 680,600,000 pounds of nickel by the year 2000.

TABLE 2

COMPARISON OF U.S. DEMAND WITH U.S. PRODUCTION 1970, 1985, 2000  
(UNITS IN THOUSANDS)

	<u>1970</u>	<u>1985</u>	<u>2000</u>
	DEMAND/PRODUCTION	DEMAND/PRODUCTION	DEMAND/PRODUCTION
COBALT	16,190 LBS/0	20,000 LBS/0	24,200 LBS/0
COPPER	1,572 ST/1,720 ST	2,900 ST/1,910 ST	5,400 ST/2,380 ST
MANGANESE	1,372 ST/66 ST	1,770 ST/0 ST	2,360 ST/0 ST
NICKEL	311,400 LB/30,600 LB	492,200 LB/60,000 LB	770,000 LB/84,900 LB

DATA FROM U.S. DEPARTMENT OF THE INTERIOR, FIRST ANNUAL REPORT OF  
THE SECRETARY OF THE INTERIOR UNDER THE MINING AND MINERALS  
POLICY ACT OF 1970, (P.L. 91-631), (WASHINGTON D.C.: U.S.  
GOVERNMENT PRINTING OFFICE, 1972).

PART III  
DEEP SEA BED  
MINING  
OF  
MANGANESE NODULES

## CHAPTER 1: FEASIBILITY

The technology exists to "harvest" manganese nodules from the deep sea bed. Using one of several designs, a deep sea mining vessel can obtain manganese nodules from 15,000 foot depths and deposit this "catch" on a cargo vessel for transportation to, and processing at, a shore based refining/processing facility. The technology is here and lacks only the capital to proceed to the operational phase of the venture.

The economic aspect of the mining operation is, however, much more complicated. Of three major factors involved in the economics of this project, the first, the fact that the majority of the expense of this project lies in the land based operations, is not generally recognized. The processing of the nodules is a detailed and costly undertaking. One company intends to refine all four of the major minerals but most are interested in refining only nickel, cobalt and copper. The recovery of 1 to 3 million short dry tons/year is claimed to be necessary to turn a profit. While operating costs vary from \$18-\$75/ton of nodules, and the sale of the final products are estimated at \$65-\$75 per ton, yielding profits varying from nil to \$47-\$57 per ton before taxes. Since the range of operating costs varies so drastically, it can only be assumed that certainties in these estimates are not enjoyed by the mining enterprises.

A second major economic impact is the influence that forces outside of the industry have on their profitability. These



forces will have a direct impact on the future of deep sea bed mining. Primarily, the current deterrents to the industry are the third world nations demanding a share in the "common heritage of mankind." Until debate on this subject is completed in the U.N. or the U.S. decides to go its own way, the industry is at a standstill until the decisions are made to: establish the economic rent which must be paid to international authorities, the future prices at which the nodules will be sold, and how the ocean mines are restricted in competition with land based mining.

The third major economic factor which will impact the operation is that of financing. Since the immense capital costs (shown in Tables 3 and 4) cannot be met by the mining companies/consortia themselves, loans from banks must be obtained. Due to the many legal complications associated with deep sea bed mining, banks are reluctant to approve the necessary loans. "Thomas C. Houseman, a vice-president of Chase Manhattan Bank, in testimony before a Senate subcommittee, made his position very clear: 'In view of the demonstrated desire of the international community to establish control over such an activity, the present absence of political sponsorship and security of tenure constitute an unacceptable business risk to a financial institution.'

The inability of mining companies to obtain the necessary loans ... effectively stops them from moving ahead ... It is possible for the U.S. government to provide mining companies

TABLE 3

OCEAN MINING COST ESTIMATES (1975) (MILLIONS OF DOLLARS)

	<u>LOW</u>	<u>MEDIUM</u>	<u>HIGH</u>
EXPLORATION AND R&D	75	125	150
CAPITAL COSTS	385	468	550
TOTAL INVESTMENTS	460	593	700
WORKING CAPITAL	40	45	50
ANNUAL OPERATING COSTS	120	143	165

SOURCE: REBECCA L. WRIGHT, "OCEAN MINING: AN ECONOMIC EVALUATION." OCEAN MINING ADMINISTRATION, DEPARTMENT OF THE INTERIOR, MAY 1976, p. 11.

TABLE 4

ALLOCATION OF CAPITAL COSTS: \$493 MILLION  
(IN MILLIONS OF DOLLARS)

<u>MINING SECTOR</u>	<u>TRANSPORT SECTOR</u>	<u>PROCESSING SECTOR</u>
PLATFORM . . . . . 54	SECTOR COSTS . . . 55	EQUIPMENT . . . . . 199
PIPE HANDLING . . . . 21		UTILITIES . . . . . 84
LIFT . . . . . 9		SITE . . . . . 20
POWER PLANT . . . . . 7		BUILDINGS . . . . . 20
NAVIGATION . . . . . <u>5</u>		WASTE DISPOSAL . . . <u>19</u>
	<u>55</u>	<u>342</u>
TOTAL CAPITAL COSTS . . . . .		493

SOURCE: J. D. NYHART, LANCE ANTRIM, ARTHUR E. CAPSTAFF, ALLISON D. KOHLER, DOYLE LESHAW, "A COST MODEL OF DEEP OCEAN MINING AND ASSOCIATED REGULATORY ISSUES." MIT SEA GRANT REPORT, (MITSG 78-4), MARCH 1, 1978, p. ES4.

with investment guarantees, thereby eliminating the risk involved to the companies and banks. Houseman stated that, were the companies to receive investment guarantees in legislation, financial support from the banks would be forthcoming."<sup>1</sup>

Most recently, the Reagan administration appears to be bent on pushing deep sea bed mining through the U.N. in a way which is fair and equitable to those companies that have invested so heavily thus far. As the political turmoil is what it is, this study is necessarily limited to the impact of deep sea bed mining given no unforeseen depletions of currently planned revenues.

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<sup>1</sup>Jack N. Barkenbus, Deep Sea Bed Resources, Politics and Technology. (New York: The Free Press, 1979), p. 22.

## CHAPTER 2: CAPABILITY

Manganese nodules provide the opportunity of reducing foreign imports drastically given the proper political and economic framework. The total possible impact has to be measured in several different areas: (1) ocean resources; (2) available concentrations; and (3) annual harvest per mine site.

To consider the available resources we must consider that mining companies have defined acceptable nodules as those containing at least 1.24% nickel, 1.03% copper, 0.24% cobalt and 24% manganese. With this in mind, it is currently estimated that the world's oceans contain 2100 million tons of manganese nodules. As shown in Table 5, the processed amount of minerals equate to an estimated 88% of the world demand for nickel, 7% of the world demand for copper, 367% of world demand for cobalt and 127% of world demand for manganese.

The existing concentrations of nodules available for mining operations vary with each company's surveyors. The various estimates represent a low of 4 available sites to a high of 185. The large variation is due to the varied definitions of "sure" sites and "possible" sites.

Based on previous determined economic models, a single mining operation is expected to harvest 3 million tons annually. This would result in a yield of 42,000 tons of nickel, 37,000 tons of copper, 4,000 tons of cobalt and 750,000 tons of

TABLE 5

POTENTIAL CONTRIBUTION OF OCEAN RESOURCES

	TOTAL SEA BED RESOURCES (MILLIONS OF TONS)	RATIO OF RESOURCES TO CUMULATIVE WORLD DEMAND 1976-2000		
		LOW	MED	HIGH
NODULES	2100			
NICKEL	26.0	1.00	0.88	0.82
COPPER	22.5	0.08	0.07	0.06
COBALT	5.0	4.39	3.67	3.28
MANGANESE	504.0	1.34	1.27	1.10

SOURCE: JUDITH KILDOW, ED., DEEPSEA MINING. (CAMBRIDGE AND LONDON: MIT PRESS, 1980), p. 101.

manganese per year. Based on 1975 levels, this equates to 5% of world production of nickel, 0.5-1% of copper, 12% of cobalt and 7% of manganese.

Given then, that production capabilities are both available and significant, we can see that the projected levels of imports in 1985 can be reduced. As shown in Table 6, the U.S. can theoretically satisfy 100% of its projected 1985 import levels in nickel, cobalt and manganese and 18% of its copper imports by employing 5 deep sea mining vessels. This would be a significant step forward in our battle to gain self sufficiency in minerals.

TABLE 6

COMPARISON OF EXPECTED LEVEL OF IMPORTS (1985) WITH POSSIBLE PRODUCTION LEVEL OF 5 DEEP SEA MINING SITES.

	<u>IMPORT REQUIREMENTS (1985)</u>	<u>5 MINE SITES</u>	<u>% OF IMPORTS</u>
NICKEL	432,200,000 LBS	420,000,000 LBS	97
COBALT	20,000,000 LBS	40,000,000 LBS	200
MANGANESE	1,770,000 TONS	3,750,000 TONS	211
COPPER	1,000,000 TONS	185,000 TONS	18



PART IV

NATIONAL SECURITY

## CHAPTER 1: MATERIALS VULNERABILITY

In the 1973-74 time frame, conflicts in the Middle East prompted the initial oil embargo imposed by OPEC. This resulted in skyrocketing prices in the petroleum industry. This was the initial tremor of the third world's drive for a new world economic order. Shortly thereafter, the International Bauxite Association was formed and bauxite taxes were raised from \$1.80/ton to \$15/ton resulting in a doubling of the price of delivered bauxite. Following these leads, mineral producer associations were formed in copper, tungsten, mercury and iron ore, and less developed countries began urging changes in the marketing structure of metals.

As a result of these activities, there has been an increased interest in the efforts put forth by the U.S. government to counter these moves and provide safeguards which will minimize the effect of future unified actions by significant mineral producers in the third world. Proposed solutions have varied from increasing efforts in mineral production technology, revising stockpile philosophies, to improving mineral management.

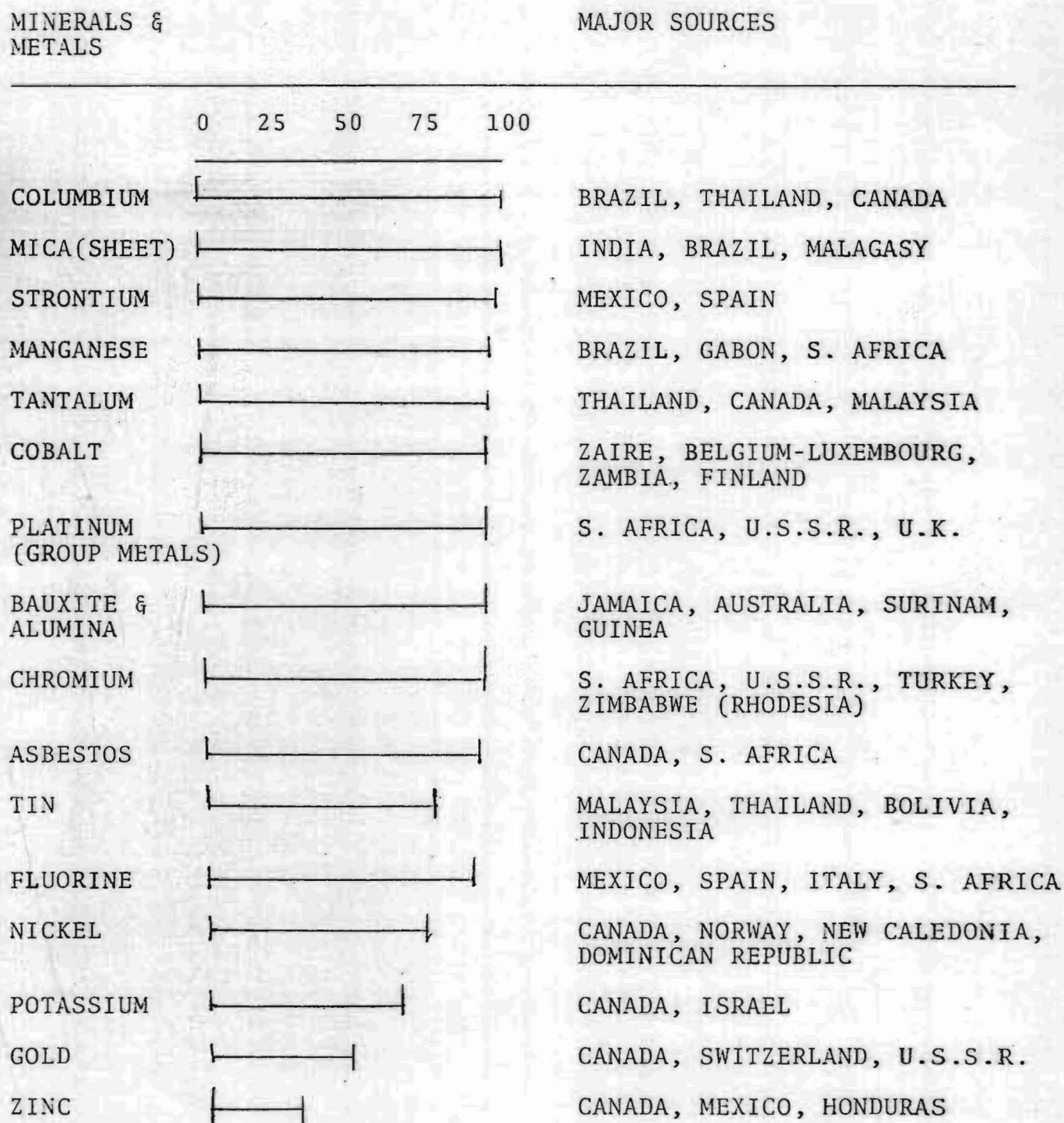
The U.S. is dependent on imports for many of its industrially used minerals. A representative sample of various imports are shown in Figure 3. An unscheduled cutoff of minerals could seriously damage our ability to produce affected goods and require the use of substitutes to produce lower quality goods (where that option would be found acceptable). If additional

deposits of a desired mineral could be found, mining operations, once initiated, could be expected to commence in a short estimate of five years, but normally ten years.

A more effective use of unilateral action would result in a joint cartel action (increasing prices and reducing output) similar to the OPEC strategy. In addition to achieving a greater monetary return and conservation of limited resources, a clever manipulator can also control the amount of a specific mineral used by a consumer in need of a non-substitutable resource. This in effect would result in exterior control of a nation's industrial capabilities (at least in those areas requiring that specific mineral).

