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COASTAL DEVELOPMENT: BARRIER ISLANDS, FLOOD INSURANCE, AND POLICY

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PROCEEDINGS OF A CONFERENCE IN
CHARLESTON, SOUTH CAROLINA

MAY 15, 1980

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COASTAL DEVELOPMENT: BARRIER ISLANDS, FLOOD INSURANCE, AND POLICY

PROCEEDING OF A CONFERENCE IN
CHARLESTON, SOUTH CAROLINA, 1980

MAY 15, 1980

JOHN M. ARMSTRONG
Conference Chairman

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PURPOSE OF THE CONFERENCE

During the past several months there has been a considerable increase in the level of discussion and debate over the future of barrier islands, federal flood insurance, development, and other subjects related to barrier islands.

This public forum was intended to provide information from government agencies, industry, and other groups regarding barrier islands.

The South Carolina Sea Grant Consortium organized this conference as one of several **1980 Year of the Coast** activities in South Carolina.

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PROGRAM

INTRODUCTION Dr. John M. Armstrong,
Director, S.C. Sea Grant Consortium,
Executive Chairman, Year of the Coast Advisory Board
pages 1-3

WELCOME & MODERATOR Senator James M. Waddell, Jr.,
Chairman, S.C. Coastal Council

N.C. MANAGEMENT PROGRAM
THE HAZARD ZONE Dr. Parker Chesson,
President, College of the Albemarle
Pages 4-14

RESEARCH ON PHYSICAL CHANGES ON
BARRIER ISLANDS Dr. Craig Everts,
Chief Engineer, Geology Branch,
Coastal Engineering Research Center
Pages 15-26

ALTERNATIVE POLICIES FOR
BARRIER ISLAND DEVELOPMENT Mr. Jack Hauptman,
Chief Division, Natural Resource System Planning
Pages 27-35

THE NATIONAL FLOOD INSURANCE PROGRAM IN
THE YEAR OF THE COAST Ms. Gloria Jimenez
Federal Insurance Administrator,
Associate Director, Federal Emergency Management Agency
Pages 36-46

BARRIER ISLAND DEVELOPMENT IN
HARMONY WITH NATURE Mr. Mark Permar,
Director of Planning, Kiawah Island Development Company
Pages 47-58

INTRODUCTION

DR. JOHN M. ARMSTRONG, DIRECTOR

S.C. SEA GRANT CONSORTIUM

EXECUTIVE CHAIRMAN, YEAR OF THE COAST ADVISORY BOARD

Today we're holding this public forum as one of the South Carolina Year of the Coast activities. For those of you who may not know about the Year of the Coast, it's a National program started by President Carter in 1979 designating this year, 1980, as the Year of the Coast to emphasize and celebrate, in the best sense of the words, the values of the resources of the coast all over the country.

South Carolina was one of the first states to recognize the validity and the need to do this, and Governor Riley appointed the Year of the Coast Committee to oversee the activities. There are a series of events planned during the year to bring to focus with the citizen in the street, in the agency, and in the universities just exactly what some of the issues and problems are in this very precious resource we have called the coastal zone.

One of the most important and timely topics to all of you who live here in South Carolina is the question of barrier island development, a key question in the minds of

developers, regulators, preservation groups, environmental groups, and so on. In recent months, there's been a great deal of activity, particularly at the Federal level, a great deal of speculation and proposal development, alternative developments dealing with this question of barrier island development, and management of the development of barrier islands. There have been some proposals put forth. There have been some excellent studies put together with some alternatives for what we could do with the nation's barrier islands. There actually has been new legislation addressed to this issue. As a result, there are a lot of rumors going around the State and the Nation about what's going to happen to barrier islands. Is there going to be flood insurance, or isn't there? Is there going to be change? Is there going to be Federal acquisition of barrier islands, or isn't there? We think, as a very typical contribution of our Year of the Coast Committee and program here, that we need to hold a public forum to see if we can't have the people who are directly involved from Washington and other places come and tell us what they have in mind and what they've found from their studies of barrier islands. This definitely is not any kind of a public hearing. It's not going to be a public debate about the issues. It's going to be an exchange, and I hope, an information gathering mechanism for all of us. That's our primary purpose today.

The Sea Grant Program is dedicated towards this information exchange and we're very happy and pleased to be able to help sponsor and put together this meeting.

NORTH CAROLINA COASTAL MANAGEMENT PROGRAM:

THE OCEAN HAZARD ZONE

DR. PARKER CHESSON

CHAIRMAN, N.C. COASTAL RESOURCE COMMISSION

It is a pleasure to be in South Carolina. This is my first trip to Charleston. It is a lovely city, and I hope to see more of it tomorrow.

Since we have a lot on the program, I'll try to get right into my remarks. I have several slides that I will be using to help explain North Carolina's coastal management program.

First, let me say that the reason I am here is because I am currently serving as Chairman of the North Carolina Coastal Resources Commission, which in North Carolina supervises the coastal management program for our state.

In North Carolina, the Coastal Management Program is almost six years old now. In 1974, our legislature passed what is called the Coastal Area Management Act. It is a very comprehensive piece of legislation. I think it has the notoriety of being one of the most amended pieces of legislation to ever go through our General Assembly. This controversial law was debated for two years before it was enacted. It was introduced in the General Assembly in 1973 and was eventually passed in 1974.

This slide shows the geographic area which is covered by our program. We have one hundred counties in North Carolina, and twenty of these fall under this legislation.

The regulatory part of our program, which involves a permitting system, does not cover all of that land. It covers primarily the land adjacent to our rivers, our sounds, and the ocean.

All of the twenty counties involved in this program had to develop a land use plan. In fact, most of the counties now are in the process of updating their plans, which is required at least once every five years.

Our program required the development of land use plans, as I just mentioned. That part of the program is behind us. The land use plans in some counties are good and in some other counties they are not as good, if you want a very honest opinion. We are now trying to improve the ones that are not of high quality.

The other major part of our program, which is the most controversial, is the regulatory system. Development that takes place in areas that we have designated as areas of environmental concern (AECs) is regulated by a permit system.

In these areas, large development projects are classified as major development and must be approved by the Coastal Resources Commission. An example would be an oil refinery or a large motel or hotel on the ocean front.

Most of the development activity is much smaller than that and is handled at the local government level. The county or the city involved does their permitting of minor development activities. I do not have time to go into the distinction between major and minor development, but they are defined in the legislation that was passed in 1974.

This slide doesn't show up very well. It is a photograph of North Carolina's Coastal Management Plan which was approved about two years ago by the U. S. Department of Commerce. So, our program has been approved by the agency involved in coastal management at the Federal level.

This is a 1969 Apollo photograph. I think it was taken in March from an altitude of about one hundred and twenty miles. It does not show the entire North Carolina coast. It shows primarily the central and northern part of the coast. The point that you see off to your right, of course, is Cape Hatteras.

When you look at barrier islands from this view, their fragile and delicate nature is impressed upon you more readily. We are talking about a strip of sand along our coasts, and North Carolina does have many miles of barrier islands.

In North Carolina, current conditions are this. We have slightly over 300 miles of coastline and about 50 percent of that is public owned. It is owned by the local, state or federal government, with most of that being held by the federal government in the form of two National Seashores, Cape Hatteras

and Cape Lookout. The public does have access to a fairly large amount of undeveloped, protected land along our barrier islands.

