LONG ISLAND COASTAL CONFERENCE
16-17 June 1993

Scenario Planning

The Future of Long Island's Coastline and Near-Coastal Environments

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James Larocca

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EXECUTIVE SUMMARY

On 16-17 June 1993 a group of nearly 200 environmentalists, business people, concerned homeowners, coastal scientists and engineers used scenario planning to explore a range of plausible futures for Long Island's coastline and near-coastal environments. The goals were to reach consensus on qualities that Long Islanders want for their coast in 2020 and to identify strategies that have the greatest chance of producing a coast with those qualities across a range of natural conditions.

Participants were assigned by lottery to four theme teams: (1) Mother Knows Best, (2) Between A Rock And A Hard Place, (3) We Have Not Yet Begun to Fight, and (4) People and Nature: A Partnership In Sustainable Development. Each team developed a rich scenario of what Long Island's coast might look like in 2020 under the conditions prescribed by their theme. Varying from a bleak picture of Long Island minus 100 feet on all shores to a fortified vision of Long Island stabilized, braced and armored against Mother Nature to a harmonic image of humans working with nature in partnership, the four teams told vastly different stories of the region's coastal environments in the year 2020.

Despite their, in some ways, diametrically opposed scenarios, a strong consensus emerged. Neither of the extremes -- Mother Knows Best nor Between A Rock And A Hard Place -- would serve Long Island well. It is unlikely that either the "do nothing" policy dictated by "Mother Knows Best" or the total reliance on hard structures dictated by "Between A Rock And A Hard Place" would produce a desirable coastline and near-coastal environments for Long Island in 2020. The only acceptable strategy to reach the goal is to work with nature. Specific strategies consistent with this theme must be tailored to each specific coastal segment. In some areas, Mother Nature should be given her due. In others, she needs to be tempered with carefully crafted combinations of soft and hard solutions.

Among the general strategies that received strong support were:

- breaches in the barrier island should be filled as quickly as possible to maintain the integrity of the barrier island. (This strategy might change as we learn more about the effects of breaches and it should not be confused with an attempt to keep the barrier system from migrating.)

- sources of sand on land and offshore should be identified that have characteristics appropriate for filling breaches and for beach nourishment projects.

- inlets should be dredged on a continuing basis and the sand placed back in the littoral drift system on the downstream side of the inlet.

- a sustained program of monitoring should be created to provide the data needed to chronicle changes in Long Island's coastline and near-coastal environments, and to trigger appropriate management actions before a crisis occurs.

- a sustained program of research should be created to provide the scientific knowledge needed to understand the natural processes that characterize Long Island's coastal environments and to understand how human actions affect those processes so that enlightened decisions can be made.

- public education needs to be enhanced to raise the level of awareness of the importance of Long Island's coastal environments to the environment and the economy.

- sources of revenue need to be developed to provide a stable funding source for these activities.

OPENING REMARKS

James Larocca
LIA President

At the Long Island Association, we have long advocated the idea that on Long Island the environment is the economy and visa versa. Nowhere is this more evident than the storms and erosion problems that have plagued the Island's coastline during the past year. Protecting and preserving our unique coastal resources is in the urgent interests of all Long Islanders. This is why the LIA as the region's largest business and civic organization, joined with the Marine Sciences Research Center, New York State Office of Parks, Recreation and Historic Preservation, Nassau and Suffolk counties and New York Sea Grant to sponsor the Long Island Coastal Conference.

The maintenance of our coastal system provides a major buffer to protect all of the businesses and residents on mainland Long Island. Its preservation is essential to all Long Islanders, whether they live directly on the shore or further inland. It is both an environmental and economic imperative that we protect the entire system, from the barrier beaches to the bays and shoreline of mainland Long Island.

The tourism industry, which is one of the largest industries on Long Island, depends largely on the coastal resources of the Island. Commercial and sports fishing, recreation and quiet enjoyment of the coastal environment forms the essence of what makes Long Island special and unique. We cannot afford not to invest in this essential element of Long Island's identity. Long Island without its magnificent beaches and shorelines serving millions of beachgoers every year is unimaginable.

The LIA sponsored this intensive two-day conference to focus on the needs of our coastal environments and the scientific knowledge that is available to address problems facing the Island's coastal resources. The past year has reminded us that the powers of nature are formidable and that time is of the

essence. One approach must be to work in harmony with these natural forces, but also understand that simply accepting the further diminution of our coastal system is inconsistent with our environmental and economic values. We hope this conference highlighted the pressing need to develop a strong policy to protect and manage Long Island's coastal resources.

Thomas Gulotta
Nassau County Executive

Long Island is a place of diversity -- in its population, in its terrestrial habitats and most importantly for our meeting today, in its coastal environments. We have long prided ourselves on the natural beauty and plenitude of Long Island's various coastlines. But as this winter's fierce storms brought to the fore, the coastline and surrounding environments exist as fragile resources for the island.

We have been forced to recognize and confront our lack of coordinated policy in our management of Long Island's coastal environments. The future of these naturally beautiful places must be preserved and protected and attended to by all of Long Island. This is why we are here today.

Joining together business and community leaders, residents concerned with their future on the island and scientists, this Conference is a significant step in the forming of a strategic plan for the future of this island. This collaboration and cooperation of diverse backgrounds and interests lends strength and a sense of importance to the Conference and most importantly to the issues at hand.

We all must have a voice and a hand in preserving and protecting Long Island. There is power in unity and innovation in diversity and during this two-day conference we will draw from the strengths of all present to map out a coastal plan.

Robert Gaffney
Suffolk County Executive

I would like to take this opportunity to welcome all of you and thank you all for coming. Your presence and participation in this conference shows a deep concern for Long Island's beaches, shorelines and environment.

The point where the land meets the sea is one of the most dynamic, ever-changing parts of our ecosystem. In Suffolk County, we have many such areas -- our barrier beaches including Fire Island and Shelter Island. For thousands of years the shape and outline of our barrier island system has been changing and shifting. Over time, these changes appear to be part of a natural balancing act, an essential give-and-take process. While one beach erodes, another is augmented. While some coastal wetlands were buried, new ones developed. While some sand dunes migrated, others remained fairly stationary.

In contrast to the vitality and energy of these natural changes lies the various units of Long Island's government. The federal, state, county and town governments have remained constant in their lack of a vision to make sense out of and deal with Mother Nature's changes.

The lack of a rational long-term coastal plan became significant this past year after we witnessed the devastating havoc wrought by the December Nor'easter. Then, just a few months later, we were hit with the so-called "Storm of the Century." While the towns, villages and county performed extremely well during these storms, it was the lack of a unified policy that led to many of the problems.

As an appointee to the Governor's newly formed Coastal Erosion Task Force, co-chaired by Commissioner Jorling and Secretary of State Gail Shaffer, I as well as the other members will work to develop that "Long-Term Policy Plan." Shortly, the Task Force will release its initial report which will focus on two critical themes -- one, the need to reach an agreement on how best to protect

our shoreline as a dynamic system and two, the continued use of the shoreline as a recreational and economic resource.