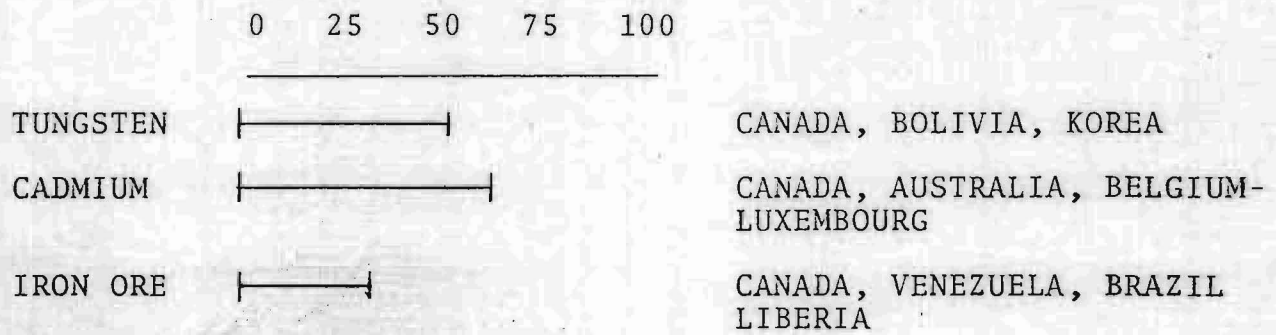
As previously discussed, manganese nodule metals represent four of the nine critical minerals which we are most dependent upon outside sources for supply at this time or in the foreseeable future. While we import all of our manganese, 53% of the world's reserves are in Southern Africa, and 82% is held by two countries, the USSR and South Africa, neither of which can be counted on for a continuous supply in the future. We also import all of our cobalt and 52% of the world's cobalt is produced in Southern Africa, primarily Zaire and Zambia. While sources for nickel and copper are less critical, we still import 74% and 18% (respectively) of these minerals. Although their current sources are reliable, we expect to double our consumption by the year 2000 and the projected sources of these minerals are South Pacific islands, Australia and Southern Africa.

FIGURE 3  
NET IMPORT OF SELECTED MINERALS AND METALS  
(% CONSUMPTION, 1979)



MINERALS &  
METALS

MAJOR SOURCES



SOURCE: CLARENCE A. ROBINSON, "DEFENSE SCIENCE BOARD URGES MULTI-YEAR CONTACTS," AVIATION WEEK & SPACE TECHNOLOGY, (DECEMBER 1, 1980), p. 133.

As our need for future sources of these minerals becomes more obvious, we seem to be inexorably drawn to the southern countries of Africa. As shown in Figure 4, it is easy to see that the vast material resources of the area are immense. Their reliability as a future supplier is not totally dependable. Frequent coups and revolutions can easily change national policies and several countries in the area have already aligned themselves with communist countries.

The four minerals being considered by this study are inextricably tied to national security. The Department of Defense depends on the industrial manufacture of arms and munitions. Whether used as repair parts or replacements/additions to existing forces, the production of defense related hardware is necessary to maintain current force levels and an increased output will be required during times of conflict. Manganese, used in the purification of iron and steel, is an essential element in this manufacturing process. Cobalt (as shown in Figure 5) used in high strength/high temperature alloys is an essential element in the manufacture of jet engine parts. Copper and nickel are jointly used in the manufacture of piping and conductors and are both used widely in the civilian community as well as the military. If the flow of these four minerals into the U.S. could be adequately controlled, the security of the country could be severely threatened.

MINERAL RESOURCES: SOUTHERN AFRICA

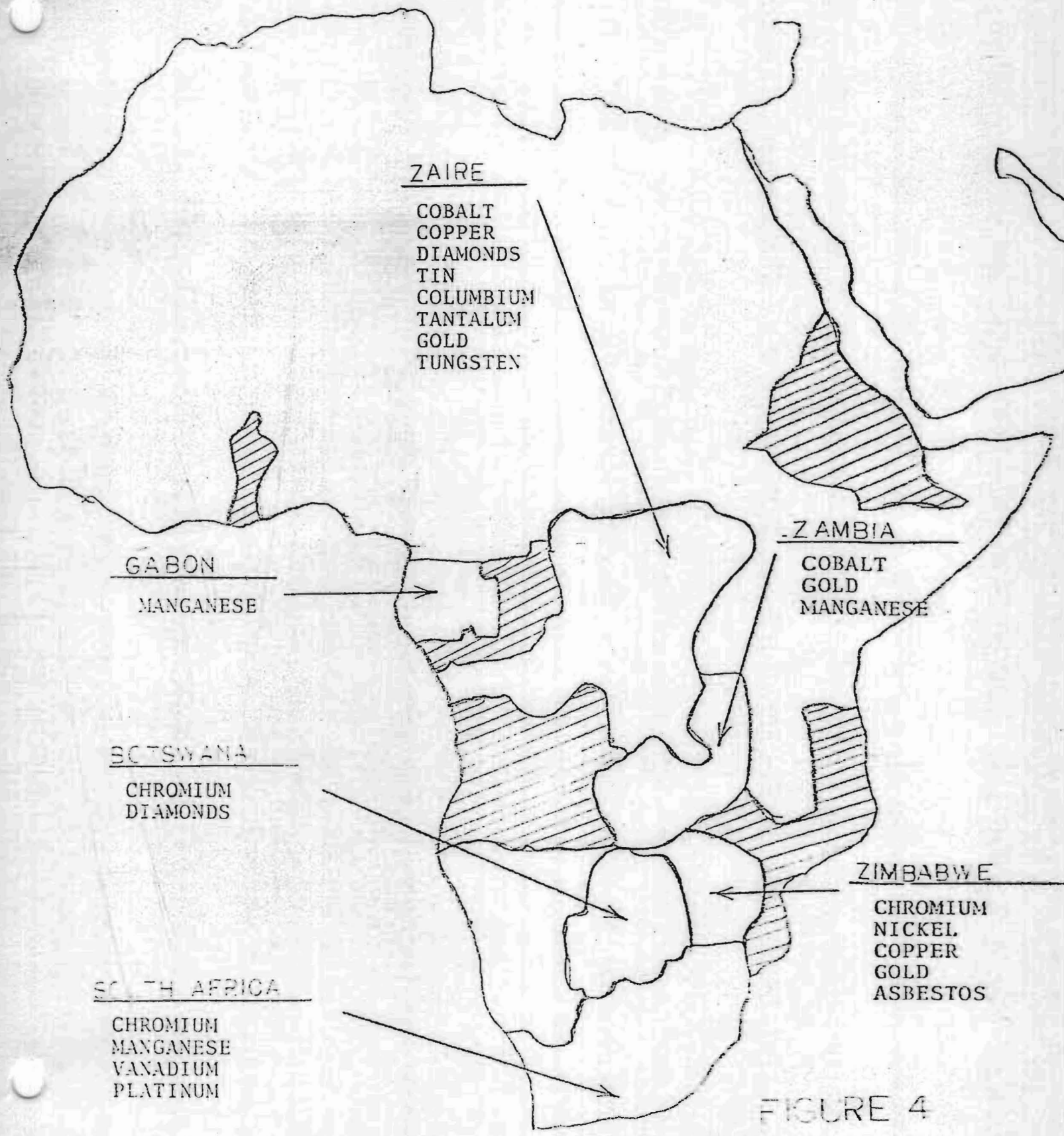


FIGURE 4

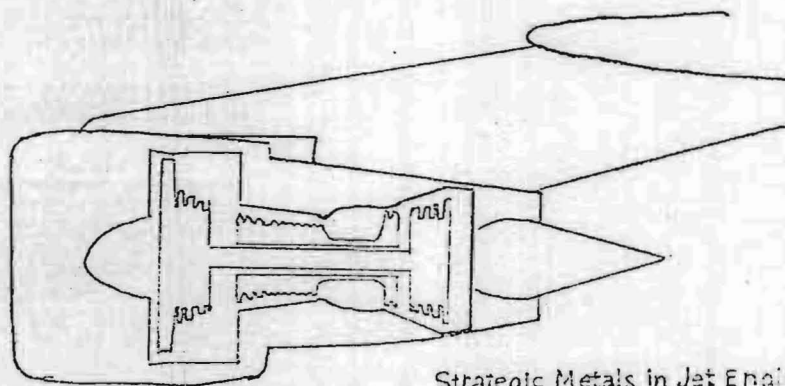
FIGURE 5

STRATEGIC METALS IN JET ENGINES

CHROMIUM  
COBALT  
COLUMBIUM

CHROMIUM  
COBALT  
TUNGSTEN

CHROMIUM  
COBALT  
COLUMBIUM  
TUNGSTEN  
TANTALUM



Strategic Metals in Jet Engines

FIGURE 5



## CHAPTER 2: ECONOMIC STOCKPILING

In an effort to protect our country from a shortage of minerals during wartime, Congress (in 1946) provided for the stockpiling of strategic minerals which would ensure a supply adequate to provide an efficient transition to the wartime production levels of our industries. This is based on the estimated needs of the military to support an armed conflict of a conventional scale for a specified period of time varying from 1 to 3 years.

Recently the administration has directed that studies are to be undertaken to determine the need for economic stockpiles. These are proposed as a hedge against unified or cartel action in the various areas of mineral production. The idea is based on the assumption that, given enough reserve supplies on hand, the mineral users could survive longer (with the same production levels) than the cartel could afford to hold back production. This idea has many supporters and opponents.

Those opposing the idea point out that the only sure way to avoid devastating cartel actions is to locate other available resources, chiefly in the unsurveyed reaches of the United States. If this is an unfruitful attempt then other more reliable sources must be found and developed. The proponents of the stockpile point out that the tapping of a new source is an extremely long lead time operation and that at least the stockpile could be built up over a shorter period and provide a much closer resource.

The concept of maintaining economic stockpiles seems to be a good idea in theory. The use of economic stockpiles could turn the world into a chess board with minerals as the pieces in the strategic positioning of the ever shrinking reserves of non-fuel minerals.

### CHAPTER 3: DEEP SEA BED MINING: ANOTHER ALTERNATIVE

While stockpiles are an obvious defense against cartelization or embargoes, they tend to offer many vulnerabilities. Should economic stockpiles be drawn on whenever there is a shortage in supplies or rise in prices? If so, at what point do we start drawing on them? Once they have been reduced, are they not then vulnerable to the supplier's actions? Will questions of this sort generate desire for another stockpile to protect the economic stockpile? These are not simple questions.

Deep sea bed mining provides a partial solution to the need for national economic stockpiles. Although many mineral needs are being considered for the economic stockpile, manganese nodule mining offers an alternative to costly surplus stores of nickel, copper, cobalt and manganese.

The mere concept of developing machinery capable of retrieving these nodules has reduced the threat of market price increases. A great deal of the success of these ventures is based on a minimum price for the final product. If a cartel was to increase prices, the economic feasibility of each deep sea mining site would increase, thus increasing the competition of production. As previously seen, the capability of deep sea production to provide these safeguards is significant due to its potential to supply a high percentage of U.S. consumption in nickel, cobalt and manganese. Due to the lower percentage supplied of copper, the protection against price hikes is not as significant.

Ocean mining also offers protection against embargoes. As our capability in this field grows, an embargo of any of the four minerals would be foolhardy as it would cause a greater reliance on deep sea bed mining capabilities.

Ocean mining will offer protection against cartel actions. This will be seen primarily in the manganese market. Copper cartels are unlikely due to the considerable size of U.S. deposits. A nickel cartel would require the active participation of Canada and is therefore improbable. Cobalt is very close to being monopolized by Zaire and price protection would already be afforded. Manganese offers a very real possibility of forming a producer's association as suppliers are diverse and are somewhat less than political allies of the U.S. Therefore, the primary protection against cartel action is created in the vast amount of manganese which can be obtained from the sea floor. The sheer volume produced would result in a breaking of any cartel attempt to restrict worldwide production.

National security is therefore enhanced by the use of ocean mining. It is immediately protected by preventing control of part of our industrial capacity and therefore our capability to produce essential material required for civilian and military needs. It also provides a protection against external powers attempting to influence our national policies. These two instances provide security against very possible actions. It can only be concluded that the national economy and security will be greatly served by deep sea bed mining.

SUMMARY

## SUMMARY

The U.S. enjoys the luxury of being more self sufficient in mineral resources than most other highly developed, highly industrialized countries. We are however becoming increasingly dependent on foreign suppliers for critical materials needed by industry to satisfy our military requirements.

Although these difficulties are not foreseen as the source of armed conflict in the future, it must be assumed that restrictions in minerals supplies may at the minimum produce considerable international frictions. Any means available to reduce our dependence on critical materials must be carefully considered in an effort to curtail the effects of reduction in these critical supplies.

A very real option is, unquestionably, the exploitation of manganese nodule resources. This choice offers protections against price increases, embargoes and cartel action which may be initiated in nickel, cobalt, copper and manganese markets.

The economic feasibility of this venture grows as minerals become scarce or prices start to rise. It offers a protection to industry, the military and enhances national security. The benefits are many and need to be carefully reviewed by policy makers.

While we are anticipating the outcome of the current Law of the Sea negotiations, we must bear in mind that there are many topics to be discussed and agreed upon. Ocean mining is

only one facet of these negotiations. Regardless of the economic and security benefits, they must be considered in light of the other available benefits which are being negotiated for in this convention. Too little flexibility in any one area can compromise desired outcomes in others. We must strive for the most advantageous position in all facets of UNCLOS realizing that reorientation of policy may be required to arrive at the best possible results.

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RHODE ISLAND'S BARRIER BEACHES:

AN ASSESSMENT OF THEIR FUTURE

BY

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Marine Affairs Seminar

GMA - 652

Dr. Dennis Nixon

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## CHAPTER 1

### INTRODUCTION

The lands and waters of the coastal zone have either been mismanaged or not managed at all since the early settling of the United States. Though initial settlements were formed on coastal sites, the early settlers found that these sites were especially subject to natural hazards and they soon abandoned them for more hospitable, inland areas. The coastal shorelands and islands were not extensively resettled until the late nineteenth century. Then, since the turn of the century, the trend from coastal development toward inland was reversed and the coastal zone is now experiencing population pressures which threaten the future viability of many sections.<sup>1</sup> Nowhere is this more evident, perhaps, than along the nation's barrier beaches. Rhode Island, while not suffering nearly from the degree of development on its barrier beaches as other states, is no exception. Economic pressures brought to bear have forced federal, state, and local governments to grapple extensively with this issue.

On October 21, 1981, then Secretary of the Interior James Watt, testifying before the Senate Subcommittee on Environmental Pollution, issued a statement as to the importance of the nation's barrier beaches. The following is an excerpt from that statement:

"While it is extremely difficult to generalize about the natural resources of coastal barriers and adjacent waters, there is no question that these habitats contribute large numbers of fish and wildlife resources, which are used and enjoyed by many."<sup>2</sup>

Their unique ability to serve as a buffer between storm surges and landward habitat as well as their integral role in an ecosystem which provides habitat and breeding areas for an abundance of living resources which are dependent on the area makes them a valuable resource to both the surrounding community and ecosystem. Although possessed with an inherent ability to adapt to the forces of nature, they are not nearly so flexible with the intrusion of man and the pressures of development.