This slide shows Jockey's Ridge. Within the last couple of years this was acquired by the State and is now known as Jockey's Ridge State Park.

This slide shows an undeveloped beach area on the northern part of our coast in Currituck County. In Currituck County there is a 23-mile stretch of barrier island which is at this time relatively undeveloped. Most of it has been platted and many lots have been sold. However, there are access problems in this particular area. Some people have land they can get to only by boat. As a result of concern for this area and development pressures, the U. S. Fish and Wildlife Service has recently proposed to purchase approximately half of that 23 miles for an estimated price tag of a hundred million dollars. This would be converted into a national wildlife refuge. I suppose that is one of the most controversial topics along the North Carolina coast at this time. Many of the people who live in that area are opposed to this, particularly the ones who own land on the Currituck Outer Banks; but, at this time the Fish and Wildlife Service has developed a draft environmental impact statement on this acquisition and will be developing the final environmental impact statement in the next few months. The county commissioners in Currituck County have endorsed this acquisition contingent on certain conditions being met by the Fish and Wildlife Service.

Along the North Carolina coast we do have highly developed areas. This is an aerial photograph of the Nags Head region, on the northern part of the coast. Here we have numerous beach front cottages.

On the southern part of the coast, we also have highly developed areas. In fact, you see in this slide extensive bulkheading to protect ocean front cottages. This is something I will get back to in just a moment.

This slide doesn't show up very well. The point I wanted to make with this graph is that sea level has gradually increased during the past several thousand years. About 19,000 years ago, the ocean was 400 feet lower than it is now. Since that time, the ocean level has been rising. It tended to slow or decrease its rate of rise about 5,000 years ago. Evidence indicates that sea level is continuing to rise. This causes part of the problem that we have along the barrier islands and other coastal regions. We use the term erosion in our discussions in reference to land eroding and the ocean threatening a cottage or some manmade structure. I think all of us are beginning to realize more and more that these are natural processes. One reason for this meeting here today is to discuss how man and his development of coastal regions is going to have to adapt to these natural processes.

The first type of danger along the coast I would like to address is the slow, gradual erosion process. This is a

slide showing a beach area in North Carolina where out in the surf zone there are numerous stumps and fragments of trees which used to be on the sound side of barrier islands thousands of years ago. This is not unique to North Carolina. We find this almost anywhere you have barrier islands. The point I am making is that these islands tend to migrate or move inland as the ocean level rises.

This slide shows erosion at the Cape Hatteras lighthouse during the last 100 years. The shoreline has gotten several hundred feet closer to the lighthouse than it used to be. There has been a lot of money spent for renourishment of the beach area and construction of groins and jetties trying to stop or slow the erosion. I am not sure that in the long run we will win this battle. A major storm could destroy this historic structure.

This slide shows an area north of the Cape Hatteras lighthouse where several years ago, there was a major storm and tremendous erosion. As a result of that storm, a beach renourishment project was started and sand was pumped in. We have seen this type of activity on many of the barrier islands in North Carolina, particularly in the past. This is the type of activity some of the others on the program are

going to address, the use of public funds to restore a beach and to protect private property.

Another type of damage that all of us in coastal management are concerned about is storm damage due to northeasters or hurricanes. In North Carolina, we have been fortunate in the last 15 to 20 years. We have many people who live on the coast today who have not experienced a bad hurricane. They don't know what to expect and they really don't think too much about hurricanes and the danger they pose.

This is a slide that was taken recently at Gulf Shores, Alabama, after hurricane Frederick. One of the people involved in our program went down and looked at what had happened. You see the remains of pilings which cottages were attached to before that storm.

This is a map which I use in some talks in North Carolina showing the tracts that hurricanes took back in the 1950's. Hurricane Hazel was one of the worst of that period. If we have that kind of hurricane pattern again in the near future, there will be tremendous damage along our coast.

This slide shows a motel at Wrightsville Beach, North Carolina. About 20 years ago there was an inlet where this motel is located today. This is a very erosion-prone area. In fact, right at the back door of that motel is a concrete bulkhead

or seawall, with the ocean lapping up against it. There is not a beach at high tide and not too much at low tide.

This slide shows Oregon Inlet, one of the major inlets along the northern part of the coast. About twenty years ago, a bridge was constructed across the inlet, connecting the Nags Head region to Hatteras Island. Previously, there had been a ferry service across the inlet. The red lines super-imposed on this photograph show the conditions in 1958. As is evident, the inlet has migrated southward--particularly the northern shoreline. This southward movement is the natural tendency along the North Carolina coast. Recently, there has been much discussion about the stability of the Oregon Inlet bridge. There have been studies which indicate that a major storm could cause great damage to the bridge. There have been arguments back and forth between the Corps of Engineers and the Department of Transportation in North Carolina about what should be done and when. The point is that it was built across a very unstable area and a major storm could cause severe damage or possibly destroy it.

I would like to move on to another topic which we have tried to address in our program. Many ocean front landowners want to construct jetties or groins out into the water to catch sand to build up property or to protect it.

What the diagram shows is that anytime you put an obstruction out into that surf zone to try to trap sand, you are literally robbing your neighbor. It's like a river of sand along the face or front of the beach. If you hold it in one place, someone downstream is going to be deprived of that flow

of sand and you're going to increase the erosion at that location. We have many instances of this in North Carolina. Our program, at this time, makes it very difficult for a property owner to do this because it's a losing proposition in most cases. Structures you put out there to benefit yourself are, in almost all instances, going to cause harm somewhere else in that system.

This slide shows the use of large boulders which are used to try to hold off the ocean. This is a short term solution. Coastal geologists tell us that any time you put up a stable barrier of that kind, and it's really not that stable, you tend to lose the beach. The surf pounds up against the barrier and scouring action is increased. Sand is carried off the beach zone and you end up with a situation like this--with the ocean lapping up against the bulkhead or the rip rap material, which ever it might happen to be.

This slide shows a large seawall in New Jersey. The ocean is on the right-hand side of that structure. You can't even see the ocean from the road which is just behind the seawall. We have coastal geologists in North Carolina who are telling us to not let this happen in our state. One alternative is to relocate ocean front cottages.

At this time in North Carolina the subject of ocean front bulkheading is of great interest to us. Our coastal management program requires us to look at tomorrow, next week, next month and next year. But, it also requires more foresight

than that--to look down the road into the future. The evidence today is that if you put seawalls and rigid bulkheads on the ocean front, you end up losing the beach area. North Carolina has a very beautiful coastline and we do not want this kind of situation in our state.

Constructing seawalls is very expensive and you will end up without a beach in the process.

This slide shows, believe it or not, some ocean front lots. We recently denied applications to build cottages on those lots. I am certain this will be carried to court. However, we felt that was a very foolish proposed development. The erosion rate in that area is relatively high, and there is a good chance that whatever is put there is going to be in the ocean in a few years.

The lot shown in this slide is two hundred feet wide and five feet deep today. Five years ago, it was two hundred feet deep.

In inlet areas along our coast, we try to stay away from any type of development. These are very hazardous areas.

This slide shows a septic tank exposed along a beach area where there has been quite a bit of erosion.