During the two days of this conference, you will hear from experts and scientists; you will be developing scenarios and you will voice opinions. It is all part of a process that perhaps should have taken place years ago. By having "everybody on the same page" we will be better able to deal with what the future brings. We will be better able to plan together, and we will be better able to react swiftly in case of an emergency.

Once again, thank you all for coming.

Orin Lehman, Commissioner
New York State Office of Parks, Recreation and Historic Preservation

Thank you for the opportunity to discuss one of the major issues faced by many of our communities and agencies. We are, of course, most concerned about the protection of our Long Island parks, so we welcome the discussions scheduled for this meeting.

We consider our Long Island State Parks to be the "flagships" of our system. Many of these internationally renowned parks are the product of several generations of investments on the most desirable, yet vulnerable barrier beaches. Our parks on Jones and Fire Islands serve more than 12 million visitors each year.

The full story, however, involves many businesses, tourism, selection of vacation sites and schools, or decisions regarding the purchase of recreational equipment. If one chooses the site for a major investment, or a day's outing in the New York Metropolitan area, one will very likely consider the availability of one of Long Island's coastal parks.

Of course, the vulnerability of these beautiful coastal parks is not news to us. Sid Shapiro, Robert Moses' Long Island Director, was reputed to be a leading expert on sand-engineering and management. Programs involving sand replenishment were inaugurated in the 1920's and have continued ever since. The U.S. Army Corps of Engineers and New York State's Conservation Department helped to continue these programs through the early 1970's.

Designs attempted to address this vulnerability. And even at heavily visited Jones Beach, more than 80 percent of the barrier island was left as a natural buffer and wildlife management area. Questions are often raised, however, as to why my predecessors invested so much at these vulnerable beaches and why we today try so hard to protect these precious resources?

For example, we recently spent $28 million in infrastructure rehabilitation at Jones Beach. The answer is simple. Since the early 20th Century, people have always wanted to spend time on lovely beaches. Usage has grown yearly, and will continue to do so in the future. One thing is sure, once lost, our major coastal parks, resorts and seaside communities will not be reconstructed or rebuilt.

Yet, with all this at stake, confusion about proper public policy shut down long-term beach nourishment at Jones Island in the 1970's. Consequently, by the late 1980's erosion and sedimentation threatened vulnerable beaches as well as the ocean parkway and the Fire Island and inter-coastal channels. We have been working to address these problems since that time.

Actually, the December 1992 storm was not an unexpected event to us. We called for action in the mid-1980's and Governor Cuomo declared a "disaster emergency" in January 1988. We acted as lead agency for the State Disaster Preparedness Commission (DPC) pursuant to this declaration. We worked on plans and projects with the U.S. Army Corps of Engineers, New York State Departments of Environmental Conservation (DEC) and Transportation (DOT), local governments and a committee of scientific advisors. Detailed surveys were conducted and long-term concerns such as sea level rise were evaluated. My good friend, and the very dedicated chair of the DPC, Dr. David Axelrod, helped greatly to coordinate this process.

When the 1992 storm occurred, we were in the midst of the second recent beach nourishment project at Gilgo (on Jones Island). Also, we had completed some recent protective, beach nourishment at Robert Moses State Park -- mostly lost to the storm. Very significantly, we had an approved emergency plan on file with the State Emergency Management Office, Department of State, and others (updated in September 25, 1992). We had "standby contracts" in place to protect our resources on an emergency basis.

Consequently, although, we were damaged and our protective resources were depleted, we did not lose major sections of infrastructure to the December (1992) storm. We were moving sand by the second day of the storm. DOT surveyors were in the field and DEC/DOS/OPRHP aerial surveys were already

documenting our vulnerability on the last day of the storm. We certainly were most anxious and concerned, but we also knew what had to be done.

The story did not end there. I wrote to the Governor's staff at the beginning of January (1993) pointing out the importance of the barrier island to Long Island's recreation, environment and economy. We noted how communities on the bays (Great South Bay) and strategic resources are dependent on a viable system of barrier beaches. The Governor, Long Island Legislators and citizens supported that position. A "deficiency" appropriation of $14 million was provided to restore damaged facilities. More than half of these funds were directly related to the restoration of protective beaches, dunes and the Orient Beach causeway. These projects are now underway. We were also able to bring these experiences to the Governor's Coastal Erosion Task Force.

We look forward to the institution of long-term management and emergency practices to help us and other coastal interests hold these cherished coastal resources for future generations.

We need to identify what's to be done if a "Hugo" sized hurricane hits us and explore how long-term erosion and sea level rise will be addressed. At the present time it appears that beach nourishment, combined with the dredging of channels seems to be the best hope for survival. However, this always seemed to me like putting a bandaid on a serious wound.

What I would urge, and urge strongly, is that the best minds and adequate money be dedicated to research, and more research, so we can defend against the tremendous forces of nature with something more than bandaids of sand.

Thank you for your interest and participation. I'm sure this conference will be most helpful and thank you for particpating.

Gail Shaffer
New York Secretary of State

THANK YOU: Good afternoon. It is my pleasure to be here with my colleague Tom Jorling, and to be able once again to meet with the many people of Long Island who care so deeply about their coast.

Tom and I have been given a most interesting assignment by Governor Cuomo -- To Co-Chair his Coastal Erosion Task Force. A challenge -- not only to work with 37 people, but to work with them on one of the most serious public policy questions facing Long Island.

The past Winter's storms did cause devastating damage -- and the storms brought to the forefront an issue which has been around for a long time. Beaches have been eroding and moving since land and water were formed. Scientific evidence indicates, for the past ten thousand years, Long Island's south shore barrier system has continuously moved landward from a location almost four miles south of where it is today. Beachfront property owners have been coping with the effects of this moving sand since the first house was put on the beach.

For almost thirty years governments have tried to stop this movement by building something between Fire Island Inlet and Montauk Point. For at least the past five years, DOS, DEC, and the property owners have been trying to push the Federal Government away from its band-aid solution for Westhampton, toward a permanent resolve. And for over a decade, we, together with other coastal states, have been changing a plethora of inappropriate public policies, to bring responsible, not just responsive public policy to guide the way the shifting beaches are used.

In the understandable rush to cope with the devastation of this winter's storms, the task force has been told that a major reason government should restore the eroding beaches is because of its economic effects -- lost beaches mean lost dollars. While this is true, more beaches are closed each year

because of poor water quality, than have been affected by severe erosion. So, if we do care about the economics of the coast, we need to look at all of the factors affecting the coastal economy -- not just erosion -- and we need to set clear priorities for the use of limited public dollars.

To that end, I could not agree more with a statement in the publicity material for this conference -- "The best way to predict the future is to create it".