The need for the preservation of barrier beaches in their natural state cannot be overstated and is recognized by all levels of government. Although each level of government has shown concern over the coastal zone and government regulation and intent in protecting barrier beaches is clearly evident, the seeming lack of coordination between the various levels of government has produced a nebulous situation which in the past has not only failed to protect barrier beaches in many cases but actually promoted development on these fragile resources. However, the picture appears brighter with the advent of recent federal legislation that seems to indicate a new willingness on the part of the federal government to effectively limit development

in these areas by eliminating federal construction and flood insurance subsidies. This recent legislation has the potential to act as the leading catalyst for an effective barrier beach management program.

This paper will examine the results of federal, state, and local legislation and regulations on the development of Green Hill Beach in South Kingstown, Rhode Island and, from conclusions drawn from that case history, assess the future of the extensive network of barrier beaches (see figure 1)<sup>3</sup> within the State of Rhode Island.



# RHODE ISLAND BARRIER BEACH STUDY

COASTAL RESOURCES CENTER  
UNIVERSITY OF RHODE ISLAND  
JANUARY 1973



## LOCATION MAP

### Key:

1. Napatree Point Barrier
2. Mashaug Ponds Barrier
3. Winnapaug Pond Barrier (Atlantic Beach)
4. Quonochontaug Pond Barrier
5. Michel, Garden and East Ponds Barrier
6. Ninigret Pond Barrier (East Beach portion)
7. Ninigret Pond Barrier (Charlestown Beach portion)
8. Green Hill Pond Barrier
9. Trustom Pond Barrier
10. Card Ponds Barrier
11. East Matunuck and Jerusalem Barrier
12. Point Judith Pond Barrier
13. Narragansett Beach Barrier
14. Bonnet Shores Barrier
15. Mackerel Cove Barrier
16. Lily Pond Barrier (Hazard's Beach)
17. Almy Pond Barrier (Bailey's Beach)
18. Easton Pond Barrier (First Beach)
19. Nelson and Gardiner Ponds Barrier (Second Beach)
20. Third Beach Barrier
21. Watch House Pond Barrier
22. Round Pond Barrier
23. Long Pond Barrier (Tappen's Beach)
24. Briggs Marsh Barrier
25. Ship Pond Barrier
26. Round Meadow Pond Barrier
27. Tunipus and Quicksand Ponds Barrier
28. Coast Guard Beach Barrier
29. Sandy Point and West Beach Barrier
30. Crescent Beach Barrier

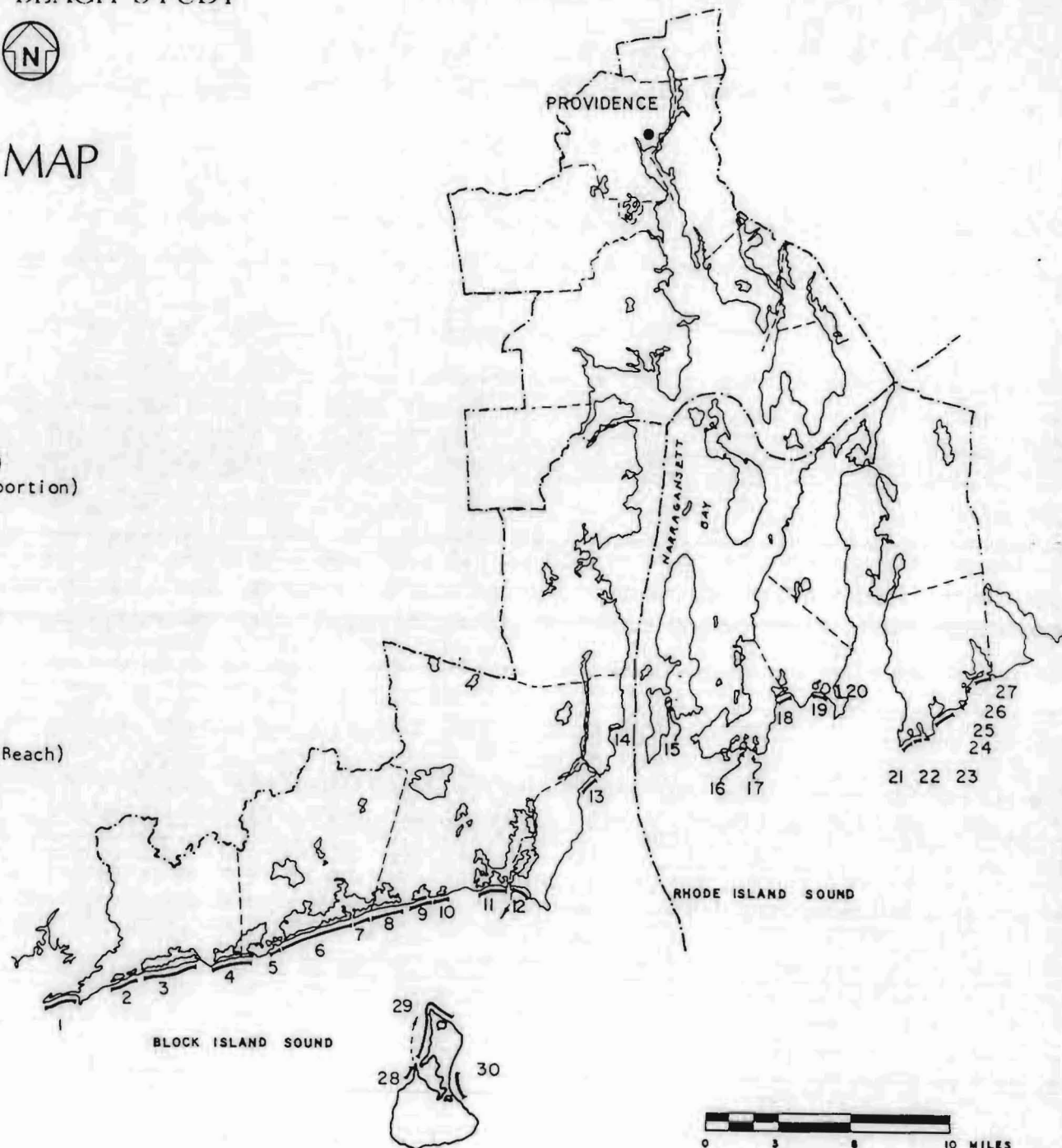


FIGURE 1

## CHAPTER 2

### THE IMPORTANCE OF BARRIER BEACHES AND THEIR IMPORTANCE IN THE RHODE ISLAND COASTAL ECOSYSTEM

Barrier beaches are narrow strips of land made of unconsolidated material extending roughly parallel to the general coastal trend and separated from the mainland by a relatively narrow body of fresh, brackish, or saltwater, or a wetland.<sup>4</sup> Their importance as part of and to the surrounding ecosystem can not be overemphasized. Although fragile, barrier beaches serve as the primary buffer between storm surges and the landward habitat. The role of reducing the open sea energies so that the landward environment may persist is a critical element in the scientific definition of a coastal barrier and one of the barriers most important functions.<sup>5</sup> Barrier beaches, while fragile and vulnerable to storm damage themselves, act as storm buffers. They absorb and dissipate the destructive energy of storm driven waves, thereby protecting the salt ponds, marshes, and low-lying mainland beyond them.<sup>6</sup> Their ability to perform this function, however, is directly tied to their freedom to shift and migrate with currents and develop those features common to barrier beaches. A complex interaction of natural forces and conditions control the position and form of coastal barriers. The action of the wind, waves, and tides on the barriers unconsolidated sediments causes erosion or

accretion of the seaward margin, thus resulting in changes in size, shape, and location.<sup>7</sup>

Coupled with this erosion process in the physical determination of the barrier beach is the ever-increasing sea level. Measurements made in Newport since 1930 show that relative sea level is gradually rising in this region at an average rate of 0.0096 feet per year or about one foot every century; due to a rough slope of Rhode Island south shore beaches of 1:30 to 12 feet above sea level, this equates to a horizontal encroachment of 50-60 feet per century.<sup>8</sup> Figure 2 illustrates the effect of erosion and the relative rise in sea level on Green Hill Barrier Beach. This change in sea level has increased the threat of coastal flooding and contributes significantly to the migration of barrier beaches in this region landward.

Despite the complex interactions involving wave action, sand distribution, nearshore currents, and rises in sea level, the barrier beach has shown a remarkable ability to adapt to the dynamics of nature and retain the integrity of its storm protection features.

However, these natural processes must remain uninterrupted in order for the barrier beach to act as a storm buffer. Left alone, coastal barriers adapt by changing shape and moving landward. They move up the coastal plain to remain above sea level - always managing to retain the

EROSION AT GREEN HILL BEACH  
Data from vertical aerial photographs

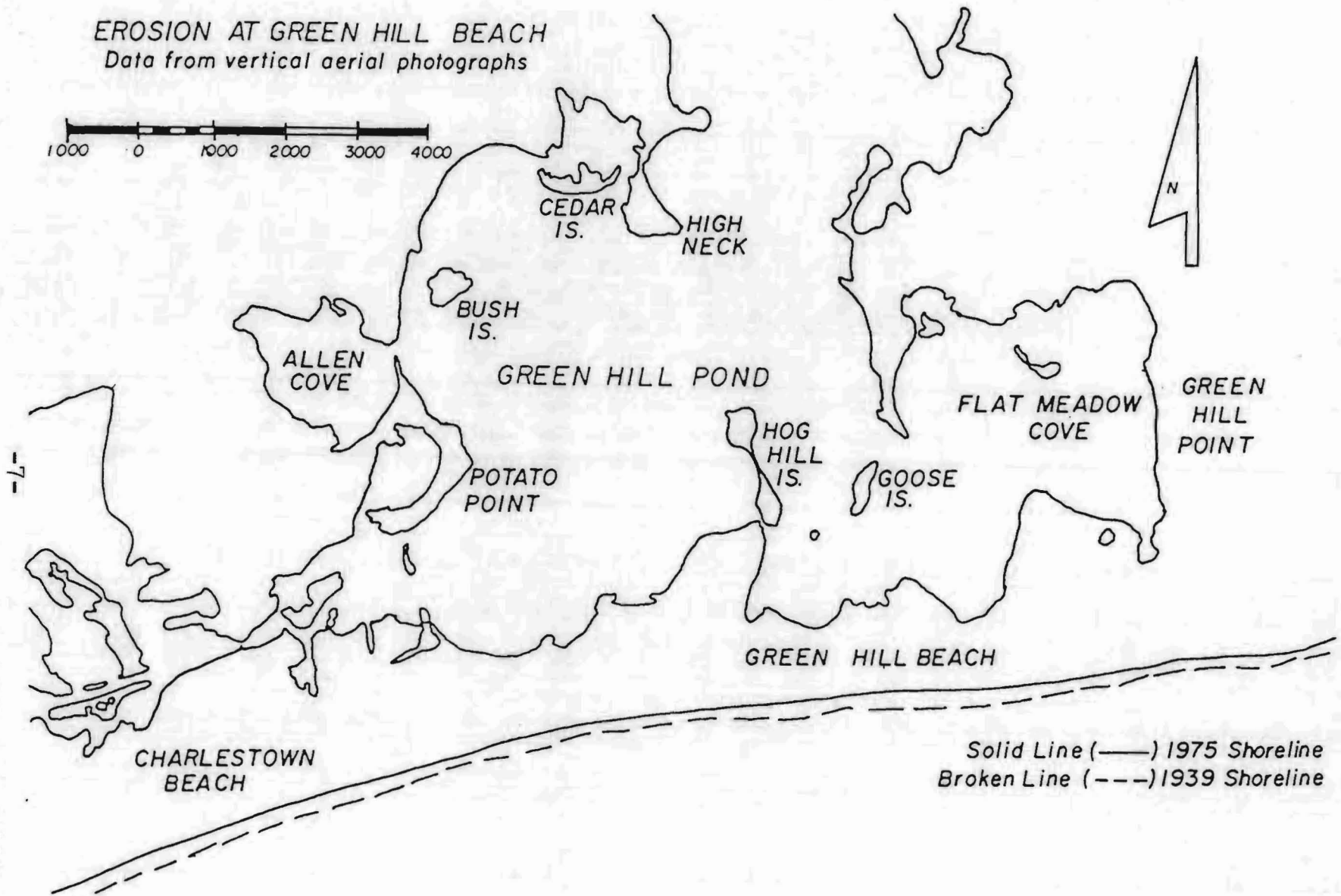


FIGURE 2

integrity of their ecosystems in spite of the often total rearrangement of their particle components.<sup>9</sup>

Although extremely adaptable to the dynamics of nature, barrier beaches do not fare as well to the intrusion of man and development. Figure 3 illustrates the definable features of a well developed barrier beach.<sup>10</sup> Most noticeable is the existence of a distinct dune region. Formed by the accumulation of sand blown off the beach face, these dunes are extremely vulnerable to wind and wave action. Wind borne sand accumulates rapidly around semi-permeable objects, and this makes beachgrass very effective in building and stabilizing dunes. Most of Rhode Island's barrier beaches support only one dune line that, in its natural state, is well vegetated with beachgrass and a few shrubs.<sup>11</sup> The inability of this beachgrass to develop or maintain itself is the major factor in increased wind erosion and results in a "blowout" - a small trail-like feature stretching along the beach side of the dune.<sup>12</sup> Failure of the beach grass to recolonize will result in a deepening and widening of the "blowout". These "blowouts" are often used as footpaths and although beachgrass is an extraordinarily hardy and well adapted plant, it will not tolerate trampling.<sup>13</sup> The end result is a severe degree of erosion along this portion of the dune.