This slide shows a cottage at Nags Head that was recently relocated at a cost of thirty or forty thousand dollars under the Federal flood insurance program. Funds were provided to relocate the cottage rather than having it fall into the ocean and then having to pay its full insured value.

Let me close by saying that in our program we are also trying to look at construction standards. This slide shows a twelve inch piling that has been notched in order to attach the cottage. The result is a four-inch supporting structure. Eight inches of it were cut away in order to attach the floor joists. If we are going to allow ocean front development, let's do it with the strongest possible construction techniques.

I will end my remarks at this point. I will be glad to answer questions that you have during the question and answer part of the program.

RESEARCH ON PHYSICAL CHANGES ON BARRIER ISLANDS

DR. CRAIG EVERTS

CHIEF, ENGINEERING GEOLOGY BRANCH, COASTAL
ENGINEERING RESEARCH CENTER

My comments differ from the others in that I will discuss the technical aspects of Coastal Zone Management. The points I wish to make are, first, that I don't think all the answers are in on what's happening in the coastal zone from the standpoint of where the sediment is going; secondly, a barrier island and its environs is a very complex system; and third, if I might, I'd like to be the advocate of the decision-makers using the results of the scientists' and engineers' studies.

I will briefly go through what I think some of the conflicting problems in the coastal zone that relate to the movement of sediment. I will give you an overview of why the islands are eroding, what the processes are that cause the sand to go from one place to the other, and what the implications are in that movement.

One of the problems is that we'd like to provide a recreational area and usually that means a beach. When that beach moves, i.e., when the beach sand moves, the beach may erode. The erosion may be in an area in which we have a fixed structure. Obviously, that causes some problems. The solution

would be to keep the beach somewhere seaward of the structure thereby providing a sandy barrier to wave action. With the recreational beach, however, if we don't have any impediments to that beach moving, the beach widths will probably stay the same as the coast erodes and retreats. So, we maintain the beach itself. We may not maintain our parking lots behind it, but the beach resource is still there.

Another problem we have in dealing with sediment movement in the coastal zone is that of trying to maintain the integrity of the living natural resources in and adjacent to the barrier islands. An example is the marshes you see behind these barrier islands. These marshes are founded on some kind of a sediment. In some cases, it's sand; in some cases, it's mud and silt; and in other cases, it's organic matter that's generated from the marsh itself. These marshes are depth dependent. That is, the plants that comprise the marsh can't grow in water that's deeper than the water they live in. So, if sea level is rising relative to land as it is in some areas, new sediment has to be transported into the marsh areas or the marshes will drown. Conflicts exist. Because of the different sediment movements on the barrier islands, we have people that want structures to remain in place; and they want people to hold the shore where it is; and then, in other cases, we want sediment to move from the beaches to provide a foundation for marshes. The next part of my discussion will be on

the different movements of sediment in the coastal zone and how they may relate to some of these problems. I will also discuss research that's going on dealing with these problems.

If we look at the barrier island in plane view, looking down on it, we see a lagoon on the landward side. The lagoon will probably be bounded by marshes on both sides. In an alongshore direction, the barrier island is bounded on one or both ends by an inlet. Seaward of the shore there is an off-shore area. I submit that the totality of sand and other size sediment movement in this entire zone is a continuum. If we disturb the movement of that sediment in some way or remove sand from someplace in that system, there will be a reaction elsewhere in the system.

The directions of sediment transport are longshore transport, i.e., moving parallel to shore, and transport normal to shore. The sand volume is also varied by removing sand from the system or putting new sand into the system (from completely outside the system) by mining or by beach replenishment.

The profile seaward of a barrier island is usually concave up near the barrier island out to depths of between five feet and 75 feet depending upon the wave action. That may be a distance of a half a mile from shore to three or four miles from shore. This is the active sediment transport zone. Sand and other sediment is moving there and if we do anything to disturb it, we'll disturb the barrier island system itself. Seaward of that the movement of sediment really doesn't affect

the barrier island.

Let's first look at longshore transport. If you viewed Ocean City, Maryland from the air, the inlet you would see was formed in the early- and mid- thirties by a hurricane. Subsequent to that hurricane, in order to maintain the inlet where it was, structures in the form of jetties were constructed. The northern jetty impounded sand that was moving from north to south, that is, trapped that sand; and south of there which is the north end of Assateague Island consequently wasn't receiving any sand coming in from updrift. The consequence was that while waves and currents still moved sand away from the north end of Assateague Island, no new sand was coming in. The island retreated until we see what we have here today, a barrier island retreat of over 300 meters. That's the longshore transport of sand, and that longshore transport of sand obviously could also be impeded by such things as groins. It can be halted in natural ways, too.

In looking at the shore normal movement of sand, one of our major research topics today, at least at the Coastal Engineering Research Center, is the question whether sand is coming in from offshore sources or whether it is leaving the beaches and going offshore to find a residence out there from whence it never returns. And, right now, we do not know, not only what quantity is moving in either direction, but we don't even know which direction it's moving. Intuitively, I think

if anything, it's moving onshore rather than offshore. That's a major research topic and it's a major question and unknown in any work we do in trying to establish where sediment is going in the coastal zone.

We have a bit better idea of where sediment is going when it moves across the barrier island, again, in a shore normal direction. One type of this sediment movement is called overwash. During a period of high water, the water, waves, and sand all move right across the island. The wind creates a stress on the sea surface which causes the water level to rise, the waves are bigger, and if the frontal dune, (that is the dune behind the beach), has low spots in it or if the dune doesn't exist, or if it is eaten away by the waves, the water and sand will rush through the low area and across the island. This obviously causes flooding and sedimentation problems for people who live on the islands. The result of overwash is a movement of sand from the front of the island to the back. Any time sand from a barrier island system is moved landward, ultimately, the beach is moved landward because the beach material is displaced in that direction. So, overwash is one way of moving sand landward and, ultimately, causing the beach to retreat a little bit landward.

On some islands south of Assateague Island the primary mode of landward migration is by overwash. The sandy area on these islands is about 200 meters wide and this is

migrating across a marsh that exists behind the island. From the air you can see the old marsh channels being filled in with the island deposits. So, overwash, in this case, is a very effective means of causing the sand to be moved towards the continental land mass.

One way to prevent overwash is to create a barrier, such that high water levels and waves are prevented from moving sand across the islands. One way to do that is to create a dune or to fill in a natural dune where it has breaches in it. This has been done in many places and it prevents overwash. It prevents flooding of the back shore area. It also prevents in some areas the movement of sand to feed those marshes that exist behind the barrier islands. In some areas it's this sand movement that's responsible for providing the foundation for the marshes. So, we have a conflict here. This is an important research project right now. We are trying to establish how important overwash is in the creation of these marshes. Is overwash really necessary in all places? Certainly, in some places it is, but how often is it necessary? Where does the sand and where does the other sediment that support these marshes come from?

Another pretty obvious way of moving sand from a barrier island back is by wind action. Large sand dunes frequently migrate from the beach toward the lagoon. It's pretty easy in this sort of a situation to establish the amount of

sand that's moving away from the beach. We establish it by repetitive surveys, and we can get an idea of what the migration rate is.