While our natural coastal systems do experience unpredictable events -- the least of which is its storms -- too often we forget that the way we interact with the phenomena of mother nature can be predicted. The way we choose to manage our actions along the coast -- whether to build or to preserve -- has a degree of predictability.

I have two suggestions for your exercises today and tomorrow. First, it is imperative in planning for Long Island's future -- to have the "vision thing". A vision, a consensus, that reflects the needs of the people, and the needs of the resources of our coastal environment. Second, while we need a grand vision to guide our actions into the future, we do not need a grand means to implement the vision. It is the simple, yet incremental and cumulative results of discipline, hard work, persistence, and perseverance, which achieve the grand vision.

For years, local, state, Federal governments have individually and, some times jointly, managed the Island's coast. There is an arsenal of regulatory controls and plans for open space, parks and sensitive resource areas. There are National Estuary Programs for Long Island Sound, New York-New Jersey Harbor, and the Peconic Bays. And, most recently, the State Legislature is considering new proposals for the Pine Barrens and the Great South Bay.

Municipalities have developed and adopted comprehensive plans and extensive land use regulations for guiding development. Government have made substantial investment in beaches, restoration of the natural environment and land acquisition for habitat and open space protection.

Yet each of these efforts, while usually complete within itself, is too often divorced from larger needs of our coasts. Each works more independent of the whole, than in sync with the needs of the whole.

It is the coast that separates Long Island from so many other places. That makes Long Island special to so many people. It is the splendor and abundance of Long Island's coast which compensate for the congestion and traffic. And it is the future grandeur of a diverse and healthy coast, which may make the cost acceptable.

I envision a Long Island Coast:

- With those personal, special places and views that residents call home, the rest of us can enjoy;

- A coast with expansive beaches, open space and parks;

- A working coast which sustains marine related industry and commerce, and the jobs so vital to the region's economic viability;

- A coast with an abundance of resources which sustains ecological diversity and stability, and

- Finally, I envision a coastal people, more sensitive to the impact they have on the coast, yet a people who can access and enjoy their coast even more.

I believe the achievement of a "Grand Vision" for Long Island's coast does not require "Grand Schemes" for implementation. In fact, I would dare suggest that the days of grand schemes with new programs, agencies, and requirements for more taxpayer monies are exhausted.

There are no deep pockets in government or business to pay for grand schemes. There is no need for new levels of government to achieve grand means of problem solving.

We do not lack government to implement a grand vision for Long Island's coast. We may lack a collective vision, but once we have a shared vision and broad based commitment, the government programs, in large part, are in place to deliver.

In the Department of State, we are drawing on our past experiences and those of other states, to focus coastal management -- from the needs of the State's coast as a whole, to the economic and environmental needs of each region.

Even though I do not propose new levels of government or new programs, we need to use the programs in place better to maximize their potential. First, many existing programs need to be a substantially better reflection of the priorities of each coastal region. Second, most people don't identify with areas outside their region. That doesn't mean there are not statewide concerns. It just means there are few statewide constituencies.

Third, local Government, while perhaps in the best position to address many coastal issues -- are not always doing so. In the absence of comprehensive local coastal management programs, we are in need of a closer link between state laws and local priorities. Finally, the coastal program has the versatility and resiliency to address every coastal region's needs within the institutional means at its disposal. We do <u>not</u> need massive reconstruction of programs or redistribution of authority. We need to focus what we have.

Over the next few months, the Department of State will be presenting the draft of the first regional Coastal Program -- A Coastal Program for Long Island Sound. In this program, you will see we have not placed the entire burden of managing the coast on strict regulation of new development. We need new growth to sustain the economy -- and simultaneously -- we need to improve the natural coast to sustain the environment.

Through the regional Coastal programs we will identify areas which can be targeted for new growth. Concentrating development directs pressure away from sensitive areas, and guides new development to those areas most suitable for it. In the regional coastal programs, we will identify environmentally sensitive areas. Areas essential for sustaining resources and where little if any

new major growth should occur. Areas where state investment should be in resource restoration and enhancement, not buildings.

Another needed element for coastal management on Long Island is Governor Cuomo's proposed Environmental Trust Fund. If enacted, the Environmental Trust Fund would supply a constant source of revenue to restore fragile coastal areas and mitigate the past effects of ill-planned growth and development. It would fill a void of revenues on a pay as you go basis.

A third critical element in implementing a vision for Long Island's coast is the central role of local governments. At the local level is both the roots of our visions and the power to address certain critical coastal issues. Issues such as non-profit source water pollution, management of congested harbors, and land use encroachment on sensitive areas. It is local governments who can best manage the incremental change in land use and development.

Finally, to achieve a grand vision for Long Island's coast, we need you -- citizens and business leaders -- to help. To the extent that you want your community to work for your coast, you must be willing to voice your concerns to your elected officials.

Together, we can articulate a vision for Long Island's coast. And together, through discipline, hard work, persistence, perseverance and cooperation we can take the necessary steps for achievement of that vision.

Thank you.

Thomas Jorling, Commissioner
New York State Department of Environmental Conservation

I would like to first thank the Long Island Association and the other sponsoring groups for the tremendous effort they have undertaken to put on this Conference focusing on the Long Island coast. Jim Larocca has been a tireless motivator, not just of this Conference, but also of his seminal point-of-view that Long Island must become the principal funding source and prime mover for shore protection efforts within the region. His innovative funding proposals are worthy of serious consideration at all levels of government and deserve supportive concurrence.

The coastal storms of this past winter taught us, once again, that we cannot take our unique coastal resources for granted. Those storms stripped away the facade that we could continue to abuse these resources and still have them to exploit and enjoy. At the same time that we recognize the need to mount a major effort to restore our devastated beaches we find that there is no level of government - federal, state, regional, or local - with a surfeit of available resources to come in and take care of the problem for us. We find ourselves in a new era of public policy making where we must generate solutions from within. We must bring our interests together and search for common ground. Not all interests can be totally satisfied and we must find ways to respect and accommodate, to the greatest degree possible, competing interests.

Governor Cuomo's Task Force on Coastal Erosion is taking a hard, broad-based look at all of these issues and hopes to develop recommendations for both short and long-term actions that will meet our common needs while staying within our collective capabilities. Implementation of these actions will require a great deal of dedication from all sectors of our society, and it will take time.

We must work to restore the natural coastal processes along our shorelines. The negative effects of inlet stabilization and navigation projects must be overcome by assuring the complete bypassing of littoral drift across these

inlets. For too long many of our beaches have suffered a net loss of critically needed long shore drift material.

When last December's storm hit, some of our beaches were already in a weakened condition and unable to provide an adequate level of protection. We need to restore them to the point where they can again provide that protection and make certain that that natural protective function is not again diminished by human intervention. We must work in concert with nature. We have discovered the hard way that we can't bend nature to our desires.