Similar to the effects of wind erosion but usually more pronounced is wave erosion. Here, wave action cuts a

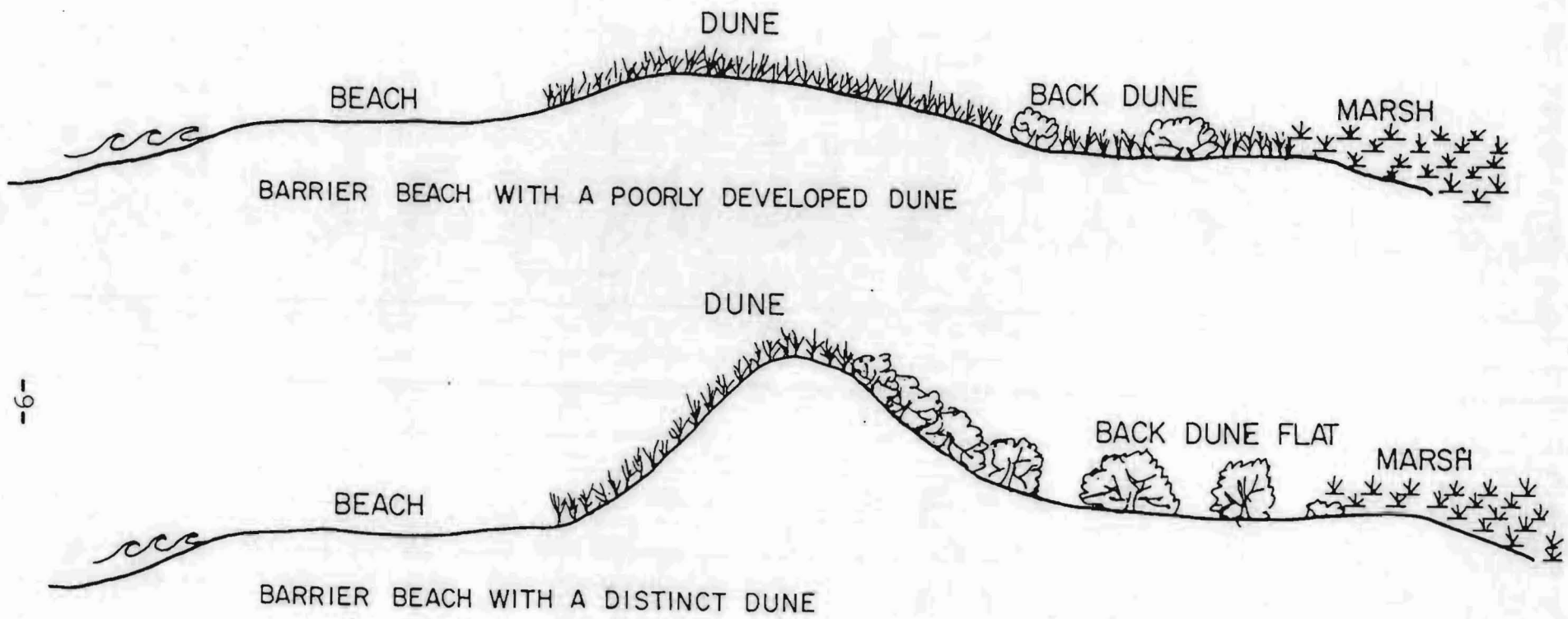


FIGURE 3

deeper and wider path than seen in a "blowout" and reduces the level of the dune to that of the beach. This is referred to as a "washout".<sup>14</sup> Again, inability of the beachgrass to recolonize will result in a worsening of the problem and ultimately lessen or negate the ability of the dune to protect the backshore area from wave action during a storm.

The ability of the barrier beaches to withstand the forces of the ocean is determined by the height and stability of the dune. To build dunes and protect them, the beachgrass must be protected, and this means controlling construction and vehicular and human traffic. Figure 4 illustrates the negative effect that construction and vehicular and human traffic has had on the dune vegetation on Green Hill Barrier Beach.

#### RELATIONSHIP TO THE SURROUNDING ECOSYSTEM

Coastal barriers provide natural resources of significant value to society. They create and nurture estuaries and wetlands which nurture fin fish and shell fish stocks vital to our nation's commercial and recreational fishing interests.<sup>15</sup>

The barrier beach, the marsh, and the coastal pond are one ecosystem. The complex relationships within this ecosystem dictate that a change to one of the elements of



FIGURE 4



the system may produce a change throughout the whole system.<sup>16</sup> Figure 5 illustrates the geographic proximity in the Green Hill Beach area of these elements. The salt marsh and coastal pond, unlike the barrier beaches, are rich in plant and animal life; but, similar to the barrier beaches, extremely sensitive to the intrusion of man and development. An apparently small change in runoff of fresh water to the pond or marsh as a result of increased drainage from development or the introduction of increased amounts of sea water or sand resulting from a poorly developed dune can radically affect animal and plant populations.<sup>17</sup>

#### The Salt Marsh

Salt marshes are low, flat areas that are regularly flooded by tidal processes and are found extensively in several of Rhode Island's salt ponds. The mixing of fresh and salt water caused by this tidal mixing produces rapid oxygen and nutrient circulation and "cleanses" the system within the marsh, causing the salt marsh to rival the biological productivity of that found in intensive agricultural areas. Salt marshes have frequently been described as "food factories" for the animals that live in coastal waters.<sup>18</sup>

Although biologically active, salt marshes also perform

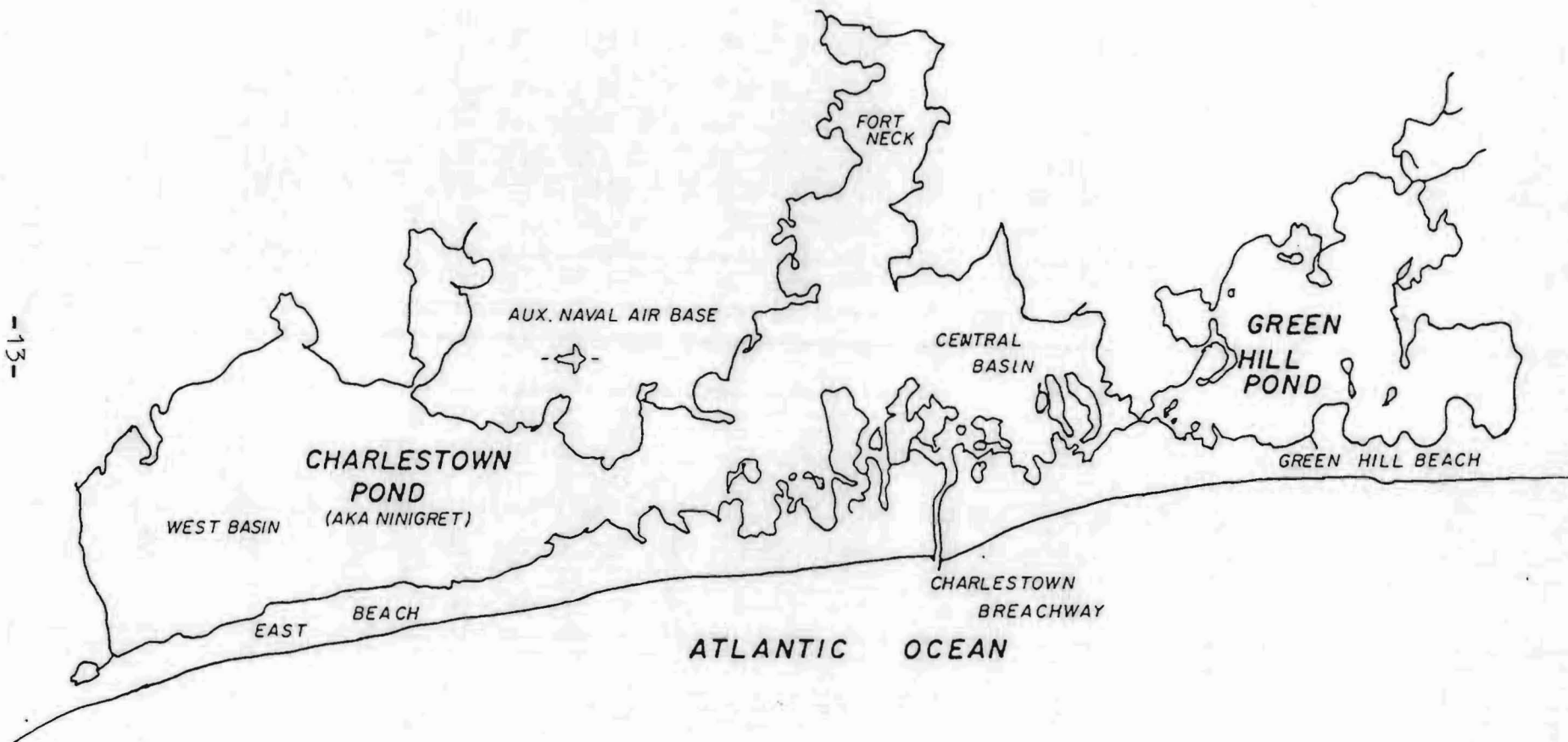


FIGURE 5

another valuable role within the barrier beach and coastal zone ecosystem. Their ability to absorb large quantities of water which would otherwise flood the mainland during a storm can not be discounted.<sup>19</sup>

Despite the obvious value that salt marshes play within the state of Rhode Island, only about 4000 acres remain.<sup>20</sup> Like the barrier beach, the salt marsh is also on the critical list. Recent abuses caused by development, excavation, and filling have reduced their numbers significantly.

### Coastal Ponds

Without the barrier beaches, there would be no salt ponds (see figure 5). Like the salt marshes, coastal ponds are also biologically productive areas. A salt pond is particularly vulnerable to man because he can so easily alter its controlling parameters. The parameters that govern the characteristics of a salt pond are summarized below:

- I. Characteristics of flow: Volume and variation of fresh and salt water flows into the pond; circulation patterns; turbulence; flushing time (the rate at which pond water is replaced by new fresh and salt water).
- II. Water properties: Salinity, temperature, transparency, nutrients, pollutants and dissolved oxygen.
- III. The Form of the Pond: Shape, size, and topography and character of the bottom.<sup>21</sup>

It is the modification of the quality and change in mixture of the fresh and salt water in the pond that has the greatest effect on the salt pond. An increased flow of seawater and the resultant increase in salinity has the potential to destroy the delicately balanced environment within the marsh. Also, an increased flow of seawater will have the tendency to bring in additional amounts of sand which is then deposited in the pond, thereby reducing its size over time. In addition to the negative effects that development has on the barrier beaches and dunes that result in the opening of new breachways, the introduction of residential septic systems has also impacted the entire ecosystem.

The number of houses on the barriers and around many of Rhode Island's salt ponds is increasing and the great majority of these houses have their own septic systems. No data are presently available on the effects upon salt ponds of leachings from septic systems, but studies made in similar environments elsewhere . . . suggest that increasing the number of leach fields around a pond will adversely affect the environment.<sup>22</sup>

#### STORM HISTORY OF RHODE ISLAND'S BARRIER BEACHES

Barrier beaches, in their natural state, serve as the first line of defense against major storms and hurricanes by protecting the backshore area against storm surge. Rhode Island has been threatened by 71 hurricanes since 1635 of which 13 caused severe tidal flooding, 25

caused moderate flooding, and 38 caused scares with little or no flooding.<sup>23</sup> While it is difficult to ascertain the damage to local communities in most cases, the hurricanes of 1938 and 1954 provide some indication of the damage incurred. By 1938, extensive development had taken place on the south shore beaches. With a few isolated exceptions, the hurricane swept all structures off all the barrier beaches in the state. Many of these areas were again built up when in 1954 another hurricane swept them clean for a second time.<sup>24</sup> The Providence Journal Company published in "Hurricane Carol Lashes Rhode Island" the following statistics:<sup>25</sup>

<u>Date of Hurricane</u>	<u>Property Damage</u>	<u>Deaths</u>
1938	\$100,000,000	317
1954	\$200,000,000	19

In a report to Congress the Secretary of the Army on April 15, 1977 stated that the occurrence at that time of a storm equivalent to that of the 1938 or 1954 hurricanes would result in losses of about \$104-108 million. The report speaks of projects under construction to reduce the potential flood damage to the area and concludes that the Secretary of the Army does not recommend and further federal expansion of funds for flood protection in the area. He suggests instead that a number of local measures be

adopted to reduce possible losses from flooding. Included among these local measures are hurricane warning and emergency flood mobilization measures, flood plain zoning regulations, and flood proofing during construction.<sup>26</sup>

Man-made methods designed to reduce the effects of storm damage have proven to be economically impractical. In the long run, land use control and coastal zone management are much more effective. Improper use of flood prone lands such as barrier beaches, as proven by the 1938 and 1954 hurricanes, only results in unnecessary losses of human life, property, and severe social disruption.<sup>27</sup>

## CHAPTER 3

### DEVELOPMENT ON RHODE ISLAND'S

#### BARRIER BEACHES

The barrier beach ecosystem is remarkably adaptable to the vagaries of nature but extremely sensitive to the intrusion of man and development. The dune which is so important to the barrier beach and which gives it the ability to withstand storm surge and buffer the backshore from this storm activity has been a favorite spot of developers for the location of residential dwellings due to the improved view that the dune affords.

Before World War II, approximately 90% of coastal barrier real estate was undeveloped and largely inaccessible to the public. In the years immediately following the war, the rate of second home development on coastal barriers escalated in response to increasing affluence, mobility, and available leisure time. The trend was especially rapid in the Northeast where numerous coastal barriers lie within a few hours drive of major population centers.<sup>28</sup>

In an effort to reduce the impact of his development, man has further compounded the problem with construction of "stabilization projects" such as jetties, groins, and breakwaters; thereby further altering the natural course of events. The response of this stressed environment will vary in proportion to its capacity for absorbing this stress.

The barrier consists of at least five distinct but integrated environments including the beach, dune field, back dune flat, marsh, and barrier pond. Each of these varies in the amount of natural stress to which it is exposed and in the amount of additional human stress which it can sustain.<sup>29</sup>

Despite present knowledge and past experience, the attractiveness of barrier beaches has tempted many people to ignore the dangers associated with living on them and, in some cases, these people do not realize the hazards involved.

Rhode Island's barrier beaches have been subject to increasing developmental pressures. Increasing numbers of commercial, recreational, and residential structures are being built, many on the dune. A developmental pattern common before the state's low lying beaches were swept clean by the 1938 and 1954 hurricanes is once again establishing itself.<sup>30</sup> Reasons for this resurgence in development included the lack of a coordinated federal and state effort to regulate development, insufficient zoning regulation at the local level, and the tenacity displayed by the public in their willingness to assume the risks of living on the barrier beach.

#### FEDERAL ENCOURAGEMENT OF BARRIER BEACH DEVELOPMENT

Over the past two decades, much of the development



on coastal barriers has been underwritten by the American taxpayer.<sup>31</sup> Not only has the federal government, through improved road systems increased accessibility to these areas, but they have also provided federal subsidies for construction of bridges and utilities on the barrier beaches with adoption of the National Flood Insurance Program and have subsidized to a large degree the construction of private dwellings.

Federal assistance, direct and indirect, comes in many forms. Direct expenditures include grants for highway and bridge construction, assistance in providing water supply and sewer systems, and projects to stabilize coastal barriers. Indirect assistance includes federal flood insurance or loan guarantees for home construction.<sup>32</sup>

The liabilities of the federal government in coastal barriers is significant. Not including flood insurance, the federal government has spent at least \$800 million since fiscal year 1975 to assist private construction on coastal barriers. In addition, the Federal Emergency Management Agency estimates that the federal government is potentially liable for \$10-15 billion in flood insurance coverage along the Atlantic Ocean and Gulf of Mexico - one of the largest liabilities against the Federal treasury.<sup>33</sup> These cost estimates discount the intangible costs such as human lives.

The effects of this federal promotion of development has been seen directly along the coast of Rhode Island. A study published in the November, 1977 issue of Housing and Development Reporter supports the stand that the National

Flood Insurance Program tends to encourage construction on barrier beaches. Sponsored by the Department of Housing and Urban Development, the author claims that Rhode Island has been most affected by the program.<sup>34</sup> The study found that "Rhode Island lending institutions which previously had refused to lend money for mortgages in high hazard areas now take mortgages secured by flood insurance once excluded".<sup>35</sup> South Kingstown began its participation in the National Flood Insurance Program in 1972 and it was then that requests for building permits were submitted to the town building inspector, in spite of the fact that the local zoning prohibition on the barrier beaches had been dropped in 1966.