It's not so easy in situations like that at the Kitty Hawk Memorial in North Carolina where there seems to be an isolated, large linear sand body. This sand mass has somehow broken away from the beach and it's moving as an entity and the questions are: Why did it start? Is this thing going to happen again? Is it a period event? and, What causes it? We're just not sure. We're also not sure in those cases where sand is moving across the barrier island when it doesn't move as a migrating unit.

Many dunes are vegetated and it appears that not much sand at all is moving because sand that gets into the grass is trapped. That may or may not be true all the time.

Another important mechanism for moving sand from the front of the barrier islands to behind the barrier islands is inlet entrapment. When sand moving parallel to shore, that is, sand in the longshore transport system, moves into an inlet, it may end up staying there, and this is especially the case when a new inlet opens. For example, when Drum Inlet, N.C. was opened in the early seventies, the ocean shoreline was straight. After the inlet opened, an inward shoreline flare was created by sand that moved from the beach into the inlet

flood tidal shoals and trapped. So, here we have a marvelous mechanism for moving sand behind the barrier islands; and thereby affecting a net landward transport of that barrier island system.

In some cases, however, this isn't an important problem when the inlet is ebb-tidally dominated. That is, the tide coming in doesn't have nearly the transporting power for sediment as the tide going back out. So, the tide going out keeps the inlet clear and keeps sand from collecting inside.

As an example of this trapping problem of inlets, I had the great pleasure recently to visit Australia. I visited the major Australian tourist resort called the Gold Coast. At the north end of the Gold Coast is a lagoon, and there is a spit building north flanking the lagoon. That spit is about three and a half miles long. The inlet at the end of the spit is called the Narang River Entrance and the river actually comes out behind the Gold Coast City area.

About 50 years ago the spit didn't exist. The river came out right at the end of the lagoon. In that 50-year time the spit built, the inlet migrated towards north, and the lagoon filled with sand that came in from the beaches at an average rate of about 100,000 cubic meters a year. Today there's something like seven million cubic meters of what was beach sand now back in the lagoon. The consequence is that the island and the whole system migrated back a little bit in that time.

There are structural ways of preventing inlets from moving and preventing the inlets from trapping sand. These may be effective in some cases.

Another consequence of preventing sand going into the areas behind the inlets is that on these shoals made of sand, marshes grow with all the biologic productivity that are associated with marshes. Again, we're facing a bit of a dilemma of whether to slow our shore retreat or maintain marshes.

Many people have talked about sea level rise as being an important aspect of shore line retreat. It's something that we're studying with some difficulty. We're interested, first, in what sea level rise does to the coast line. That is, what affect does it have on the coast. Obviously, a rise in the static water level on a sloping beach will cause a retreat of that beach or at least an apparent retreat because the shoreline will retreat; but it also creates a disequilibrium on that concave up-profile that I showed towards the beginning of my discussion.

If sea level were to rise and we tried to hold the shoreline in the place it is and maintain the equilibrium profile of that concave up-shore face, it would require, in some instances, large quantities of sand that isn't available. The consequence is that sea level rise may require that the shoreline retreat just to keep the sand budget in some kind

of equilibrium.

Our problem, then, is trying to quantify the effect of sea level rise on the shoreline and on the marsh areas. Secondly, and I think the big unknown we face today, is to develop some method to predict what sea level is going to do in the future. For the past three thousand years or so, sea level has been generally static. That is, it hasn't moved more than a meter or two up or down. In the last 50 years or so, based on tide records taken by the National Ocean Survey, there are very strong indications that sea level is rising again. Now, I think it is not at all unlikely that in the past two or three thousand years sea level went through a series of oscillations. We may be in an up-oscillation right now. The question is can we predict the next 50 years. We can't right now, I don't think anybody can; but from a coastal management standpoint, it's a very important question.

Man can influence the volume of sand in the system in several ways. One is by sand mining. Cronulla, Australia, for example, is an area that they've been sand mining in for many years. Today, they're taking something like two million cubic yards of sand a year from this coastal dune and using it for construction purposes. Prevailing winds and prevailing gales both come from offshore in this area. The beach is eroding and they've had a lot of problems with that erosion;

and yet, they are still removing sand. They are removing it, I understand, because the government has a long term lease with the sand mining company that apparently they can't break.

A reason for putting sand on the beaches, i.e., increasing the amount of sand on the beach, is by beach replenishment. If we know what the total loss of sand per year is and if we go someplace else and bring sand into the system, that is into the system from seaward of wherever the seaward limit of sand movement on and off the beach is or from landward of the lagoon, we're actually adding sand to the beach. It may be very expensive and it'll probably be a recurring expense; but we generally aren't hurting something by doing it.

What I've been talking about in this sediment transport discussion is something that we call a sediment budget and a sediment analysis. It is a tool for looking at all the different ways sand moves on and near a barrier island. In the barrier island system, we're looking at sand moving in from offshore or moving to the offshore zone, sand moving parallel to shore, sand moving across the barrier islands by overwash or by wind, and sand being lost in inlets which may cut down the longshore transport of sand. We can quantify this in a nice equation where the dependent variable is the change in the shoreline with time. Independent variables are all the

sand volume change rates that affect the beach. Unfortunately, we just don't know what those rates are. I hope, based on my few comments, that you will realize we don't know everything about the movement of sand in the coastal zone. We don't know what the implications of various things are such as sea level rise relative to land. We don't even know if it is rising. We don't know if sand is coming in from offshore or being lost offshore.

I am making a pitch for research, solid research, into the coastal zone. I think people are making decisions now in some cases not based on a complete knowledge of what's going on; and not just the Coastal Engineering Research Center, but at least 100 other researchers in the United States are working on these problems. I would hope that you, who are decision-makers today and who will be decision-makers in the future, will come to those researchers and ask them what's going on prior to making a decision.

ALTERNATIVE POLICIES FOR BARRIER ISLAND DEVELOPMENT

MR. JACK HAUPTMAN

CHIEF DIVISION, NATURAL RESOURCE SYSTEM PLANNING

HERITAGE CONSERVATION AND RECREATION SERVICE

As you heard from the last two speakers, we do know the islands are moving and we know when we build things on movable places, there's a high economic cost, there's an environmental cost, and there's a social cost.

In his 1979 environmental message, the President noted that there were a number of Federal programs that were encouraging development of barrier islands, resulting in the loss of their natural, cultural, and recreational values. So, at his direction, our agency conducted the barrier islands study. The study identified some three hundred study units. A study unit was either a barrier island or a system of barrier islands.

We found that approximately 600,000 acres are managed by Federal, State, or local agencies. Some 900,000 acres are in private ownership. Some 200,000 acres are considered developed. Six hundred thousand acres are undeveloped and protected; and some 700,000 acres are undeveloped and not protected from future development. In terms of land-use, the greatest amount of area is wetland--approximately 800,000 acres. Urban areas are nearly

230,000 acres.

Between 1950 and 1974, slightly more than 137,000 acres were added to the urbanized category. Incidentally, although it is not exactly a direct proportion, something like 138,000 acres of wetlands were lost from the barrier island system in that period of time.

Forty islands that had no urban acreage in 1950, had some urban acreage in 1973. Fourteen percent of the total barrier island acreage is urban versus three percent of the land in urban areas nationwide. The present rate of urbanization on barrier islands is two times the rate of urbanization nationwide.