We must also develop a quick response capability to ensure that needed action, whether to close a newly formed breach or to proactively strengthen a potential washover site, doesn't take months simply getting contracts in place before work is even begun.

The Governor's Environmental Protection Fund incorporates many of these needed elements. The bill provides funds for State and local coastal projects, and provides for a quicker response to restore the natural protective capacity of our coastal shorelines after suffering damage from a storm event. The Environmental Protection Fund contains several other features of great importance to all of Long Island. In these days of scarce fiscal resources it focuses State expenditures on the protection of our State's critical environmental resources.

Once again let me thank the sponsors of this Conference for creating a lively and provocative format to focus on the importance on Long Island's beaches and the means to ensure their continued health and existence into the future.

INTRODUCTION OF SPEAKERS

J.R. Schubel, Director
Marine Sciences Research Center

Before I introduce our next three speakers -- all scientists -- let me say a few words about the role of science in scenario spinning.

Does science play a role? Of course! But science and engineering are not the whole answer. Tolstoy once remarked that science does not tell us how to live; that it has nothing to contribute on moral issues. He was right. As Wolpert points out in his new book, The Unnatural Nature of Science, *"It is the politicians, philosophers and finally all citizens who have to decide what sort of society we will live in."* And, they also will determine what kind of an environment we will have.

Decisions on what kind of an environment we choose to have are decisions that everyone must help make. Science can provide important input; indeed it is the only appropriate way to add the scientific dimensions to environmental issues, but there are other dimensions to environmental issues and there are other issues. Once again, quoting Wolpert, *"It would be folly to entrust decisions about how to use science to scientists or to any other group of experts."*

The next three speakers will present a summary of what we know about the most important features of Long Island's shoreline and about the processes that formed and continue to shape those features. They also will offer some observations on the misuses and failures of attempts by humans to modify those processes.

INTRODUCTORY PRESENTATIONS

Conference participants were treated to three outstanding presentations. The first presentation was by Professor Henry Bokuniewicz of Stony Brook's Marine Sciences Research Center. Dr. Bokuniewicz concentrated his remarks on the coastal processes and features that characterize Long Island's north shore. The second presentation was made by Dr. Timothy Kana, President of Coastal Science and Engineering, Inc. of South Carolina. Dr. Kana concentrated his remarks on Long Island's south shore. He offered comparisons with other areas, particularly with South Carolina. The third presentation was by Jay Tanski, coastal resources specialist with the New York Sea Grant Institute. Mr. Tanski concentrated his remarks on the potential impacts associated with new inlets.

A FEW KEY POINTS
from the
PRESENTATION
by

Dr. Henry Bokuniewicz, Professor
and Associate Dean for Education
Marine Sciences Research Center

The north shore of Long Island presents managers with a wide variety of coastal characteristics. The western stretch is dominated by long embayments separated by necks of land. Coastal lowlands are found here in the heavily developed heads of the harbors; narrow low lying coastal spits and barriers, many of which are developed and ecologically valuable wetlands. All of these areas are subject to flooding which may persist for several tidal cycles during severe Nor'easters.

The headlands are often characterized by coastal bluffs. These bluffs dominate the eastern stretch of the shoreline where they extend in an almost unbroken line from Mt. Sinai Harbor to Orient Point. During periods of storm tides, the narrow beaches at the base of these bluffs can be drowned. Waves can then directly attack the toe of the bluff, undercut the bluff face and cause it to collapse. Sediment and vegetation delivered to the beach in this manner is rapidly dispersed. Once stripped of its protective vegetation, the bluff face will continue to erode slowly as sand is washed down to the beach. This process supplies the beach with sand, but only about one-fifth of the sand eroded from the bluff is found in transport on the beach; a substantial amount must be lost offshore.

In general, the systems that transport sand along the north shore are compartmentalized; that is, different stretches of the coast are separated by headlands, harbors, or inlets and there is little exchange of sand between compartments. Site-specific studies are needed to learn the particular features of each compartment and the impacts of human activity (e.g. groins, bulkheads, inlet dredging, etc.) in each.

COASTAL PROCESSES AND LONG ISLAND'S SOUTH SHORE AFTER THE STORMS OF 1992-1993

by

Dr. Timothy Kana, President
Coastal Science and Engineering
Columbia, South Carolina

The winter storms of 1992-1993 produced some of the worst flooding and erosion on Long Island's shores in 30 years. Among the most dramatic scenes were a breach of Westhampton Beach, just west of the groin field, and a row of severely damaged houses perched in the surf on western Fire Island. Not since the 1962 Ash Wednesday storm has there been as much damage to Long Island coastal property.

As evidenced by attendance at this conference, there is renewed interest in coastal erosion and concern for the future of Long Island's shoreline.

- Will the beaches recover?
- What will happen to the bays if new inlets are not closed?
- Will the barrier islands continue to protect the mainland?
- Will there be a place on the beach to sunbathe by next summer, or by the year 2020, the planning horizon considered in this conference?

We professionals cannot answer these questions with precision (anymore than we can predict next year's weather). But there are certain results of erosion that follow common natural laws.

First, sands in the littoral zone (foredunes to the offshore bar) shift in response to changes in wave heights and water levels. Large storms erode dunes and shift much of the sand offshore. This is nature's way of flattening the beach and dissipating wave energy over a wider area. After storms, excess sand beyond wading depth has a tendency to move back onshore and rebuild the recreational beach. This is referred to as the *beach cycle*. We see evidence of

this by comparing the winter beach (larger waves, flatter profile) with the summer beach (smaller waves, steeper beach face and a wider berm for our beach blankets). Storms such as the December 11 or March 13 northeasters produce this basic response, but with greater magnitude. The dunes cut back more (to the point where some oceanfront houses may be left on the storm beach) and sand moves further offshore. The *beach cycle* will restore much of this sand, but not all. Some will remain offshore or shift to other sections of the shoreline. The size and number of storms in 1992-1993 suggest it will also take longer than normal for the beach to readjust. The questions for planning then are:

- When and where will the new beach equilibrate? and
- What will be the net loss of sand?

Much can be learned from Long Island's experience after the March 1962 storm and experience from other beaches. The greatest sand loss from the beach is at inlets. When a breach occurs through a barrier island, waves and currents push massive quantities of littoral sands into the bay. By a similar process, when foredunes are breached or overtopped, storm waves will move sand across the barrier as broad sheets--called washovers. This vertical buildup of the back barrier comes at the expense of next year's beach. Breach inlets and washovers increase the long-term erosion beyond what it would be if the foredunes survive a storm.

If storms subside and the sea does not rise for several years, many sections of the beach will recover. Some washovers and dune breaches will heal and begin to gain elevation as vegetation takes root. Still, dune building by wind is a slow process that, if not completed before the next storm surge, may provide conduits for future barrier beaches.

Natural closure of inlets is an even slower process. The new channel must first shoal before an incipient beach ridge can close it off. But if even a low-intensity storm occurs, the breach may reopen before the new inlet is permanently sealed. Many of Long Island's historical inlets persisted in this fashion for 30-50 years before others took their place.