## CHAPTER 4

### EFFECTS OF FEDERAL, STATE, AND LOCAL REGULATION ON THE DEVELOPMENT OF RHODE ISLAND'S BARRIER BEACHES

The regulation of development on the barrier beaches of Rhode Island has been addressed or affected by legislation originating in the three basic levels of government - federal, state, and local. Although each level of government has shown concern over these fragile coastal ecosystems, legislation at each level was not necessarily complementary and, at times, had the effect of actually promoting development on those beaches or forcing the lowest level of government to adopt specific regulation to protect their own interests as they were not being adequately protected by the state or federal governments.

In order to fully understand the legal issues and uncertainties that have arisen regarding development on Rhode Island's barrier beaches, it is necessary to look at the role each level of government has played on an individual basis.

#### THE FEDERAL ROLE

The United States Constitution carefully has preserved the sovereignty of each state and has granted the federal government specific powers. Any legislation which is adopted on the federal level must be within the scope of

that specified power. Only those powers which are necessary to regulate activities which affect many states and their interactions come within the scope of the federal government. <sup>36</sup>

The basis for the Federal government's role and the establishment of federal programs in the coastal zone is based on the constitutionally granted authority given the Congress to regulate commerce. In *Gibbons v. Ogden*, Justice Marshall interpreted commerce to equal transportation which in turn equals navigation.

"All navigable waters are under the control of the United States for the purpose of regulating and improving navigation."<sup>37</sup>

The Coastal Zone Management Act of 1972 (P.L. 92-583, 86 Stat 1280)

With passage of the Coastal Zone Management Act in 1972 and the subsequent amendments of 1976 and 1980, the federal government has taken the lead in establishing a national set of priorities for the management of the nation's coastal zone. Although originally designed as part of a national land use planning program, the Coastal Zone Management Act (CZMA) is essentially the only element of that program to come to fruition. Passed with essentially unanimous support, CZMA was an essential step forward in solving the problems of the increasing competition for a

limited resource and the lack of any level of government attempting to integrate national priorities with the needs of state and local governments. CZMA was passed by Congress in an effort to encourage states in the development and implementation of their own coastal management programs.

Prior to CZMA, legislation did exist on the state level to attempt to manage coastal issues. Generally, however, that legislation was largely a result of crisis management to "introduced threats" rather than part of a comprehensive statewide management effort. To become eligible for funding, CZMA outlines certain requirements for the individual state programs.<sup>38</sup>

- I. CZMA requires identification of the coastal zone. Landward boundaries must be based on shoreline controls which have direct impact on coastal waters.
- II. CZMA requires that the program define permissible uses of the coastal zone.
- III. CZMA requires that the program list all areas of particular concern.
- IV. CZMA requires that the program establish priorities of uses in the coastal zone.
- V. One of the most important requirements of CZMA is the identification of the means by which the state proposes to exert control over land and water uses.
- VI. CZMA requires that consideration be given in the program to national interests.

CZMA is a voluntary law and does not require states to develop management programs. In an effort to encourage their participation in a national coastal management

program, two key elements were included in the original legislation. Federal funding in the form of categorical grants were available to those states which had developed management plans and had them approved by the Office of Coastal Zone Management within the National Oceanic and Atmospheric Administration of the Department of Commerce. In addition, a consistency provision that required the federal government abide by the individual state management programs after approval of the plan granted the states some control over the federal role in their local areas. This new approach provided coastal states with unprecedented influence over some federal actions.<sup>39</sup>

The Coastal Zone Management Improvement Act of 1980 substantially amended the original statute and provided for the expansion of national objectives in coastal zone protection. Particularly significant to the management of the nation's barrier beaches, changes to section 303 of CZMA "established an explicit national coastal protection policy encouraging states, working with the federal and local governments and the public, to develop management programs that address new national coastal policies". Included among this new direction to the states was the following objective:<sup>40</sup>

Manage coastal development to minimize loss of life and property caused by improper development in flood prone, storm surge, geological hazard, and erosion prone areas, or in areas of subsidence and salt water

intrusion, and by destruction of natural protective features such as beaches, dunes, wetlands, and barrier islands.

The National Flood Insurance Program and Flood Disaster Protection Act of 1973

The National Flood Insurance Program and Flood Disaster Protection Act has been administered by the Department of Housing and Urban Development's Federal Insurance Administrator since 1968. The Program allows property owners in flood prone municipalities which have instituted flood control measures to purchase flood insurance from private agents at rates subsidized 90% by the program.<sup>41</sup> Designed to guide development away from flood prone areas, the program has taken away the market control of these areas and effectively promoted development.

Federal standards adopted as part of the National Flood Insurance Program concentrate on regulating the design of structures in these areas and require the following "flood proofing" measures.<sup>42</sup>

- I. They require that the lowest floor of residential structures be elevated to above the 100 year still water flood level.
- II. They require that non-residential structures be flood proofed to the 100 year level.
- III. They require additional design features to minimize flood damage to or movement of structures and water and sewer systems.

The National Flood Insurance Program has had difficulty in establishing regulatory standards which accommodate the severe wave action and storm surge typical of the open ocean shoreline. Design standards for coastal areas subject to high velocity wave action (the V-zone on NFIP maps) do not account for wave height or runup which can account for an increase of as much as 50% over still water flood levels.<sup>43</sup> Figure 5 illustrates the effect of wave runup and wave setup on coastal water levels during flooding.<sup>44</sup> This regulatory emphasis on "flood proofing" new structures through the use of design standards rather than location restrictions that would prohibit development in flood prone coastal areas such as barrier beaches has served only to complicate state and local efforts in controlling development in these areas.

With National Flood Insurance Program subsidies so readily available, insurance companies which in the past refused to underwrite the high risks incurred with construction on barrier beaches and banks which had refused to issue mortgages without insurance protection, now found that the market control which had worked so well to restrict development in the past was effectively removed - and that the federal government would pick up the tab for this restriction of market control.

The obvious result of this program is that certain flood proofing or flood preventing measures are required in new construction on the flood plain.<sup>45</sup> However, and



more important:

". . .flood insurance sustains and even increases already high demand and property values in coastal areas, substantially reduces financial risk of property owners from damage from hurricanes, and tends to act as a counterforce to effective coastal flood plain management."<sup>46</sup>

The Omnibus Reconciliation Act of 1981 (P.L. 97-35)

As part of the Reagan Administration "New Federalism", the Omnibus Reconciliation Act of 1981 was signed into law by President Reagan on August 13, 1981. Provisions in this Act call for the prohibition of new federal flood insurance coverage for new construction or substantial improvements on structures on undeveloped barrier beaches after October 1, 1983. Flood insurance issued before that date would remain in effect regardless of location. The "undeveloped" barrier beaches referred to in the Act were identified by the Department of the Interior and included 188 undeveloped coastal barrier units, totaling 747 miles of beach in 16 states, that would be subject to the flood insurance cutoff.<sup>47</sup>

The passage of the Omnibus Reconciliation Act of 1981 signalled to lower levels of government the continuing intention of the Reagan Administration to reduce or eliminate those federal programs that tend to frustrate conservation objectives. The elimination of federal insurance to barrier beaches will serve to return the areas to market control and subsequently naturally restrict these sensitive areas

to new development. Although it can be argued that new construction will still take place by those few individuals able to afford construction of dwellings on barrier beaches without mortgages, the reluctance of banks to issue mortgages to the vast majority of those people requiring mortgages will serve to severely restrict any new development in the majority of those barrier beaches designated as undeveloped by the Department of Interior.

The Coastal Barrier Resources Act (P.L. 97-348)

Signed into law by President Reagan on October 18, 1982, the Coastal Barrier Resources Act (CBRA) is another element of the Reagan Administration's "New Federalism" and was enacted despite the strenuous objections of the National Association of Realtors and the National Association of Home Builders. CBRA establishes the Coastal Barrier Resources System and prohibits the expenditure of most new federal financial assistance within the units of that system.<sup>48</sup> This legislation is directed specifically to the nation's barrier beaches and recognizes their unique and valuable role. CBRA prohibits new federal funding for federal flood insurance, bridges, roads, sewers, economic development, home construction, and new shoreline erosion and stabilization projects on undeveloped barrier beaches within the Coastal Barrier Resources System. Exceptions include expenditures for energy activities and exploration

dependent on coastal waters, air and water navigation aids and devices, fish and wildlife protection and enhancement measures, national security activities, and disaster relief to save human lives.<sup>49</sup>

Section 4 of CBRA established the Coastal Barrier Resources System which is referred to by a set of maps dated April 28, 1982 (revised September 30, 1982) and filed with the Committee on Merchant Marine and Fisheries of the House of Representatives and the Committee on Environment and public works of the Senate. These maps delineate those areas that are treated as undeveloped for the purposes of CBRA.

A threshold of approximately one structure per five acres of fastland was used in determining if a coastal barrier was developed. This threshold has been used in previous delineations of undeveloped coastal barriers prepared by the Department of the Interior. Areas that exceed this threshold tend to interfere with natural processes of coastal barriers and, therefore, generally would not fall within the definition of an undeveloped coastal barrier. It is important to note that, for the most part, coastal barriers are either much more or much less developed than this threshold level.<sup>50</sup>

All federal agencies that administer programs within the Coastal Barrier Resources System are affected by CBRA. Section 5 of CBRA states that new federal expenditures and financial assistance are prohibited for any purpose. The importance of this part of CBRA cannot be overstated. The pattern of growth within the coastal zone has been greatly affected by the numerous federal economic, social, and

environmental programs within the zone. As many as fifteen federal programs were concerned with projects (such as installation of roads, bridges, sewers, and water supply systems) that prove to be essential for community development and growth.<sup>51</sup>

The implementation of CBRA and the subsequent prohibition of new federal expenditures will serve as the common denominator that has been so sorely needed to ensure the viability of a national set of objectives designed to regulate, and not promote, development on the nation's barrier beaches.

It is important to note that Section 5 of CBRA does not prohibit private financial transactions or banks from issuing mortgages for homes within the extent of the Coastal Barrier Resources System. The construction of structures funded by state or local governments is also not prohibited. Although private and state and local government construction is not regulated, the absence of federal subsidies for new insurance policies or for new construction will serve to return these undeveloped areas back to a market control which has, in the past, effectively regulated development.

Section 8 of CBRA is designed to ensure that the CBRA will not interfere with a state's right to protect, rehabilitate, preserve, and restore lands within its established boundaries and that state and local governments are free to take additional measures, consistent

with federal laws, to control their coastal resources.<sup>52</sup>

### THE STATE ROLE

In 1969, a group of concerned citizens recognized that Rhode Island's 419 mile coastline, and Narragansett Bay in particular, were in danger. No single plan or authority existed to regulate the use of these resources, developments that were restricting future choices were proceeding at an accelerating rate and much of the great value had already been lost. The problem of how coastal resources should be managed became the topic of two years of intense legislative debate.<sup>53</sup>

Prior to passage of the federal Coastal Zone Management Act, the State of Rhode Island, in 1971, enacted legislation creating the Coastal Resources Management Council (CRMC) (Title 46, R.I. General Laws, Sections 46-23-1 through 46-23-12). This seventeen member council was delegated authority by the state legislature as the principal mechanism for management of the state's coastal resources and granted jurisdiction over management of the state's coastal zone.

"Any person, firm, or governmental agency proposing any development or operation within, above, or beneath the tidal water below the MHW mark, extending out to the extent of the state's jurisdiction in the territorial sea shall be required to demonstrate that its proposals would not (1) conflict with any resources management

plan or program; (2) make any area unsuitable for any uses or activities to which it is allocated by a resources management plan or program; or (3) significantly damage the environment of the coastal region. The Council shall be authorized to approve, modify, set conditions for, or reject any such proposal."<sup>54</sup>

In addition, the Council was granted authority "over those land areas (those areas above the MHW mark) where . . . there is a reasonable probability of conflict with a plan or program for resources management or damage to the coastal environment".<sup>55</sup> Uses and activities within these areas include:

- I. Power generating and desalination plants,
- II. Chemical or petroleum processing, transfer, or storage,
- III. Minerals extraction,
- IV. Shoreline protection facilities and physio-graphical features,
- V. Intertidal salt marshes, and
- VI. Sewage treatment and disposal and solid waste disposal facilities.<sup>56</sup>

The above legislation has, in effect, given the CRMC direct authority over those activities that are likely to significantly affect the shore or tidal waters.<sup>57</sup>

"The Council is the last step for in-state permit procedures and acts formally only when all local and other state approvals have been obtained. Persons proposing alterations along the shoreline are informed by Council staff or local authorities when a Council permit is required."<sup>58</sup>

It is important to note that the burden of proof, as defined in Section 23-6, is not on the State of Rhode Island but the permittee to ascertain that the proposed

development falls within the guidelines set up under the Council.

Although coastal regions under CRMC jurisdiction are subject to CRMC regulations, it is emphasized here that the Coastal Resources Management Program (CRMP) created by the CRMC does not regulate the following activities or land uses:

- I. The Program will not have zoning controls or powers. These will remain the responsibility of local government.
- II. The Program does not regulate single family homes or control sprawl unless they have a direct impact on coastal resources.
- III. The Program will not stop all development on altered or developed barrier beaches.
- IV. The Program does not propose increased public acquisition of recreation facilities other than those areas proposed in the Bay Island Park Plan.
- V. It is not a growth management program, however, the Program does direct growth away from some key coastal resources.<sup>59</sup>

In 1974, Rhode Island became one of the first states to receive assistance under the Federal Coastal Zone Management Act.<sup>60</sup> Thus, although the Coastal Zone Management Act provided much needed funding for the coastal zone management program within Rhode Island, the State previously recognized the importance of its coastal resources and set about to protect these resources through the creation of the CRMC and adoption of the CRMP.

Three of the stated goals of the CRMC for the

management of the Rhode Island coastal region and, in particular barrier beaches, are stated below:

- I. Protect and preserve valuable natural and cultural resources such as historic sites, barrier beaches, coastal ponds, wetlands, and fishing grounds that are vulnerable to development and misuse.
- II. Protect the public from hazards brought by floods, erosion, and the placement of buildings and septic systems on unsuitable landforms and soils.
- III. Establish a working partnership among local, state, and federal governments that insures the efficient administration of the coastal management program.<sup>61</sup>

As delineated above, while the state has a natural interest in the protection and preservation of its barrier beaches, there are no regulations specifically denying "across the board" development on barrier beaches. Although a brief moratorium existed in 1967 on development following a major storm and a moratorium exists while formulation of a revised CRMP is being sought, the state has generally taken a reactive role rather than assuming the lead in the regulation of development on its barrier beaches.