The study identified some twenty Federal agencies whose programs affect barrier islands. About one-fourth of those programs directly or indirectly provide protection. Nearly one-half of those programs involve grants, loans, permits, licenses, what have you, that could, if managed improperly, have an adverse impact on the ecological systems of barrier islands. The remaining programs cover the administration of lands, insurance, disaster relief, all of which have an effect on the barrier islands.

Some of the conclusions of the study are: the barrier islands are indeed special. That was articulated by the first two speakers. And policies must be developed to take into consideration those special values. The review of the existing Federal authorities relating to barrier islands revealed that

there was a need for a clear, consistent Federal policy dealing with barrier island issues. Our charge was to develop such a policy.

The study also found there is a role for the States and there is a role for the private sector in developing this policy; and information on which to base the formulation of the barrier island policy needs to be made available to planners, the public, and those dealing with the barrier island issue. Hopefully, we'll do that. These gentlemen are doing well at that.

If you haven't seen the completed study yet, this is what it looks like. This gives you the basic information that's been provided to the Federal program managers as well as anyone else who is interested; but we decided after this was done to develop an environmental impact statement because we hoped to propose some new Federal actions.

What the environmental impact statement did was examine specifically the Federal programs that I mentioned. It presented some three levels of alternatives, and within those options, three different levels of action. The first level was essentially a nothing-new level. This is what the Federal programs are doing now.

The second level identified programs that were in existence, but were not being fully implemented. One good example of that is two Presidential Executive Orders that came out in 1977, one on floodplains and one on wetlands. Incidentally,

ninety percent of the barrier islands are either floodplains or wetlands or both. Those Executive Orders have been in force for about two years now; but they're not being enforced at this particular time; and there is a lot of work to be done there.

The third level of options was called the higher level of options. These required either new Presidential initiative, in the form of Executive Orders or new legislation, to move barrier island protection forward.

In all, about 130 options were displayed in the environmental impact statement, and the purpose of displaying them was to provide the basic scientific data, including the economic data as we could find it, which was very difficult. We gave the various Federal agencies the display of options and hopefully enough information. Much of it was persuasive so we hoped good decisions could be made by those decision makers.

The draft of the environmental impact statement was released in January and we immediately ran out of copies. We had to reprint it and distribute it again in February. The review period was ended on April 7th of this year. I'm not too thrilled about that because the environmental impact statement is the first one I've ever heard of that went out over the signature of the Secretary of the Interior and the Secretary of Commerce to the heads of the other Federal agencies and said, "Hey, look at this, select the options you want us to report to

the President and what you're going to do about it, and tell us what it's going to cost for you to do it." We have not gotten very good response from Federal agencies today. We're still working on that and that's my job. In the next few weeks we'll be dealing with some of the Federal agencies that have the greatest effect on barrier islands, and we'll try to get some decisions from them. If we do not get decisions from them, we propose to develop decision documents for the President that will include the options that the Secretary of Interior proposes to select and report to the President; and in addition, the Secretary's recommendations for the other agencies' courses of action. We hope we can do it the other way, but we'll see.

Let me give you some examples of the options that we are considering. One set of examples might be on developed islands; there we work with the Federal Emergency Management Administration to develop some options that they might consider in a new policy for post-disaster relief in developed areas. Essentially, what we propose that they do there is to limit the emergency work. Obviously, anything that dealt with health, welfare, safety and what have you. If someone was drowning, we weren't going to require an environmental impact statement before throwing him a doughnut or anything like this. We are now talking about limiting work after the disaster; and we are proposing that they consider several options based on

two premises: first, to reduce the recurring Federal costs on barrier islands; and secondly, to let the natural process occur. If you accept those premises, this is what you might want to consider doing in developed areas after a disaster: Limit the repairs to essential repairs of vital community services--water supply, sanitation systems, communication systems and so on. Perform limited repairs, do not rebuild. Regarding permit restoration or reconstruction of public facilities, encourage 100% grants to those communities outside the base floodplain; or in some cases, recommend 90% grants to those communities to build similar facilities, possibly off the island entirely. I understand that, if before a hurricane, there was a firehouse and a police department and a school, this agency can build one building for all three of these functions and locate it somewhere else. The purpose, again, is to limit the recurrent costs and allow the natural processes to occur. We recommend agencies consider no restoration of natural or man-made beaches or dunes or any other shore protection measures after the disaster.

It is our premise that, when a structure has remained substantially undamaged after a hundred-year storm (which is essentially what a hurricane is), there is no need to put a dune out there that is supposed to protect it from a five-year storm. Now, that policy of dune building is a hysteric policy that came from river floods where they knew how much

snow was in the mountains or that they were likely to get so much rain in the next six months; therefore they'd sandbag the riverbank to that height. That probably gives someone on a barrier island a false sense of security and not any real security at all. In fact, due to the natural processes on barrier islands, any work to reshape or rebuild beaches and dunes either man-made or natural only results in recurring costs and interference with the natural processes. Hurricane Frederick demonstrated that.

One of the inherent hazards in barrier islands is the false sense of protection which these dunes, beaches and shore protection structures seem to create. Gulf Shores, Alabama lost hundreds of homes which they thought to be strategically located behind twelve and fifteen foot dunes. Not only were the homes destroyed, the dunes disappeared.

Those are some of the options we're trying to deal with as far as developed islands are concerned; and some of the array of other options we've laid out, both for developed and undeveloped islands, begin with grants and some things I don't know if you could even perceive that affect barrier islands. For example, there are a variety of grants for sewer treatment plants. In Gulf Shores, I saw a lot of septic tanks sitting up on the beach. They used to be four or five feet under the sand. Right now, I understand, there is some interest in putting in major sewage treatment facility, providing sewers in all those areas that were on septic systems and essentially increasing

the capacity for development on that island to much more than it was even before the disaster. So, grants of this type can be growth-inducive the same as loans can be, or bridge permits. If we don't permit bridges to barrier islands, we're going to limit their accessibility and therefore discourage their development.

One that interests me as far as regulation is concerned is the Interstate Sales Act. As I understand it, any particular development of 50 homes or more must be subject to part of the Interstate Sales Act; and therefore, the developers must disclose the fact that the places they're building in, not only might be in the 100 year floodplain, but also have a ten percent chance of being blown away every year. I understand there are quite a few developments now going in on barrier islands that are less than 50 units because of that Act. A lot of 49-unit developments seem to occur for one reason or another. We have some options in our study that suggest maybe the Act should be revised to bring that size requirement down to developments of five units or more, so that this truth-in-lending kind of talk must be presented in interstate land sales for five-unit developments as well. Maybe if purchasers are told that the places they're interested in buying might, one, not be there because they are being eaten away by erosion or overwash; two, they are in a major floodplain; and three, they have a ten percent chance of being blown away every

year; this requirement might discourage development on those islands.

However, what has happened in the last twenty years or so is that through all the various Federal programs, the Federal government has essentially been subsidizing people onto the islands. Possibly, the way to approach this problem over time, and the way the options ought to be looked at and, I think, will be looked at by the various agencies and by the people I report to, is to try to develop a consistent policy that might gradually subsidize people away from that very hazardous place because it is not just a natural resource issue. It's a social issue and a political issue as well.

So, that's what is on my mind and I'll be pleased to answer questions later. Thank you.