Importantly, the number of inlets that are self-maintaining along the coast is directly related to tide range. Where normal tides are higher, such as the South Carolina coast (6-8 ft. ocean tides), natural inlets may occur every few miles. Such a coast is adjusted to wide swings in tide range and the extra tidal energy serves to keep the channels flushed and open. Long Island's south shore, however, has much lower tides, barely 2 ft. at Montauk. As a result, the number of inlets that can be self-maintaining are fewer. In settings like this, inlets will be many miles apart -- for example, over 32 miles from Fire Island Inlet to Moriches Inlet even before stabilization.

But what happens when a storm occurs? The surge, or rise in the tide level, creates a temporary situation similar to Carolina's tides. Massive quantities of ocean water enter the bays, flood low-lying areas, then wait for the ocean tide to fall. When it does soon after the storm passes, the impounded waters seek the nearest exit. If the choice is an inlet 15 miles away, or nearby breaks through the dunes, some of the tidal waters may move across the dune breaches. If a breach is large and underlain by easily erodable sands, the receding surge can do the work of ten dredges in a few hours. Swift currents cut through the sands until the beach and ocean tide levels are the same and a new inlet is formed. After the 1938 hurricane, at least six inlets formed along Westhampton Beach, one every few miles. This was an adjustment of the barrier island to the higher tides during the storm -- in a sense, a natural change toward a coastline shaped like South Carolina's.

As we have seen in Westhampton since December 1992, the new breaches may widen, deepen, migrate, or consolidate with others, destroying more buildings as they go. But with a restoration of normal tides comes an increase in shoaling rates, as two or more channels now vie for control of the bay tide. In the short run, say a few years, several channels may persist at the expense of viable navigation in any one. If a new breach is dredged for navigation, it will either increase the tide range of the bay and generally change salinities and flushing rates, or it will accelerate shoaling in the remaining inlets. Such is more or less the case now for the Westhampton breach and Moriches Inlet.

If breaches and washovers are natural responses to storms, why not leave them alone and let them eventually heal themselves? Certainly in many cases this is

acceptable management. But where diverse interests compete for the same coastal resources, some intervention by humankind may be warranted. Leaving nature to run its course may eliminate viable navigation or transport of needed materials in established channels; it may wipe out an economic fishery; it may prevent recreational access, or it may lead to more flooding of the mainland and beach facilities. Doing nothing is not without costs. But are the economic and environmental costs of doing something worth it? This cannot be answered generally, but must be evaluated and determined independently for each site. How Long Island responds to coastal storms should be different than how South Carolina responds, for example, given their differing tidal regimes and economic interests.

As site-specific alternatives are considered for each section of the coast, the problem often begins as a sediment budget problem -- that is, conserving the supply of sand along the shore. The key to this is careful monitoring of sand resources -- measurements of beach erosion, computation of offshore shoal volumes, estimates of longshore sand transport, and more-than-casual observations of dune size in front of one's beach house. Such quantitative measurements will show rates of erosion are not uniform, but often can be related to:

1) *Proximity of present inlets and jetties* (think of east Tiana Beach near Shinnecock Inlet).
2) *The presence of groins* (think of how little damage occurred within the Westhampton groin field this year).
3) *The lack of groins* (think of the section of Westhampton that made the news).
4) *Proximity to breaches and washovers* (think of Westhampton again, but also Old Inlet off Bellport) and *proximity to abandoned inlets* (think of western Fire Island where Fire Island Inlet used to be).

The site-specific erosion rate usually has something to do with regional coastal processes, the configuration of the shoreline, and size of nearby tidal inlets. Erosion solutions then must link the site with these regional controls.

There are orderly ways of formulating engineering solutions to beach erosion which consider environmental and economic constraints, as well as technological requirements. These begin with site analysis and quantification of coastal processes -- not by interviews with quarry owners or concrete manufacturers. New technologies have a place, but should be considered after the causes and rates of erosion are determined -- do you buy a shirt before you know the size you need?

But what if the experts cannot agree on the solution? This is a simple fact of life that applies to all things designed. What is acceptable to some is tasteless or too expensive for others. However, we will improve our chances of reaching consensus on the erosion problem if we consider it in a common time frame. Responding to the immediate emergency with massive nourishment or shore-protection structures would be exceedingly expensive and ignores the probability of some natural beach recovery. Yet doing nothing because the sea may flood all of Long Island in 5,000 years is irrational, given our desire for access to the coast -- now. What if we can agree on a reasonable planning horizon of 10, 50, or 100 years -- say through the year 2020 at the least? Won't this narrow the range of alternatives and reduce the number of expert opinions?

Lacking an ideal erosion database for Long Island, we might be tempted to delay all solutions along the shoreline until we have more data. But in closing, I would suggest we revisit 1962. Certain beach restoration projects were completed after the March storm. Some bear a striking resemblance to today's problems and needs -- particularly closure of the Westhampton breach and restoration of dunes along parts of Fire Island. Ten million dollars (1992 dollars) were spent on beach restoration in 1962, providing a basis for comparison. To delay, sometimes means higher costs. Whereas the 1962 breach was closed at a cost of $400,000 (1992 dollars) within one month after the storm, the December 1992 breach will cost over $5 million to close (in rough figures). Higher costs of a closure in September 1993 are not as much related to inflation as they are to natural widening of the channel in these intervening nine months since the original breach. New inlets have the biggest impacts on sediment budgets. They require priority attention whether to close or not to close -- to stabilize or not to stabilize. In contrast, loss of dunes, such

as Old Inlet's pose less immediate threats. Some may be dealt with by recycling sand from washovers or the beach itself (remember some sand returns to the beach after storms). Bulldozers can reshape the dunes quickly and inexpensively. Once the dune profile is restored, wind-blown sand and native vegetation will cover the bulldozer tracks and allow nature to resume its course.

Regardless of the management approach to erosion, it is a natural process that will remain with us into the future. If the integrity of Long Island's barrier islands depended on mild waves, no storms, and a stable sea level, they would have been lost centuries ago (or displaced greatly from their present positions). But the fact that the beaches have rebounded after storms and have remained generally in the same place provides hope for the future -- at least through the year 2020. Just as the focus of attention after this year's storms was on certain localities, the restoration needs are skewed toward these same reaches. This year's solutions should consider next decade's response. We can work with the natural processes -- including the *beach cycle* and the littoral transport system -- or we can fight nature. Storms like this year's remind us which approach is possible.

A FEW KEY POINTS

from the

PRESENTATION

on

THE IMPACTS OF SOUTH SHORE INLETS

by

Jay Tanski
New York Sea Grant Extension Program

There are 7 major inlets along the South Shore, including the new inlet at Westhampton formed by the 1992-3 winter storms. Six of these inlets are stabilized by jetties and used for navigation purposes. These features exert a dominant influence on the behavior of the shoreline by interrupting the natural longshore transport of sand along the coast. By trapping or diverting millions of cubic yards of material from the nearshore beach system, these inlets cause some of the most severe erosion problems found along the shoreline. Based on long-term shoreline changes, the impact of each of the individual inlets becomes more substantial from east to west along the South Shore.