The CRMC has found it necessary to assign all barrier beaches to one of two categories as follows:

- I. Altered or Developed Barrier Beaches
- II. Undeveloped Barrier Beaches<sup>62</sup>

Appendix A identifies the classification of individual barrier beaches within the state. Criteria for the



designation of "developed" versus "undeveloped" barrier beaches has been based on past development history rather than the suitability of the individual barrier beach for any development at all. Again, this stance has left the door open for further development on those beaches currently designated as "developed" whether or not they are suitable for 1) further development or, 2) any development at all.

### THE ROLE OF LOCAL GOVERNMENT

The role of local government in the regulation of development of the barrier beaches of Rhode Island is tied directly to the long-standing delegation of the zoning power from the state to the local level. The Rhode Island State Legislature has authorized its municipalities to adopt zoning regulations, building codes, and subdivision regulations and under Rhode Island Law (Chapter 54-24 General Laws) communities may restrict the use of land subject to flooding.<sup>63</sup>

There is also broad language giving municipalities the necessary powers to act for the benefit of the community's health, safety, and general welfare and are known as police powers. These police powers may be delegated to the municipalities via enabling legislation, through the state constitution, or state statutes granting certain specific responsibilities.<sup>64</sup>

The ability of local governments to regulate development through the use of its police powers (as delegated from the state government) seems clear and well founded in

state law.

THE TOWN OF SOUTH KINGSTOWN AND THE REGULATION OF DEVELOPMENT OF GREEN HILL BARRIER BEACH

The Town of South Kingstown has assumed a leadership role within the State of Rhode Island with respect to limiting development on barrier beaches and, for the purposes of this paper, will be used as an example of the role of local government in that regulation.

BACKGROUND

After the hurricane of 1954, South Kingstown zoned Green Hill Beach (see figure 5) as a Flood Damage Zone and thus prohibited construction on it.<sup>65</sup> Section VII-A of the South Kingstown zoning ordinance, adopted October 22, 1956, stated:

Beach Danger - BD District Uses

In a Beach Danger (BD) district no building shall be erected or altered and no building shall be used for any purposes except:

- I. Boat docks, fishing studes, and small beach cabanas as conditioned in Section X-A;
- II. Non-building uses such as bathing beaches, picnic areas, golf clubs, auto parking spaces, parks or wildlife refuges, together with such small buildings for daytime occupancy only which are auxiliary to these uses. . .<sup>66</sup>

The combination of this local ordinance and the inavailability of flood insurance for structures on barrier beaches effectively worked together to allow Green Hill Beach to remain undeveloped.

In 1966, with adoption of a new zoning ordinance, South Kingstown dropped the Beach Danger portion of their zoning ordinance.

Reasons for this deletion are difficult to reconstruct, however, it had been 12 years since the last hurricane and the conditions which it had produced were no longer fresh in anyone's mind. Moreover, it was generally felt that the newly revised state health regulations regarding the placement of on-site sewage disposal mechanisms would serve to limit development on the beaches.<sup>67</sup>

It was not, however, until 1972, when South Kingstown began its participation in the National Flood Insurance Program that construction on Green Hill Beach skyrocketed. Prior to 1972, a total of 4 building permits were issued for dwellings on the beach. In 1972 alone, 30 permits were issued by the building inspector in South Kingstown. Table 1 further illustrates the effects of the National Flood Insurance Program and provides data on the subdivided lots on the barrier beaches of South Kingstown.

The combination of a lack of a local zoning ordinance and the willingness of banks to issue mortgages concurrent with South Kingstown's participation in the National Flood

TABLE 1

DEVELOPMENT ON THE BARRIER BEACHES OF SOUTH KINGSTOWN

TOTAL SUBDIVIDED LOTS - 170

\* TOTAL UNDEVELOPED LOTS - 126

\* TOTAL DEVELOPED LOTS - 30

\*NUMBERS DO NOT EQUAL TOTAL BECAUSE SEVERAL OF THE DEVELOPED LOTS ARE OVERSIZED

DEVELOPED LOTS

BUILDING PERMITS ISSUED PRIOR TO 1972 - 4

\*\* BUILDING PERMITS ISSUED 1972 - 30

BUILDING PERMITS ISSUED POST 1972 - 3

\*\*7 OF THESE WERE SUBSEQUENTLY CANCELLED IN 1973 FOR REASONS UNKNOWN

STATE RESIDENT OWNERSHIP OF DEVELOPED LOTS - 3/30 (10%)

OUT OF STATE OWNERSHIP OF DEVELOPED LOTS - 23/30 (77%)

UNKNOWN (OWNER'S RESIDENCE NOT AVAILABLE - 4/30 (13%)  
IN TAX ASSESSOR'S OFFICE)

BEACHSIDE LOTS (DEVELOPED) - 14

BACKSIDE OF DUNE LOTS (DEVELOPED) - 16

TABLE 1

Insurance Program spurred development on Green Hill Beach to a level it had never before experienced. The lessons of the 1938 and 1954 hurricanes, which had leveled every existing structure on the beach at the time, were clearly forgotten.

It was about at this time that a new awareness of coastal zone management precipitated the idea of renewed flood danger zoning ordinances within South Kingstown.

Events that spurred this interest included the following:

- I. In June of 1973, South Kingstown voters approved a referendum adopting a new Zoning Enabling Act. This new enabling legislation gave the Town of South Kingstown statutory authorization to adopt regulations for designated areas, and controlling and limiting development in such areas subject to periodic or seasonal flooding.
- II. The Army Corps of Engineers supplied a set of flood maps as part of South Kingstown's participation in the National Flood Insurance Program. These maps enabled the Town to delineate accurately the areas subject to flooding so that development in such areas could be regulated.
- III. Several barrier beach reports were published providing necessary supporting data for zoning beaches as Flood Danger Zones. The most important among these was the Olsen and Grant report on Rhode Island's Barrier Beaches: Volumes 1 and 2 (cited earlier).
- IV. The Rhode Island Coastal Resources Management Council, which was created in 1971, was in the process of adopting a Management Plan impelling statewide concern and awareness in coastal zone management.<sup>68</sup>

A new amendment to the Zoning Ordinance of South Kingstown, authorized by the Rhode Island Zoning Enabling Act, gave the town authority to zone flood hazard areas as well as the right to protect areas of ecological significance. This amendment was adopted May 29, 1975 and delineated a High Flood Danger (HFD) Zone as follows:

"Section A, Article I, Section 2, Zones and Zoning Maps is hereby amended by adding the following:

There shall be a High Flood Danger Zoning District, designated as an HFD Zone."<sup>69</sup>

With the adoption of a revised zoning ordinance in 1976, the Town of South Kingstown prohibited any use within the HFD Zone which would involve 24 hour per day human habitation in this area. Uses permitted within the zone as a result of this zoning ordinance are listed in Appendix B.<sup>70</sup>

#### SUMMARY

The federal government, through the power granted it to regulate commerce, has instituted a comprehensive coastal management program attempting to integrate national priorities with state and local needs. The Rhode Island state government (both before and after passage of the Coastal Zone Management Act) has displayed an active interest in its coastal resources through the creation and subsequent operation of the CRMC. However, the local government,

in this case South Kingstown, did not feel that its barrier beaches were being adequately protected and were forced to adopt zoning regulations to protect those beaches.

In a letter to the Chairman of the CRMC on February 5, 1975, the President of the South Kingstown town council stated:

"The town council of the Town of South Kingstown has had the opportunity to review the CRMC proposed revisions to its barrier beach policy and regulations. We feel the proposed revisions would have many undesirable effects upon the barrier beaches within the Town of South Kingstown. Specifically, the revisions propose that two of the three barrier beaches in the town be classified as "developed" barrier beaches, presumably where development (including residences) may be permitted."<sup>71</sup>

Mr. Gray's letter went on to say that a recent South Kingstown Planning Department Study showed that on the 99.3 acres of Green Hill Beach there were only 30 residences; the beach had a development capacity of 233 houses based on then existing platted lots - therefore the beach was only 13 percent developed with the remaining land being open sand dunes and bordering on a salt pond.<sup>72</sup> The issuance of the 1976 CRMP included Green Hill Beach as a "developed" beach, while the other barrier beaches in South Kingstown (Moonstone and Browning) were classified as "undeveloped".

Again in 1977 the Town of South Kingstown offered comments to the CRMP dated summer 1977. South Kingstown

found its organization, content, and the process through which it was developed to be in the best interest of the coastal resources of the State of Rhode Island. The Town of South Kingstown did however, offer the following comments during the public hearing for the Council's consideration.<sup>73</sup>

"Much of the coastal zone is not suitable for development due to the areas susceptibility to storms and erosion. South Kingstown therefore, has developed a management plan using strong zoning measures to restrict development along its coastline. The plan is designed to protect those areas where a significant degree of storm damage is likely or those where residential development would increase the rate of erosion. The first zoning measure was the adoption of a Flood Danger District, also known as the High Flood Danger Zone. A second zoning measure was adoption of the regulation in the Zoning Ordinance requiring a 150-foot setback from an on-site waste disposal mechanism to an intertidal salt marsh or mean high water line of a tidal water body."

The Town of South Kingstown felt the proposed CRMP did not support the above mentioned effort of the town. Green Hill Beach has been designated as "developed" and therefore, residential development is not prohibited on it categorically. South Kingstown felt it was in its own best interests to not allow further development on Green Hill Beach. However, the Council has left the possibility open and thereby has put the local ordinance in a questionable situation.<sup>74</sup>

It is interesting to note that, in the latest draft revision to the CRMP - dated 25 March 1983 - Green Hill



Beach remains classified as a "developed" barrier beach.

The classification of Green Hill Beach and other barrier beaches within the state as "developed" is, again, not based on suitability for development but past development history. Keeping the hurricanes of 1938 and 1954 in mind and their impact on development history, the Town of South Kingstown officially objected to the classification of Green Hill Beach as "developed" and took regulation of development on Green Hill Beach into its own hands. The resultant zoning regulations were a direct result of the federal and state governments failure to meet local needs. The State of Rhode Island, with a financial interest in obtaining federal approval of its Coastal Resources Management Plan, was forced to take a more general view while dealing with a substantially higher number of issues than did the local governments.

## CHAPTER 5

### THE ANNICELLI CASE

The Town of South Kingstown is the only Rhode Island municipality to attempt to limit development on its barrier beaches through a zoning ordinance. Faced with a situation in which its interest in preserving barrier beaches was not being adequately supported by the federal or state governments despite their recent interest in coastal zone management, the Town of South Kingstown took unilateral action and on May 29, 1975 created a High Flood Danger (HFD) Zone District.

The power of local government to protect a valuable resource left unprotected by federal or state legislation through zoning regulations and the exercising of its inherent police powers resulted in a landmark court challenge that has the potential for having significant impact on not only Rhode Island's barrier beaches, but also the unprotected barrier beaches of the nation.

"The Town of South Kingstown is in the forefront of localities nationwide that are attempting to mitigate the widespread adverse consequences of hazardous development on barrier beaches. Because of the short history of such regulation, many states will look to the decision of this court (the Rhode Island Supreme Court) for guidance, and, if the lower court is upheld, may in all likelihood be deterred from instituting needed protection for their own barrier beaches."<sup>75</sup>

## BACKGROUND

On May 8, 1975 Ida Annicelli, a Connecticut resident, signed a purchase and sale agreement with the owner of real estate on Green Hill Beach. Three weeks after the agreement was signed, the South Kingstown Town Council adopted amendments to the Zoning Ordinance creating the HFD Zone.

On October 24, 1975 Mrs. Annicelli took title and possession of three parcels of land on Green Hill Beach totalling 31,750 square feet. The stated purchase price was \$16,750. Figure 6 illustrates the location of that land on Green Hill Beach.<sup>76</sup>

On November 19, 1975 Ida Annicelli applied to the South Kingstown Building Inspector for a permit to construct a single family dwelling on her property. At that time, she also applied to the State Department of Health for a permit to construct an Individual Sewage Disposal System (ISDS). Although her application for the ISDS was approved, her building permit was denied by the Town of South Kingstown on the grounds that a single family dwelling was not permitted in an HFD Zone. Section 14.53 of the Zoning Ordinance, entitled "Uses and Structures Prohibited within the HFD Zoning District", provides in part as follows:

"No residential dwelling designed or used for overnight occupancy shall be constructed within the HFD Zoning District as defined herein. This prohibition shall apply even

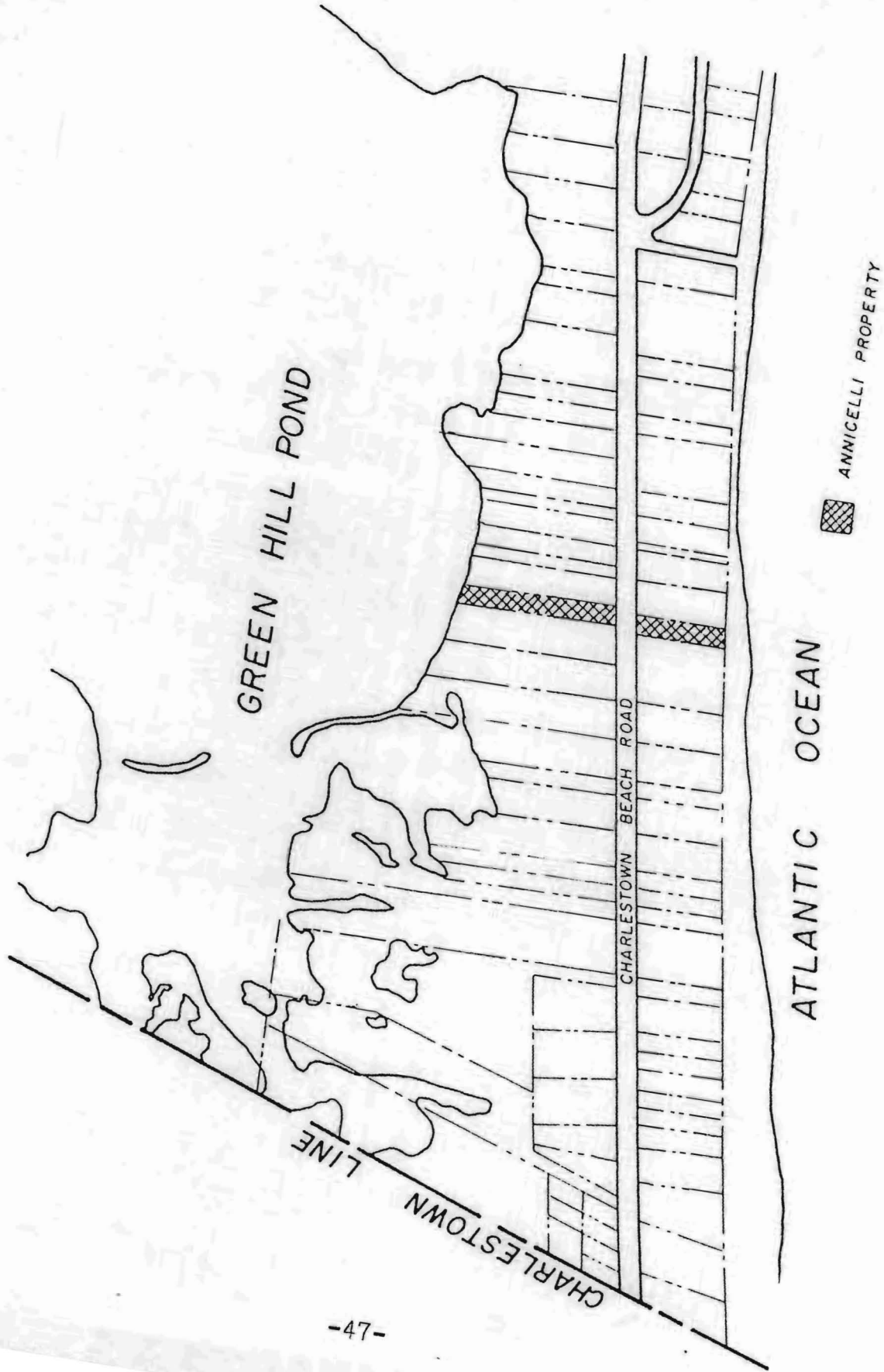


FIGURE 6

if the land within said HFD Zoning District is above the Base Flood Elevation."<sup>77</sup>