THE NATIONAL FLOOD INSURANCE PROGRAM IN
THE YEAR OF THE COAST
MS. GLORIA JIMENEZ
FEDERAL INSURANCE ADMINISTRATOR
ASSOCIATE DIRECTOR, FEDERAL EMERGENCY MANAGEMENT AGENCY

It's always great to have an excuse to come to Charleston. I wish I could stay longer. The Year of the Coast is a year of decisions. Communities which enjoy the benefits of the coast and shoreline must make decisions to balance economic development with the flood and wind hazards that are characteristic of such locations.

The problem of balancing development with natural hazards is made more complicated by the fact that 80% of the people living on the coast have never experienced a significant hurricane. To such persons, necessary standards of safety, based on empirical evidence, appear to be absurd and unreasonable.

Coastal communities faced with this serious problem have new opportunities to address it. They can work with the redirected National Flood Insurance Program to formulate a comprehensive floodplain management effort that will make economic development and the flood and wind hazards compatible, and hopefully, the long elusive goal of local-Federal coordination can be achieved. I'm pleased to tell you that

a frame work is evolving to integrate the National Flood Insurance Program with Coastal Zone Management efforts. In combination they have the potential to protect the environmental values of barrier islands in coastal areas.

Average annual flood losses in the United States continue to increase. Even with total compliance with existing minimum national flood insurance program requirements, losses will escalate. As states and communities begin to understand this important fact, I've observed that they have begun to adopt regulations that exceed the minimum program requirements. These more restrictive regulations are provided for in our regulations at the present time; and any floodplain management regulations adopted by a state or a community which are more restrictive than the Federal criteria are encouraged and shall take precedence.

Increased hazard area development means increased disaster relief. Between 1972 and 1979, a period of little hurricane activity, the Small Business Administration, the Federal Disaster Assistance Administration, now known as the Office of Disaster Assistance, Response and Recovery, spent an average of \$1.4 billion annually on disaster relief. Approximately 80% of this figure was for flood related damages.

A final item of background information that is of importance in this is the growing experience of repeated

flood losses at the same location. Hurricane Camille damaged property which was rebuilt and later damaged by Hurricane Frederick. Actions which continue to expose property owners to flood and wind hazards must be recognized as counter-productive. A realistic appraisal of the hazards must be made to lead to rational development decisions.

Communities that lie wholly or in part within the velocity zones or V-zones as identified on our flood hazard maps must address several difficult issues. As I said, they must balance desired economic growth with a realistic and comprehensive assessment of the flood and wind hazards.

The second issue relates to how the flood hazard is to be defined. Because wave heights do exist, they must be factored into the analysis to compute the hundred year flood elevations.

A third issue is the need to blend both preventive measures, floodplain regulations which are intended to curtail and restrict and encourage wise development of new construction, and corrective measures, relocation and flood proofing of existing structures, into a comprehensive program. Action must be taken not only to prevent new flood problems from developing but it must also be taken to reduce the continuing and unacceptable flood losses that occur to existing development.

The need for a comprehensive program leads to the fourth issue. How will the National Flood Insurance Program be viewed. In a positive context, it can be considered as a means to achieve an acceptable balance between these two forces, development and hazard mitigation. A negative perspective views the program as a set of cumbersome rules and regulations which deny people the right to make use of their property. A proper perception of the Federal Insurance Administration, the agency responsible for operating the National Flood Insurance Program, is a necessary step in achieving local-Federal coordination of floodplain management. It's my hope that local agencies will come to recognize us as an ally.

To assist communities in addressing these very difficult issues, a number of changes have been initiated by the Federal Insurance Administration. The program was recently reoriented to emphasize technical assistance to communities. In the early days of the program, we were required to identify the hazard and we spent most of our funds and resources on mapping the country and encouraging communities to adopt ordinances. We are a small agency. Few people realized that nationwide, we have less than 325 people working on the National Flood Insurance Program; and that includes the people who are involved in the insurance aspects of the program. So, that was about all we could do;

and in that period, the 12 years that the agency has been in existence, we have recruited over 16,000 communities into the program; but I recognize that all 16,000 of these communities do not have the same serious flood hazard. I also recognize that we have limited resources and we're not likely to get additional resources, so we had to concentrate those very scarce resources on the communities that had the most serious problems. I was concerned because many of those communities, even if they had good intentions, did not understand how to incorporate floodplain management into their overall goals. So, emphasis was on the most flood-prone communities and we think there are about 6,000 of them nationwide. We're seeking to investigate every possible way to keep unnecessary development out of the floodplain and to relocate existing flood-prone structures wherever possible. In this connection, I have determined that where community ordinances prohibit rebuilding severely flood damaged structures, the flood insurance policy can cover a constructive total loss. This means that the claims payment can exceed the actual flood damage in consideration of the true total loss. It's my hope that this interpretation will encourage communities to exceed the minimum program regulations thereby facilitating eventual clearance of extremely hazardous areas. We will also use the constructive total loss approach on repeatedly damaged structures if the

insured is willing to donate the land to government for open space purposes.

An illustration of the redirection took place a few days after Hurricane Frederick. I sent a hazard mitigation team to the Mobile area for the purpose of assessing what actions could be taken in rebuilding so as to mitigate future damage from hurricane flooding. You know, I was a Girl Scout and I had some of your folks in Charleston chuckling last night when I said that Girl Scouts try to leave a place better than they found it and that's sort of our motto. It's foolish to rebuild a community the way it was after it's been demolished. The team developed 21 hazard mitigation strategies for the Mobile area. They range from recommending stricter construction standards to identification of structures that could be flood proofed and others that should be relocated. It identified areas of special concern and recommended a comprehensive detailed plan to be developed for the community that suffered the most devastation.

Because of my concern about increasing flood losses and increased development in velocity zones, I have initiated certain procedures that are designed to protect lives, property and environmental features in these coastal high-hazard areas.

First of all, I have accepted the recommendation of the National Academy of Science to include in our flood

insurance studies a methodology to calculate wave heights associated with storm surge in communities threatened by hurricanes along the Atlantic and Gulf Coasts.

In 1969, when FIA began it's flood insurance study program and until recently, our studies were performed using the still water surge level because a suitable and generally applicable methodology was not available. FIA asked the National Academy of Science to develop a uniform and generally acceptable methodology for estimating the hundred year wave crest. On April 15th of this year, the first studies using this new methodology were published for communities along the Alabama Gulf Coast. We selected the Alabama coast because of the recent flooding and destruction from Hurricane Frederick.

We are proceeding to include or add wave heights to all our coastal studies; and this project is scheduled for completion in all 1100 Atlantic and Gulf Coast communities by 1982.

If FIA ignored using the wave height criteria, then we would knowingly be creating a false sense of security in coastal areas. Residents of coastal areas would elevate their structures only to the still water levels and would not be protected from the impact of waves from hurricanes.

Furthermore, using still water levels has meant that the insurance rates for new construction do not reflect the full hazard to which a structure is exposed to damage. By

using the wave height crest levels, FIA will more accurately reflect the hazard for all concerned.

It is encouraging to see communities such as Nantucket Island and states like New Jersey and Rhode Island come forward to request that this more accurate appraisal be expedited for their areas.