In Florida, it has been estimated that 80 to 85 per cent of the erosion along the coast is due to inlets. A similar situation probably exists on Long Island. The impacts of inlets can be mitigated by initiating "bypassing" programs where material is artificially moved from one side of the inlet to the other to restore the natural flow of sand.

New inlets formed during storm events are a major concern because they may cause significant changes in the bay and mainland areas, as well as along the ocean shore. Potential impacts associated with new inlets or breaches include:

-Increased tidal ranges and storm water level elevations in the bays which can cause increased flooding and erosion on the mainland.

-Changes in the physical and environmental characteristics of the back bay, such as salinity, temperature, circulation and shoaling patterns which may affect biological resources such as finfish and shellfish.

-Increased ocean shoreline erosion due to trapping of sand from the longshore system.

-Increased shoaling at existing stabilized inlets.

Presently, we do not have the information necessary to accurately quantify the magnitude of these potential changes. While some may be relatively small, or actually have beneficial impacts, others may have major impacts on traditional uses of the South Shore bays and mainland coast.

*Mr. Tanski prepared a hand-out which was distributed at the Conference. A copy is included in Appendix A.

INTRODUCTION TO SCENARIO PLANNING

J.R. Schubel

Let me sketch out the activities for this afternoon and evening. We will use the scenario planning strategy. You will be engaged in a fascinating, exciting and, we hope, productive exploration of the possible futures of Long Island's coastline and near-coastal environments. We will use the year 2020 as our planning horizon.

Scenarios are not predictions, although one might argue that the strategy of developing scenarios is consistent with the admonition that if you are going to make predictions, make lots of them. Scenario creation is about perceiving possible futures in the present, rather than about predicting the future. Scenarios are descriptions of how things might turn out. And, good scenarios do not simply extrapolate present trends.

The use of scenarios first emerged after World War II as a method of military planning. The strategy was refined in the 1960s for work with the U.S. Air Force. In the late 1960s and early 1970s, Pierre Wack, a planner with Shell, refined and enriched the strategy further. Other than for military planning, the most frequent applications of the scenario strategy have been in the business/industrial sector. The strategy has broad applicability, however, and we have used it for academic planning and for environmental planning. We will draw upon the articles by Pierre Wack (Wack 1985 a,b), the recent book "The Art of the Long View" by Schwartz (1991), and our own experiences from Ben Gurion University, Long Island Sound and San Francisco Bay for the application in this conference.

Schwartz (1991) points out that scenario creation is not a reductionism process; it is an art like story telling. According to Schwartz, a good scenario deals with the world of facts and the world of perceptions. It's integrative: *"...despite the fact that reductionism is necessary to find out how things work, integrative science is necessary to put new discoveries in a larger context and also to determine what the new inventions and methods will do in addition to*

what they are designed to do" (Cairns, 1991). Science is important, but it is only one element in creating scenarios.

The purpose of scenarios is to gather and transform information of strategic importance into fresh perceptions. A good set of scenarios consists of a few alternative and internally consistent pathways to the future. "They are not a group of quasi-forecasts, one of which may be right. Decision scenarios describe different worlds, not just different outcomes in the same world." (Wack, 1985b). According to Wack: "The point, to repeat, is not so much to have one scenario that 'gets it right,' as to have a set of scenarios that illuminates the major forces driving the system, their inter-relationship, and the critical uncertainties. The users can then sharpen their focus on key environmental questions, aided by new concepts and a rich language system through which they exchange their ideas and data."

Wack (1985b) suggests two questions to test the value of scenarios:

(1) What do they leave out? In five to ten years leaders must not be able to say that the scenarios did not warn them of important events that subsequently happened.

(2) Do they lead to action? If scenarios do not push leaders to do something other than that indicated by past experience, they are nothing more than interesting speculation.

Scenario planning -- planning based on scenarios -- is about making choices now with an understanding of how things might turn out. It is expected, of course, that the choices made now will influence which scenario actually plays out. This is, after all, the purpose of planning -- to shape the future. This conclusion is consistent with the conclusion of Will and Ariel Durant in their little book The Lessons of History: "The future never just happened, it was created." It also is consistent with what Peter Drucker, the well-known management specialist, had to say about long-range planning: long-range planning does not deal with future decisions, but with the future of present decisions.

Schwartz (1991) described the benefits of scenario planning in this way. The end result of scenario planning "... is not an accurate picture of tomorrow, but better decisions about the future." John Scully, then CEO of Apple, once said "the best way to predict the future is to create it." Scenario planning is designed to put us in a better position to have more control over the future; in this case over the future of Long Island's coastline and near-coastal environments.

In developing scenarios, the initial steps involve the identification of driving forces, pre-determined elements and critical uncertainties. Scenarios use logics to describe how the driving forces might plausibly behave in the future. Good scenarios force us to see alternative futures and to act to shape the future.

Driving forces are forces that influence the outcome of events; they move the plot; they determine a story's outcome. In selecting driving forces, one should look at decisions that have to be made related to:

- Society -- population, values, etc.
- Economics
- Environment
- Politics
- Technology

Pre-determined elements are events that do not depend upon any particular chain of events. They either have already occurred or are almost certain to, but events whose consequences have not unfolded. If an event seems certain regardless of which scenario plays out, that event is by definition a pre-determined event.

Critical uncertainties are those elements that will shape the future that are not pre-determined. They can be natural events that are unknown, or societal decisions that can not be forecast with certainty because of changing priorities and a variety of socio-political factors.

Each of you was asked before the conference to submit lists of the five **pre-determined elements** and the five **critical uncertainties** that you thought would be most important in determining the future of Long Island's coastline and near-coastal environments in the year 2020. All of the responses we received have been summarized in Exhibit 1. The steps in scenario development are outlined in Exhibit 2.

Let me repeat: the objective for the remainder of this conference is not to predict the future of Long Island's coastline and near-coastal environments. ***The objective is to explore the range of plausible futures for our coastline and near-coastal environments so we can better understand the factors that will determine which future will actually "play out".*** With this information, we will be in a better position to influence as many of those factors as possible; i.e. to increase the probability of the desired future. Scenario planning is a way of rehearsing for the future; of getting prepared to identify key indicators and to act accordingly.

We will develop four scenarios -- four plausible and internally consistent stories about the future of Long Island's coastline and near-coastal environments. We have to start by picking some themes or "drivers." We've done that for you. A set of good themes should consist of themes that are distinctly different and that encompass the plausible range of alternatives, some good and some bad. The scenario themes we selected are summarized in Table 1.