At this point in time, Mrs. Annicelli did not appeal the denial of a building permit to the South Kingstown Zoning Board of Review, but filed an action in the Superior Court, Washington County, Rhode Island claiming inter alia that the denial necessitated by the ordinance constituted a taking of private property for public use without just compensation, in violation of the United States and Rhode Island Constitutions.<sup>78</sup> At the same time, the Town of South Kingstown argued that construction on Green Hill Beach was detrimental to the barrier beach ecosystem and damage occurring during storms and flooding would endanger lives and property. In addition, the town argued that a taking of private property had not occurred because the permitted uses (section 14.41 of the Zoning Ordinance) and excepted uses (section 14.42) of the property remained. (See Appendix B)

Not unexpectedly, Annicelli argued that the property was best suited for use as a single family dwelling. This conclusion was based upon the belief that the permitted or excepted uses were completely impractical as applied to Annicelli's property because of the size and location of the lot and the nature of its topography.<sup>79</sup>

"Annicelli's appraiser estimated that the property was worth \$1,000 in its present state because none of the enumerated uses was practical and \$1,000 was, as he put it,

the 'most anyone would pay . . . for a spot to sit on the beach to go swimming'. The town's appraiser opined that the property was probably worth \$8,500. However, he conceded that several of the uses were impractical while denying that Annicelli was deprived of all reasonable or beneficial use of her property."<sup>80</sup>

The Superior Court trial justice found that the HFD Zone, as applied to Annicelli's property, constituted an indirect confiscatory taking without compensation in violation of Articles V and XIV of the amendments to the United States Constitution and Article I, Section 16 of the Rhode Island Constitution. In his decision, the trial justice concluded that the town was obliged to exercise its powers of eminent domain to compensate Annicelli. He determined that the effect of the HFD Zone was to return the beach property to its natural state and that, under these circumstances, it was inappropriate for the town to exercise its police powers.<sup>81</sup>

Judgement for Annicelli directed the South Kingstown building inspector to issue the required building permit on the reasoning that the single most beneficial use of the land to Annicelli was to use it for a single family dwelling and that removal of that particular use through a local zoning restriction resulted in an unconstitutional taking of private property.

The balance between the public interest in South Kingstown to preserve barrier beaches in their natural state and Annicelli's right to use her property as she

sees fit was tipped in the direction of the private property owner. Public rights may be protected by the exercise of the police power unless the damage to the property owner becomes overbearing and amounts to a confiscation.<sup>82</sup>

On appeal to the Rhode Island Supreme Court, the justice ruled that although "pecuniary loss or diminution in value is not the controlling factor in the issue of confiscation because a property owner does not have a vested property right in maximizing the value of his property, in the case at hand, all reasonable or beneficial use of Annicelli's property has been rendered an impossibility (by the South Kingstown HFD zoning ordinance)."<sup>83</sup> However, the Superior and Supreme Courts did disagree on one point. The Rhode Island Supreme Court found the Superior Court to have erred in ordering South Kingstown to issue a building permit to the Annicellis. Rather, it ruled, if the zoning ordinance limited the uses of the land to a degree where all beneficial use has been ruled out, then a taking has occurred and the Town of South Kingstown is required to properly compensate the Annicellis. It further directed that a hearing be held to determine the fair market value of Annicelli's property.

#### CONSEQUENCES OF THE SUPREME COURT RULING

The consequences of the Rhode Island Supreme Court

ruling in the Annicelli case has the potential for far reaching effects on the ability of a local government to exercise its police powers and zoning authority to preserve barrier beaches and, in a larger sense other threatened resources, in their natural state. The difference between "taking for a public good and taking to prevent a public harm", as defined by the Rhode Island Supreme Court, is subtle. Although there was general agreement as to the fragile nature of the barrier beaches and surrounding ecosystem, the Rhode Island courts have ruled that prevention of construction of a single dwelling in an area where 30 such structures already exist does, in fact, constitute a taking for the public good. Again, it is emphasized that the ability of the Barrier beach to maintain development should not be based on previous development history but its ability to withstand and adapt to that development.

The Rhode Island Supreme Court, in its July 13, 1983 Opinion, stated that "the town should have exercised its power of eminent domain rather than its police power." Local governments have not been delegated the power of eminent domain.

Local governments, without use of zoning regulations such as the HFD Zoning Ordinance, have been stripped of their power to limit development on their barrier beaches. Their ability to justly compensate land owners along this



high priced real estate simply does not exist.

No town has enough money to condemn and buy up every square foot of privately owned beach land. If a litigant wins compensation, on what is it to be based: the original purchase price, or the potential worth of the property if developed - but developed as what? And what is the value if the land now becomes ineligible for federal flood insurance?<sup>84</sup>

Financial realities presented as a result of the Rhode Island Supreme Court ruling have effectively negated the ability of local government to regulate development on its barrier beaches. As a result, they have been forced to rely on state and federal government protection.

## CHAPTER 6

### CONCLUSION

Over the past 25 years, the demand on barrier island resources has increased more rapidly than public institutions have been able to respond. This lag has exposed an urgent need to recognize the national interest in barrier islands and beaches and in their conservation.<sup>85</sup> Despite the rich wildlife values of these areas, their highly unstable nature, and their vulnerability to storms and hurricanes, coastal barriers are being developed at an estimated rate of 5000-6000 acres per year.<sup>86</sup> Rhode Island has been no exception to this growth in development along its barrier beaches. Since the last hurricane devastated the South Shore in 1954, growth along this network of barrier beaches has proceeded at unprecedented rates.

In recent years, however, there has been a growing awareness of the valuable role of the nation's coastal ecosystems. The federal government assumed a leadership role in 1972 with passage of the Coastal Zone Management Act and encouraged coastal states to develop their own coastal zone management programs through the use of financial and "jurisdictional" incentives. Rhode Island has been in the forefront among states in the recognition of the value of its coastal zone and, in particular, the role of the barrier beach in that coastal ecosystem. Even prior to passage of the 1972 Coastal Zone Management Act, Rhode Island had passed legislation creating a Coastal Resources

Management Council - delegated by the state legislature authority as the principal mechanism for management of Rhode Island's coastal resources.

Efforts to protect barrier beaches have begun at all levels of government. These efforts have focused on averting what is perceived to be the greatest threat to barrier beaches - unwise development.<sup>87</sup> Despite the apparent recognition by all levels of government of the value of the nation's barrier beaches, legislation has not always stemmed development and the lack of coordination both within and between levels of government has, at times, actually promoted development. Federal tax dollars have encouraged development of the nation's barrier beaches and subsequently perpetuated that development by promoting extensive disaster relief and insurance in the aftermath of hurricanes and major storms.<sup>88</sup>

The Federal Government has invested billions of dollars to subsidize private development of coastal barriers, while at the same time acquiring other coastal barriers to protect the fragile and environmentally sensitive resources associated with these coastal systems. Public policy, therefore, has both encouraged development and fostered protection. Within the last few years there has been a recognition that these federal programs are working at cross purposes, and that the costs of development, including the threats to man and natural resources, are more significant than previously understood.<sup>89</sup>

In his 1977 Environmental Message, President Carter stressed the consequences of continued unwise use of this resource:

"Coastal barrier islands (and beaches) are a fragile buffer between wetlands and the sea . . . many of them are unstable and not suited for development, yet in the past the federal government has subsidized and insured new construction on them. Eventually, we can expect heavy economic losses from this shortsighted policy."<sup>90</sup>

The National Flood Insurance Program, allowing property owners in flood prone areas to purchase flood insurance at rates subsidized up to 90% by the federal government, has taken away market control of development in coastal areas. Private property owners, previously denied mortgages without the necessary flood insurance, now found these mortgages readily available. The private property owners obtaining mortgages for homes in flood prone areas obtained the necessary (and previously prohibitively expensive) flood insurance through the subsidies offered by the National Flood Insurance Program. The market control which had worked so well in the past to restrict development was gone - and the federal government was picking up the tab for that loss of market control.

Although it can be argued that Rhode Island's interest in its coastline and the subsequent efforts of its Coastal Resources Management Council in protecting those resources along that coastline would have occurred without the passage of the Coastal Zone Management Act, there can be no doubt that the financial and "jurisdictional" incentives offered in the Coastal Zone Management Act accelerated that interest. The Rhode Island Coastal Resources Management Council issued

a comprehensive Coastal Resources Management Program and, in 1974, Rhode Island became one of the first states to receive assistance under the provisions of the Coastal Zone Management Act. The Coastal Resources Management Program was, indeed, a major step forward for Rhode Island in the effective management of its coastal zone and established goals of protecting and preserving the state's barrier beaches.

However, the Program does not propose to stop all development on the state's "altered or developed" barrier beaches. The Coastal Resources Management Council has found it necessary to establish a distinction between the "altered or developed" barrier beaches and the "undeveloped" beaches. This distinction is not meaningful for two primary reasons. First, it has not been based on the individual barrier beach's suitability for development, but past development history. Second, the protection of the "undeveloped" barrier beaches is largely meaningless because the majority of these beaches are owned by government or conservation groups unlikely to push for development. It is the "developed" barrier beaches that are not regulated sufficiently by the Program and require protection against development. Therefore, regardless of the dangers presented to the community or surrounding ecosystem, the fact that a particular barrier beach had structures on it left the door open for further development on that barrier beach.

Although a new emphasis on management of the nation's coastal zone was evidenced by the passage of the Coastal Zone Management Act and Rhode Island's Coastal Resources Management Program reflected that renewed emphasis within the state, local governments still had to face a marked lack of cooperation with respect to management of their barrier beaches due to the inability of the federal or state governments to adequately protect that resource. Faced with a situation in which it was forced to protect its own interests, the Town of South Kingstown exercised its police powers and zoning authority as delegated from the state government to regulate development on Green Hill Beach. However, the recent Rhode Island Supreme Court decision in the Annicelli Case against South Kingstown has effectively stripped the town of its ability to regulate development on Green Hill Beach without properly compensating the property owner. While the decision reasserts individual property rights, it does little to show how the public interest in protecting and preserving a valuable resource is to be upheld. Despite the well intentioned efforts of federal legislation and state coastal programs, the local government had been forced to protect its interest in preserving its barrier beaches and has been prohibited from effectively doing that with the Annicelli decision. From this perspective, the outlook for the protection of Green Hill Beach and the other barrier beaches within the

state appears bleak. South Kingstown is the only Rhode Island city or town to limit development of barrier beaches. Because one town has now lost a case brought by a landowner, it is unlikely that other towns will enter the fray.<sup>91</sup>

On the other hand, recent federal legislation seems to indicate a new willingness of the federal government to specifically address barrier beach development. The passage of the Omnibus Reconciliation Act of 1981 and the Coastal Barriers Resource Act of 1982 represent an even more sensitive awareness of the value of the nation's barrier beaches and attempt to lessen federal interference in these areas. Whether passed by the Reagan Administration to stem federal spending or in an honest effort to conserve these valuable resources matters little - their impact on the coastal zone is what matters. While recognizing the federal government should not dictate what private property owners do with their property, the American taxpayer should not be expected to subsidize the recurring costs and high risks of private development on barrier beaches. The new legislation also provides the framework for a consistent and reduced federal role regarding undeveloped coastal barriers.<sup>92</sup>

Provisions in the Omnibus Reconciliation Act call for the prohibition of new federal flood insurance for new construction or substantial improvements on structures on

undeveloped barrier beaches after October 1, 1983. Although it can be argued that new construction will still take place by those few individuals able to afford construction on barrier beaches without mortgages, it is now those individuals that are forced to assume the risks associated with construction in these flood prone areas and not the federal government. The unwillingness of banks to issue mortgages without flood insurance will serve to restrict new development by returning these coastal areas to a market control.

The Coastal Barrier Resources Act prohibits new federal funding for federal flood insurance, bridges, roads, sewers, economic development, home construction, and new shoreline erosion and stabilization projects on undeveloped barrier beaches within the Coastal Barrier Resources System. The importance of this legislature can not be overstated. The pattern of growth around the coastal zone and on barrier beaches has largely been fueled by the numerous federal economic, social, and environmental programs within the zone. Although private and state and local government construction is not prohibited, again, the absence of federal subsidies will serve to return these undeveloped areas back to market control.

The outlook for the barrier beaches of Rhode Island is better than it has ever been in the recent past, primarily due to the passage of the Omnibus Reconciliation Act of 1981 and the Coastal Barrier Resources Act and the



elimination of federal incentives for barrier beach development. State coastal policy has not protected local interests with respect to "developed" barrier beaches and has forced local government to issue restrictive zoning ordinances that have been subjected to legal action. However, the outcome of this litigation is less important, at least to the Town of South Kingstown, now that Green Hill Beach has been designated as an undeveloped beach within the Coastal Barrier Resources System. The door is still open, however, for the further private development on other "developed" barrier beaches throughout the state.

Although the implementation of the Omnibus Reconciliation Act of 1981 and the Coastal Barrier Resources Act protects the barrier beaches from further federal development and subsidies and attempts to treat the development problem at its source, the barrier beaches within Rhode Island remain threatened. In light of the recent limitation of a local government's ability to restrict development through zoning ordinances, it is evident that those barrier beaches regarded by the state Coastal Resources Management Program as "developed" need stronger management from the state level. Now that the federal government has significantly reduced its role in the development of barrier beaches, it is time for the state to tailor its Coastal Resources Management Program to fit local needs.