Secondly, starting in late 1980, and this is very important because it affects Charleston as well, flood insurance premiums for all new construction in coastal velocity zones will be evaluated, rated and approved in the central office to make sure that proper rates are being charged and that construction conforms to the appropriate elevations. This step is being taken to assure that the government is receiving adequate actuarial premiums for the risk.

A third initiative is the change in our rules on break-away walls in velocity zones and it came about as a result of concerns expressed by local building inspectors. Our present rules do not specify the type of break-away walls that can be used to enclose pilings in coastal velocity zones. Many property owners have used solid break-away walls which have the appearance of being normal walls. As a result, according to local building inspectors, property owners have added habitable space in the areas behind the solid break-away walls and below the base flood elevation making a mockery of our regulations. It's difficult for local building inspectors

to do continuous inspections of previously approved premises. Furthermore, solid break-away walls can become detached from a structure during a hurricane and create a serious hazard; and more important, flood insurance rates are based on the expectation that the damage below the base flood elevation will be negligible. The habitable use of space below the base flood elevation indicates that the expected damages underlying the actuarial rates were underestimated.

This proposed rule which was published for comment in the Federal Register on March 7th will prohibit the use of solid break-away walls in these zones and will allow only wood constructed lattice break-away walls in coastal velocity zones below the base flood elevation. This proposed rule will minimize the safety hazard posed by solid break-away walls, assure the accuracy of our rates and ease coastal communities problems of post-permit enforcement.

Lastly, FIA is working on a Coastal Construction Manual to improve construction techniques in coastal communities. This manual will advise communities on how to improve foundations and connections and will provide for additional bracing for piles and columns. It will give value for construction standards to meet the additional elevation requirements for wave heights. Much of the information in this manual was verified by observation of damage following Hurricane Frederick. The manual will be available shortly. However, we are

prepared to provide technical assistance if local governments need it at the present time.

The Federal government has played a major role in encouraging the rapid development of the coast. Recent hearings on the Burton Bill have shown that the Federal subsidy will amount to over \$23,000 per acre for new development. This subsidy assists with the installation of the urban infrastructure, water lines, sewer lines, roads, highway, bridges, disaster relief and subsidized flood insurance, as well as coastal flood protection. Such subsidies tend to make development inevitable. I take little comfort from the fact that the subsidy associated with flood insurance accounts for only 7% of the total Federal subsidy.

To bring the Federal program in line with the President's Executive Orders on floodplains and wetlands, these are Executive Orders 11988 and 11990, very important numbers for people who live in flood hazard areas. I've initiated discussions with the other agencies involved in these subsidies. Working together, the prospect of balancing development with the natural hazards appears attainable. Shortly, the White House will issue a letter requiring all of these Federal agencies to enter into an interagency agreement with FIA to assist in pre-disaster hazard mitigation planning as well as post-disaster recovery efforts.

The Executive Orders, by the way, require that Federal agencies very carefully evaluate the impact of any projects they are asked to fund on coastal areas and floodplains, and if the answer is that it will cause development in these areas, then most likely they cannot fund it; or if they do decide to fund it, they must assure that it's developed in such a way as to mitigate the hazards.

Hurricane Frederick caused massive damage to the Mobile area. Few lives were lost due to the residents willingness to evacuate probably because some had had first-hand experience with Camille, but we must remember that Frederick was an average size hurricane. How will we fare if we experience a severe hurricane, and if a severe hurricane hits the East Coast where there is such extensive development, the potential damage is staggering to contemplate.

Concerned scientists have been warning of the dangers inherent in massive coastal development. Many articles and books have reported the research findings related to this subject. Prudence dictates that these findings be incorporated into the decision-making process of local governments. It's a tremendous effort, but it has to take place at the local level with the state and federal agencies providing assistance and guidance. The FIA is prepared to do it's job in assisting local governments in making wise decisions that bring into balance desired development for the natural hazards in this the Year of the Coast.

BARRIER ISLAND DEVELOPMENT IN HARMONY WITH NATURE

MR. MARK PERMAR

DIRECTOR OF PLANNING

KIAWAH ISLAND DEVELOPMENT COMPANY

What I'd like to do today is build upon those issues that were outlined by the previous speakers with particular attention to the first two gentlemen who spoke in light of the theories and practical applications and the lessons learned from those. I think the intent of Dr. Armstrong in asking me to come here is to give you an example of a development within the macro-approach that was outlined by the previous two speakers. So, with that, let me give you a little bit about what Kiawah is all about.

I work for a group called the Kiawah Island Company which is developing an island, a classical barrier island in a sense, off the coast of South Carolina and for those of you that are not familiar with Kiawah, the relationship of the island to Charleston is indicated on this graphic. The island is approximately 21 miles from just about this point to downtown Charleston; and unlike many other resort islands, it is within proximal distance of a fairly urbanized area.

The island is a classical barrier island, many examples of which were outlined in the diagrammatical pre-

sentations by the first two gentlemen. The island is approximately 10,000 acres in size. Of which about half of that was identified suitable for development, actually a little bit less than half.

The island was purchased in 1974 for a cost of \$17.3 million which compares with the gentleman before us who purchased the island in the early 50's for \$125,000. So, it's a true representation of the increased value of properties along the ocean particularly in this portion of the East coast.

At that point, the owners that purchased the island gave us a very direct charge in terms of direction that we needed to take. That being, if we're going to go about this in a way that would be commensurate with the high quality in which they envisioned, we needed to take time out up front and go about a logical analysis of what the island would allow us to do, both from a marketing standpoint as well as a natural-systems standpoint.

One of the first tasks that was outlined in our work program, which lasted for a concentrated period of over year in terms of initial intensity, and I might add continues to this day, was to conduct an environmental analysis that would be commensurate with the obvious financial and marketing analysis that would be correspondent to a project like this.

An interdiscipline group known as the Environmental Research Center from Columbia took the principal lead in this program; and the approach that was taken would be commensurate with other major land developments in that the methodology was known as the McHargian approach, which essentially is to take the whole of an object, extract all the key points in that element and dissect each of those points in terms of your analysis, equate your findings in terms of sensitivity to development and then begin to assemble the pieces back together again in a way which displays the relationship of not only smaller issues within each of the elements that you extract, but the relationship of one element to another.

So, what you'll see here are several examples of just that. Extracting the island into very distinct topics of which there are well over 50 in major categories.

The first being a mapping and analysis of the existing conditions as we first stepped onto the island. This would include not only issues of locating man-made or man-alterations to the island itself, (while keeping in mind that there were but a handful of houses on the island when we first stepped on it); but also the natural systems, open fields, the tree coverage, et cetera.

This specifically is a mapping of tree coverage and unique species forms. This not only includes a planned

mapping or graphic expression as indicated, but the beginnings of a series of sectional analysis all the way down the island, to add to my opening remarks, the island is an elongated piece of property about ten and one half miles long and approximately one mile wide at the widest point.

The key point to establish in these analyses are not only generalized tendencies for particular topics, for example tree coverage at this point, but identifying those hot spots, or areas that are extremely sensitive to future conditions. This is what is known as Sparrow Pond. It's located in an area close to some fairly intense development and was in a state, as indicated, that was a rather unhealthy natural condition.