There are two fundamentally different ways to write scenarios: (1) start with the present and spin out a narrative to some future time horizon, say 2020, or (2) start with that future time horizon, describe the situation then with a few backward glances about how Long Island's coastline and near-coastal environments got that way. We'll take the second approach. We'll start by describing the situation in 2020 consistent with the theme of your scenario.

Each scenario should be the equivalent of no more than 5 double-spaced typed pages. Scenarios aren't right or wrong. They are only more or less useful for developing strategic plans to achieve a derived set of conditions: the conditions Long Islanders want for their coastline and near-coastal environments in 2020.

Plausibility and credibility consistent with the assigned theme are the proper criteria for judging scenarios.

Remember, we have a set of desired characteristics for our coastline and near-coastal environments in the year 2020. These were developed by consensus of the participants. We have compiled all those characteristics submitted by those who filled out the survey sheet we sent to each of you. Your responses are summarized in Table 2. They have been sorted into categories; only redundant ideas have been eliminated. It is clear that some of the desired characteristics are in conflict. These will be dealt with in the development of the scenarios.

A BRIEF RECAP

A scenario is a story; it is a tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out. A set of scenarios can be considered to be a set of organized ways for us to dream effectively about the future of Long Island's coastline and near-coastal environments. Some scenarios might better be described as nightmares.

We will develop the four scenarios in parallel; four teams, four scenarios -- one each. Each team should move through the scenario several times and reassess, re-examine, refine, and enrich the story. Good scenario spinning is an iterative process.

Once a team has developed the richest scenario it can for its assigned theme, it may select another theme of its choice and develop a scenario for it. We hope you'll chose from the four themes we've selected, but if you can frame a better one, do it. You will be assigned to scenario theme-teams by lottery.

TABLE 1

SCENARIO THEMES

I. *MOTHER KNOWS BEST*

Whatever Mother Nature does, she knows what's best for Long Island's coastline and near-coastal environments. Humans must accept the consequences and adapt.

II. *BETWEEN A ROCK & A HARD PLACE*

The only way for Long Island to cope with a rising sea, storms, coastal erosion and flooding is to armor the shoreline using a rich array of shore parallel and shore perpendicular hard structures.

III. *WE HAVE NOT YET BEGUN TO FIGHT*

To date, human efforts to deal with shoreline problems have not been at appropriate levels, and have failed to exploit the full array of strategies for dealing with a rising sea, storms, coastal flooding and erosion.

IV. *PEOPLE & NATURE: A PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT OF LONG ISLAND'S COASTLINE & NEAR-COASTAL ENVIRONMENT*

People work with nature in identifying and implementing strategies to conserve important values, uses and functions of Long Island's coastline and near-coastal environments.

TABLE 2

DESIRED DISTINGUISHED CHARACTERISTICS IN 2020

(All Suggestions Submitted by Participants In Advance of the Conference)

Barrier Beach and Coastal Erosion

- An appropriate balance has been achieved between recreational use of beaches and protection of critical habitat for wildlife.
- Housing and development have been moved off barrier beaches.
- Inlets are maintained until a major breach occurs, then one of the others (the one to the east) is allowed to close.
- The barrier beach is intact as a moving, dynamic sandbar that helps dissipate wave energy and protect the south shore of Long Island, while also creating a protected bay area where shellfish, fin fish, and recreational activities can add to enjoyment of Long Island residents.
- An effective erosion control program has been in place for more than two decades.
- Long Island has the cleanest beaches in the world.
- Technology is applied to deal creatively with erosion problems.

Policy and Management

- Long Island has a balanced and realistic coastal management plan.
- A Long Island Coastal Council (Commission) has been created which places most of the control over L.I. beaches in the hands of Long Islanders.

TABLE 2 CONT'D.

- Well-planned, implemented and maintained flooding and erosion control projects are the rule rather than the exception.

- There is widespread public recognition of the ecological value of beaches and coastal environments for living resources and ecosystem health.

- A new level of government/business/community cooperation has been achieved and sustained.

- Landowner agencies take responsibility for protecting and managing rare and endangered species.

- There has been a gradual conversion of private coastal property (on Jones Beach and Fire Island) into public property as the houses are destroyed.

- There is continued local control over land use issues.

- Publicly accessible shorelines.

- Coastal development is sustainable.

- Long Island's beaches and near-coastal environments are protected by legislation.

- There is widespread public awareness of the importance of beaches and near-coastal environments to Long Island's environment and economy.

Water Quality

- Cleaner beaches; once-closed beaches have been re-opened and water quality continues to improve.

TABLE 2 CONT'D.

- A living, thriving L.I. Sound.
- Garbage-free waterways.
- Water quality and fisheries harvests continue to improve.

Natural Coastal Environment and Tourism

- Beaches and near-coastal environments have been allowed to return to more natural conditions, but with public facilities to accommodate 25,000 people daily for each 1 km. stretch of barrier island (but not parking lots); wooden (not brick or stone) structures; bridges have been allowed to deteriorate.
- The region's "national" beaches -- from Jones Inlet to Shinnecock -- are promoted to redevelop a healthy tourist economy.
- No net loss of wetlands.
- Public access to the shore has been enhanced.
- Provision for housing along the shoreline is allowed, but limited.

Other

- Protection of the ecosystem and of rare and endangered species has been enhanced.
- People on beaches behave as good environmental stewards; no litter, etc.
- Environmental stewardship is the norm.

TABLE 2 CONT'D.

- Extensive development of parking facilities, restaurants, and motels on the mainland for tourists, and docking facilities on the bayside of the barrier island.
- Extensive bayside dredging and 5-fold increase in ferries and ferry service to public beaches and facilities on the barrier island.
- Important natural resources have been conserved and are vigorously protected.
- Economic value of natural resources to region has been enhanced.
- Working waterfronts are an important component of the regional economy.

In developing each scenario, ask a series of "what if" questions. Start with broad questions; then a series of narrow questions; then broad questions. Keep zooming in and out as you weave your story.

To spin rich scenarios, you need to suspend your disbelief long enough to explore different possibilities; possibilities that previously you may have denied. Barbara Tuchman once remarked: "Men will not believe what does not fit in with their plans or suit their prearrangements." In developing your scenario, each of you must check your plans and prearrangements at the door. Your scenario must be consistent with your assigned theme. It does not mean you endorse that theme as the one you want for Long Island.

Can we -- this group -- think creatively about an uncertain future for Long Island's coastline and near-coastal environments? If we can't, who can?

This is a high risk conference. It would have been far less risky -- indeed it would have been virtually risk free -- to have a series of formal presentations and some animated discussion in the form of Q and A. We perhaps could even have avoided criticism by a judicious balancing of viewpoints. But, what new would we have accomplished? Not much. We've had those conferences before. We'll have them again; but not today and tomorrow.