Regardless of the legal situation within Rhode Island,

it is only a matter of time before another hurricane or major storm demonstrates its long forgotten power and wreaks havoc on the state's barrier beaches. Certainly then, the need will be demonstrated for the clear-cut state management program for the "developed" barrier beaches that is so desperately needed.

## APPENDIX A

### DEVELOPED AND UNDEVELOPED BARRIER BEACHES\*

#### Developed

Atlantic Beach, Westerly  
Central Beach, Charlestown  
East Beach, Charlestown  
Charlestown Beach, Charlestown<sup>1</sup>  
Green Hill Beach, South Kingstown<sup>1</sup>  
East Matunuck-Jerusalem Beach, South Kingstown-Narragansett  
Roger Wheeler Beach (Sand Hill Cove), Narragansett  
Narragansett Beach, Narragansett  
Bonnet Shores Beach, Narragansett  
Mackerel Cove Beach, Jamestown  
Hazard's Beach, Newport  
Bailey's Beach, Newport  
First (Easton's) Beach, Newport  
Second (Sachuest) Beach, Middletown  
Third Beach, Middletown  
Tunipus (South Shore) Beach, Little Compton  
Crescent Beach, New Shoreham  
Watchhouse Pond Beach, Little Compton  
Sakonnet Harbor Beach, Little Compton<sup>1</sup>  
Conimicut Point, Warwick

#### Undeveloped

Napatree Beach, Westerly<sup>1</sup>  
Maschaug Beach, Westerly<sup>1</sup>  
Quonochontaug Beach, Westerly-Charlestown<sup>1</sup>  
East Beach (Ninigret Conservation Area to Charlestown Breachway)<sup>1</sup>  
Moonstone Beach, South Kingstown  
Browning Beach, South Kingstown  
Long Pond Beach, Little Compton<sup>1</sup>  
Round Pond Beach, Little Compton<sup>1</sup>  
Briggs Beach, Little Compton<sup>1</sup>  
Ship Pond Cove, Little Compton  
Round Meadow Pond Beach, Little Compton  
Quicksand Pond Beach, Little Compton<sup>1</sup>  
Sandy Point, New Shoreham<sup>1</sup>  
West Beach, New Shoreham<sup>1</sup>  
Casey Point, North Kingstown<sup>1</sup>  
Bissill Cove, North Kingstown<sup>1</sup>  
Greene Point, North Kingstown<sup>1</sup>  
Tibbitts Creek, North Kingstown  
Gull Point, Portsmouth (Prudence Island)  
Coggeshall/Sheep Pen Coves, Portsmouth (Prudence Island)<sup>1</sup>

\* As listed in Rhode Island Coastal Resources Management Program Draft Revisions (Dated March 25, 1983)

McCurry Point, Portsmouth  
High Hill Marsh Barrier, Little Compton<sup>1</sup>  
Fogland Point, Tiverton<sup>1</sup>  
Sapowet Point Barrier, Tiverton  
Fox Hill Pond, Jamestown  
Mary's Creek, Warwick  
Baker's Creek, Warwick  
Buttonwoods Cove, Warwick  
Gaspee Point, Warwick  
Nayatt Point, Barrington  
Mussachuk Creek, Barrington  
Rumstick Point, Barrington  
Hog Island, Bristol<sup>1</sup>  
Musselbed Shoals, Portsmouth  
Nag Pond, Portsmouth<sup>1</sup>  
Jenny Pond, Portsmouth<sup>1</sup>

<sup>1</sup>Denotes those barrier beaches or portions thereof where federal flood insurance will not be granted pursuant to the Coastal Barrier Resources Act of 1982.

APPENDIX B

USES ALLOWED IN FLOOD DANGER ZONING DISTRICT

S - By Special Exception Only

P - Permitted

- |  |   |
|--|---|
| 1. Field Crop Farms  | S |
| 2. Livestock Farms   | S |
| 3. General Crop and Livestock Farm   | S |
| 4. Horticultural Nursery   | S |
| 5. Fish Hatcheries   | S |
| 6. Parking or Outdoor Storage of One (1) Commercial vehicle of up to 1½ ton capacity on a lot  | S |
| 7. Indoor or screened Outdoor Storage of no more than three (3) Commercial Vehicles of less than 1½ ton capacity not including any accessory Machinery and Equipment for such, where not an accessory use to a permitted principal use | S |
| 8. Ship and Boat Building and Repairing  | S |
| 9. Commercial Dock or Pier   | S |
| 10. Utility Substation or Pumping Station  | S |
| 11. Sales of Fruit and Vegetables Produce Raised on the Premises   | P |
| 12. Storage, Repair, and Sales of Boats and Marine Accessories   | S |
| 13. Lunchroom or Restaurant (no alcoholic beverages)   | S |
| 14. Bicycle Sales, Rentals (including repairs)   | S |
| 15. Marine Oriented Supplies and Bait (including rental)   | S |
| 16. Off-Street Automobile Parking Facility Accessory to a permitted use  | P |

- |     |   |   |
|-----|---|---|
| 17. | Commercial Off-Street Parking Lot   | S |
| 18. | Government-owned Building (except penal, garage, or utility)  | S |
| 19. | Tent Camps  | S |
| 20. | Golf Course   | S |
| 21. | Boat Liveries (small boat rentals)  | S |
| 22. | Marinas   | S |
| 23. | Bathing Beaches   | S |
| 24. | Individual Beach Cabanas, Dressing Rooms, or Bathhouse  | S |
| 25. | Beach Club or Yacht Club  | S |
| 26. | Bathing Pavilion  | S |
| 27. | Conservation Lands, Wildlife Areas, Nature Preserves  | P |
| 28. | Private Parks, including subdivision parks  | P |
| 29. | Campgrounds (non-profit)  | S |
| 30. | Indoor and/or Outdoor Private Non-Profit Recreation not elsewhere classified  | S |
| 31. | Any accessory use customarily incident to a use permitted in the district and located on the same lot as the permitted use                        | P |
| 32. | Any accessory use customarily incident to a use permitted as a special exception in the district and located on the same lot as the permitted use | S |

FOOTNOTES

<sup>1</sup>Dan K. Richardson, The Cost of Environmental Protection: Regulating Housing Development in the Coastal Zone (New Brunswick, N.J.: Center for Urban Policy Research, 1976), p. 5.

<sup>2</sup>U.S. Senate, Coastal Barrier Resources Act: Hearings before the Subcommittee on Environmental Pollution of the Committee on Environment and Public Works (Washington, D.C.: U.S. Government Printing Office, 1982), p. 149.

<sup>3</sup>Stephen B. Olsen and Malcolm J. Grant, Rhode Island's Barrier Beaches: Volume I (University of Rhode Island, Kingston, R.I.: The Coastal Resources Center, 1973), p. ix.

<sup>4</sup>State of Rhode Island, Coastal Resources Management Program (Providence, R.I.: March, 1978; As amended February 23, 1982), p. 35.

<sup>5</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress (Washington D.C.: U.S. Government Printing Office, 1982), p. 4.

<sup>6</sup>Malcolm J. Grant, Notes submitted to the South Kingstown Planning Department as a witness for the defense in the Annicelli Case.

<sup>7</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 4.

<sup>8</sup>Olsen and Grant, p. 7.

<sup>9</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 5.

<sup>10</sup>Olsen and Grant, p. 9.

<sup>11</sup>Olsen and Grant, p. 9.

<sup>12</sup>Olsen and Grant, p. 10.

<sup>13</sup>Olsen and Grant, p. 10.

<sup>14</sup>Olsen and Grant, p. 9.

<sup>15</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 8.

<sup>16</sup>George L. Seavey, Rhode Island's Coastal Natural Areas: Priorities for Protection and Management, Marine Technical Report No. 43 (University of Rhode Island, Kingston, R.I.: Coastal Resources Center), p. 20.

<sup>17</sup>Olsen and Grant, p. 20.

<sup>18</sup>Olsen and Grant, p. 19.

<sup>19</sup>Anna F. Prager, "Annicelli v. The Town of South Kingstown: A Case Study," Thesis, University of Rhode Island, 1978, p. 12.

<sup>20</sup>Seavey, p. 8.

<sup>21</sup>Olsen and Grant, p. 21.

<sup>22</sup>Olsen and Grant, p. 22.

<sup>23</sup>Department of the Army, Corps of Engineers, Hurricane Survey Interim Report (Narragansett Pier, R.I.: U.S. Government Printing Office, 1960).

<sup>24</sup>Olsen and Grant, p. 11.

<sup>25</sup>Providence Journal Company, "Hurricane Carol Lashes Rhode Island," Providence Journal, 1954, pp. 1-3.

<sup>26</sup>Secretary of the Army, Report on Rhode Island Coastal and Tidal Areas, 89th Congress, 1st Session, House Document No. 145 (Washington, D.C.: U.S. Government Printing Office, 1965), p. 3.

<sup>27</sup>Prager, p. 4.

<sup>28</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 10.

<sup>29</sup>Olsen and Grant, p. 26.

<sup>30</sup>Olsen and Grant, p. 31.

<sup>31</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 10.



<sup>32</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 10.

<sup>33</sup>U.S. Senate, Coastal Barrier Resources Act, p. 148.

<sup>34</sup>Prager, p. 36.

<sup>35</sup>Prager, p. 36.

<sup>36</sup>Prager, p. 61.

<sup>37</sup>Prager, p. 30.

<sup>38</sup>Garrett Power, The Federal Role in Coastal Development (St. Paul, Minnesota: West Publishing Co., 1974), p. 332.

<sup>39</sup>Thomas D. Galloway and Dennis Nixon, "The Newest Federalism and Coastal Areas," Oceanus, Volume 25, Number 2, Summer 1982, p. 4.

<sup>40</sup>Phoebe A. Eliopoulos, "CZM: Program at a Crossroads," Environmental Reporter, September 17, 1982, p. 6.

<sup>41</sup>Prager, p. 34.

<sup>42</sup>State of Rhode Island, Coastal Resources Management Program, p. 49.

<sup>43</sup>State of Rhode Island, Coastal Resources Management Program, p. 49.

<sup>44</sup>State of Rhode Island, Coastal Resources Management Program, p. 48.

<sup>45</sup>Prager, p. 35.

<sup>46</sup>H. Crane Miller, "Coastal Flood Plain Management and the National Flood Insurance Program: A Case Study of Three Rhode Island Communities," Environmental Comment, November, 1975, p. 2.

<sup>47</sup>Phoebe A. Eliopoulos, p. 18.

<sup>48</sup>U.S. Department of the Interior, Federal Register, Volume 47, No. 224, Coastal Barrier Resources Act; Interpretative Guidelines and General Statement of Policy, (Washington, D.C.: U.S. Government Printing Office, 1982), November 19, 1982, p. 52388.

<sup>49</sup>Eliopoulos, p. 18.

<sup>50</sup>U.S. Senate, 97th Congress, 2d Session, Coastal Barrier Resources Act, Report No. 97-419, (Washington, D.C.: U.S. Government Printing Office, 1982), p. 2.

<sup>51</sup>Eliopoulos, p. 18.

<sup>52</sup>U.S. Senate, 97th Congress, 2d Session, Coastal Barrier Resources Act, p. 8.

<sup>53</sup>State of Rhode Island, Coastal Resources Management Program, p. xiv.

<sup>54</sup>Title 46, Rhode Island General Laws, Sections 46-23-1 through 46-23-12; Added by Chapter 279, Public Laws 1971.

<sup>55</sup>Ibid.

<sup>56</sup>Ibid.

<sup>57</sup>State of Rhode Island, Coastal Resources Management Program, p. ii.

<sup>58</sup>State of Rhode Island, Coastal Resources Management Program, p. iii.

<sup>59</sup>State of Rhode Island, Coastal Resources Management Program, p. viii.

<sup>60</sup>Prager, p. 37.

<sup>61</sup>State of Rhode Island, Coastal Resources Management Program, p. xx.

<sup>62</sup>State of Rhode Island, Draft Revisions to the Coastal Resources Management Program dated March 25, 1983 (Providence, R.I.: March 25, 1983), pp. 72-73.

- <sup>63</sup>Prager, p. 72.
- <sup>64</sup>Prager, p. 72.
- <sup>65</sup>Prager, p. 24.
- <sup>66</sup>South Kingstown Zoning Ordinance adopted October 22, 1956
- <sup>67</sup>Prager, p. 25.
- <sup>68</sup>Prager, p. 26.
- <sup>69</sup>Amendment to the South Kingstown adopted May 29, 1975
- <sup>70</sup>Revised South Kingstown Zoning Ordinance (March, 1976),  
Article 12.
- <sup>71</sup>Prager, p. 74.
- <sup>72</sup>Anthony Lachowicz, Memo to John E. Connors, Jr.,  
Town Manager, South Kingstown: Revised Barrier Beach Policy,  
January 30, 1975.
- <sup>73</sup>Prager, p. 38.
- <sup>74</sup>Prager, p. 39.
- <sup>75</sup>Ida Annicelli v. Town of South Kingstown, et al.,  
Civil Action No. 76-7, Brief Amici Curiae of Natural Resources  
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- <sup>76</sup>Prager, p. 8.
- <sup>77</sup>Ida Annicelli v. Town of South Kingstown, et al.,  
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- <sup>78</sup>Natural Resources Defense Council, Inc., Brief Amici  
Curiae, p. 2.
- <sup>79</sup>R.I. Supreme Court Opinion of July 13, 1983, p. 5.
- <sup>80</sup>R.I. Supreme Court Opinion of July 13, 1983, p. 5.
- <sup>81</sup>R.I. Supreme Court Opinion of July 13, 1983, p. 5.

<sup>82</sup>R.I. Supreme Court Opinion of July 13, 1983, p. 13.

<sup>83</sup>R.I. Supreme Court Opinion of July 13, 1983, p. 15.

<sup>84</sup>Author unknown, "Beach Ruling Seemingly Based on Sand," Providence Journal, July 17, 1983.

<sup>85</sup>John Clark, "The National Interest in Barrier Islands and Beaches: Natural Resource Values," Barrier Islands and Beaches: Technical Proceedings of the 1976 Barrier Islands Workshop, Annapolis, Maryland, May 17-18, 1976, p. 43.

<sup>86</sup>U.S. Senate, 97th Congress, 2d Session, Coastal Barrier Resources Act, p. 2.

<sup>87</sup>U.S. Senate, 97th Congress, 2d Session, Coastal Barrier Resources Act, p. 3.

<sup>88</sup>U.S. Senate, 97th Congress, 2d Session, Coastal Barrier Resources Act, p. 2.

<sup>89</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 15.

<sup>90</sup>Natural Resources Defense Council, Inc, Brief Amici Curiae, p. 11.

<sup>91</sup>Author unknown, "Beach Ruling Seemingly Based on Sand," Providence Journal, July 17, 1983.

<sup>92</sup>U.S. Department of the Interior, Undeveloped Coastal Barriers: Report to Congress, p. 15.

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