An analysis of that showed us that it was extremely important to retain the edge conditions, the tree coverage and low shrubs, in terms of any improvements that we would make there. This is an example of retaining that edge condition which is so critical to the ponding area in addition to cleaning out the area, that is in the center of the pond, and not touching the edge conditions at all and making it not only an aesthetically pleasing environment but a much healthier natural system.

This is an example of a mapping of the subsur-

face conditions which begin to get involved in not only future structural elements on the island itself, but an understanding of what the dynamics of the soils are for select areas, that are sensitive or not sensitive for future development. This site in particular begins to express conditions that are similar throughout the island, extremely low areas within the center of the island. This area is not extremely sensitive to development; but you have to be extremely careful in terms of disruption to the water table. Again, not only from the island as a whole but from the tree coverage that you hope to retain.

That's the same shot of that area that shows us the present Inn complex on the island itself.

This is a mapping of the mammal habitats and coincidental to this was the travel patterns for the island itself, and again, sectional analysis all the way down the island in which we begin to locate particular species, their travel patterns, the population count. This included not only the more familiar animals that you'd find in a remote setting like this, but it also included an inventory of wild goat herds, wild horses, other animals that were previously domesticated that were left on the island.

Inclusive of that were the loggerhead turtles of

which we are the only Federally licensed group to monitor their patterns and we've done that since setting foot on the island. One of the methods of doing this is locating select hatchery sites during the breeding period.

Another example is mapping of historical sites which not only included a historical analysis of the life of the island since it was first populated, but also the beginnings of identifying probably the most dominant historical site on the island, the Vanderhorst House.

This is a mapping of the morphology of the beach itself. I think we enjoy a luxury that you didn't see in some of the previous presentations in that our beach is propogating. It's building up at a rate of about five to ten feet as a minimum per year; and unlike some of the other areas of development, our problems are ones that may come to us in the future of ocean front lots that are not as close to the beach at the time of original purchase.

This is a specific mapping of potential break points. Points, that for any number of reasons, are areas not suited for intensive or even least intensive development that we keep track of on a fairly regular basis. We fly aerial photography of the island a minimum of every two years, and fly the islands just for sight reconnaissance at

least every two months to see the changes in the dynamics of the beach itself.

Now, all of this as well as many others that I didn't bring with me need to come together in terms of theoretical analysis and practical application of how to proceed with development. This is a mapping of areas that begin to address sensitivity for development in which we begin to earmark those areas that are least tolerant to future development to those areas that are best suited for more intensive development. Based upon these findings, we generated a preferred master plan which began to localize land use, circulation patterns, and intensity of development. The series of elements that are controlled in any normal community whether it's a resort village like ours or whether it's Charleston, they're the parts that you have to address in future development.

We then began to identify the initial phase of development. That portion which would begin to put Kiawah on the map and begin to address our competition in a sense. Zones one and two which are indicated on this graphic were just that; and it's approximately 850-900 acres of land which were best suited for development and allowed for a location specifically tolerant of intense development.

As you can see by this graphic, also part and parcel to the plan itself, was the inclusion of a public

beach access area which is indicated in this slide and which allows for not only immediate public access by people in this area, but also would increase the accessibility that was not apparent when we first purchased the island. Kiawah, at that point, was extremely inaccessible, and to date as a result of this effort by both the public and private sector, it is much more so.

At this point, we also begin to look at detailing issues. Again, in a fairly graphic analysis, we are dealing with theory here but it begins to address clearing limits, in that we do not clear to the limit of the right-of-way, we clear to those areas that are within the free-zones of safety for traffic as well as the zones for drainage systems.

This is an example of just such an effort. At this point, too, I could point out that the way we handle our roadway system, in the sense the curb and gutter system that we have shown allows for less clearing. We generally control all the master drainage system under the ground or in lagoons as opposed to handling it with open swales and ditches.

This graphic begins to represent an area that may be, by other development standards, problem areas--which are the low areas or as the older dunes begin to become vegetated due to the maturity of the island, itself, the valleys and the peaks are still remaining on the island. The valleys,

obviously, collect water in our problems areas. We have chosen to use those and in a sense work with the natural systems and begin to locate recreational amenities that not only can handle our master drainage system, but can enhance property values around it. So, this, again was a graphic exercise to see how that could best take place.

I might point out that with working with nature, you can have a drainage system that can withstand major events like the proximity of the hurricane that came near the area recently in which we dropped the water level and the drainage system works like a giant sponge; and we can begin to control water levels with weir fixtures like this.

We also begin to look at housing siting analysis in which we attempt to retain as much tree cover as possible. Again, handling many of the master drainage systems by minimizing the disruption to the natural topography and have combined access points to minimize the disruption to the natural setting.

This is an example of actual design of the units to mimic in a sense the tree coverage of that area most sensitive along the beach itself and the tertiary area of the dunes where the wind swept oaks and myrtles are.

This is an abstraction of an exercise that we go through in which we begin to look at travel and distance times and our effort there conceptionally was to have all

the key elements of the village (which is our method of promoting real estate for the resort operation) well within walking distance. So, that someone can come to Kiawah and in this village park their car and realistically be within walking distance of all the major activities.

This is a graphic describing the first phase of development which was a combination of our lot sales and a housing sale program. Again, based upon the entry level which is the resort village, itself.

Loaded with all that ammunition, in a sense loaded with the theory that we were working with for about a year and a half, if not more, we ventured into the market system in 1976 with this first village. It's a very strong element with our program in that we have these concentrated areas in fairly intact locations such as this first village in which you can reach all the key elements.

Central to that is the Inn, itself, which is small in size but was extremely gracious in terms of fitting into the natural environment.

Also included were the housing units that were built by the Company around the Inn and by choice of most property owners that bought these, they entered a rental program that we administrate; and in a sense, the hotel is more than just the hotel rooms themselves.

A small commercial area, the Straw Market, of a

little less than 20,000 square feet. The golf shop and an eighteen hole course. Again, taking advantage of the areas I've already cited. The tennis and other accessory uses such as bike rentals in which we encourage people to get out of their cars and go bicycling for either destination purposes or for your enjoyment; and the final element which deals with pool and recreational facilities, and obviously the beach facilities, themselves. That's one reason why we located the village where we did.

I think one thing I really need to convey to you is, we as a company can go through many years of theoretical discussion and discussion by application; but unless you can convey that to the people that actually put it in place, whether it's the people that built this or whether it's the people that built our Inn, we need to convey the attitude about Kiawah.

Also, part and parcel to that is an informative system that helps us begin to have self regulation in terms of how people relate to the environment.

Going forward, we have a greater task before us. Before, we were an unknown commodity, now we are becoming known, not only in the South Carolina area, but beyond in the Midwest, the Northeast, or other market areas. Our attitude is to carry forward the same key elements of design and the relationship to the natural environment that we've

had in our first phase. This is inclusive of the next eighteen hole course, the beginnings of what will eventually be a marina site on the northern side of the island, and a town center. Some of the early sketches are indicated by these graphics.

And I think, if I could say just one thing in closing, we feel that the methodology that I outlined here is the real strength of what Kiawah is all about. We sell Kiawah. We don't necessarily just sell individual housing units or lots. Our strength is we sell Kiawah and how we go about our business; and we feel that it is compatible to develop an island in a way that is sensitive to the environment and financially successful. So, again, with a shortened program, I think I've tried to hit upon the key elements of what we're all about.