Here are a few final tips:

- Maintain flexibility of perspective.
- Suspend your personal filters; your personal predispositions; Don't be captive to positions organizations you belong to may have taken.
- Keep your radar "out"; what's on the screen? Are we missing things?
- Keep your eyes on the fringes, on the interfaces; look for connections.

Each team has until tomorrow morning to develop the scenario for its assigned theme, and for any other themes it chooses. Tomorrow morning we will reassemble in plenary. Each team will report its scenario(s); each team will tell its story and, as a group, we will search for robust strategies; those strategies that work best across a range of scenarios to produce a coastline and near-coastal environments in 2020 that have the characteristics you identified.

Good luck.

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SCENARIO DEVELOPMENT

At this point the group broke into teams. Conference participants were assigned to scenario theme teams by lottery.

Each scenario theme team had a facilitator and a rapporteur. Each team also had two or three coastal scientists or engineers who served as resource specialists. The facilitators, rapporteurs, and resource specialists of each scenario theme team are listed with each scenario.

Each team worked throughout the afternoon and evening to develop its scenario. The scenarios in the section that follow were presented during the plenary session the following morning at Jones Beach.

EXHIBIT 1

LONG ISLAND COASTAL CONFERENCE

16-17 JUNE 1993

Combined List of Survey Responses

Pre-Determined Elements

Definition: *pre-determined elements are events that do not depend upon any particular chain of events; they either have already occurred or are almost certain to, regardless of which scenario plays out.*

We have sorted the participant's responses into a small number of categories.

Erosion Problems

- Erosion problems continue along much of Long Island's shoreline; both north and south shores; problems are chronic and episodic.
- Barrier beach breaching and overwashes continue to occur.
- Society continues to be divided over its resistance vs. acceptance of shore erosion and of the process and ways of dealing with it.
- Shoreline alteration -- natural/artificial -- continues.
- Mainland flooding associated with storms continues.
- Erosion due to past attempts to control it (groins) continues.

- Erosion due to public access continues.
- Interruption of littoral drift/exacerbation of erosion by human-made structures (e.g. groins, jetties and bulkheads), and by natural features (inlets) continues.

Public Access

- Public access continues to be a major issue.
- Limits are placed on public access to public beaches.
- Demand for public access rises.

Land Use

- Demand for recreational/commercial uses of coast will increase.
- Problems of how to integrate land use with clean water objectives, boundaries, non-regulatory control, growth management continue.
- Struggle for control of land use continues.

Storms

- Major storm events continue to occur.
- Storm frequency and intensity increase because of global change (Is this a predetermined event or is it a critical uncertainty?)
- Coastal storms/property damage continue.
- Long Island experiences a massive hurricane or northeast storm; the question is not whether, but when.

Fisheries and Habitat

- Dynamic natural beaches are critical habitat for rare and endangered species.

- There is a gradual loss of waters certified for shellfish harvest.

- Fish populations continue to decline (Is this a predetermined element or is it a critical uncertainty?).

- Habitat continues to be lost and fragmented (Is this a predetermined element or is it a critical uncertainty?).

- Pollution and nutrient-loading increase (Is this a predetermined element or is it a critical uncertainty?).

Population and Development

- Population pressure and urbanization increase.

- Multiple and conflicting uses of coastal areas by growing population increase.

- Development pressure increases.

Water Pollution

- Sewage effluent is in our waterways.

- Storm drains continue to feed our waterways.

- Non-point source pollution remains an issue.

Policy and Funding

- Financial burden of recovery from the December 1992 Nor'easter, as well as from future mitigative measures persists.

- Funding shortage/economic uncertainty persists.

- Intergovernmental differences in priorities continue.

- Importance of cost-effectiveness in future "solutions" of non-structural objectives grow in importance.
- Effects of political decision/indecision persist.
- Loss of local tax base due to loss of property value occurs.
- Strain on insurance funds grows.
- Acquisition of private lands by public authorities increases.
- Acquisition of private lands by private entities.

Global Warming and Sea Level

- Sea level not only continues to rise, but at a more rapid rate, increasing erosion and potential for shoreline flooding.

Law

- "Taking clause" of the fifth amendment to the United States Constitution becomes a greater issue.
- Municipal Home Rule (Chapter 843 of the laws of 1963) continues.

Other

- Litter and crime along the coast increase.
- Mosquito control remains an issue.
- Desire to live close to shore remains strong.
- Dependency of regional economy on coastal resources continues to be strong.

EXHIBIT 1 CONT'D.

Critical Uncertainties

Definition: *critical uncertainties are elements that will shape the future that are not pre-determined. They can be natural events that are unknown, or societal decisions that cannot be forecast with certainty because of changing priorities and socio-political factors.*

Storms and Hurricanes

- The number, severity and timing of major storms.
- The predicted increase in the frequency and intensity of hurricanes for the Atlantic coast over the next 20 years.
- Development of effective coastal storm damage control-techniques.
- Public response to major shoreline changes produced by storms.
- Extent of damage to region's beaches and near-coastal environments by a 100-year storm.

Barrier Beach and Coastal Erosion

- Extent of damage to man-made structures on the barrier beaches over the next 100 years.
- If the barrier island is not allowed to migrate northward, what type of damage can we expect on the south shore of Long Island?
- If the barrier island is allowed to migrate, what type of damage can we expect on the south shore of Long Island?

- Preferred strategies for barrier beach repairs -- sand/rock = soft/hard solutions.

- Long-term erosion control vs. emergency repair: which model will characterize the region?

- Degree of public acceptance of natural migration of the barrier island vis-a-vis fear of beach and dune erosion and flooding.

- The recurring costs of beach nourishment.

- Acceptance and effectiveness of shoreline restoration and fortification through periodic beach nourishment.

- Maintenance of north shore beaches if bluff erosion is severely curtailed by humans.

- Long-term cost of protecting private property on the barrier beach and agreement on who pays.

- Barrier beach housing -- allowing it vs. prohibiting it.

- Public access/preservation trade-offs.

- Shoreline abandonment and subsequent loss of value.

Eutrophication and Water Pollution

- Episodic blooms of exotic species; brown tide-like events.

- Offshore oil or chemical spills.

- Funding for massive water quality enhancement programs and their effectiveness.

Policy, Management and Funding

- Degree to what state of economy impacts use and money available for cleanup/protection/access.
- Governmental (state and federal) funding to Long Island for coastal programs.
- Dedicated income streams for coastal projects at local level.
- Interactions between local industry and environmental groups to provide joint funding for conservation, research and technology.
- Extent of intergovernmental/community cooperation.
- Coastal management policy.
- Sustained attention to the coastline in the face of other priorities.
- Degree to which economics will force concentration of funding for the coastline on areas that are highly populated by year-round residents.
- Willingness of general population to expend significant amounts of money over a long period of time in fighting natural processes that ultimately will still occur.
- Economic feasibility of filling in all breaches that occur along our coastline.
- Public understanding of the importance of the coastline to the environment and to the economy of Long Island.
- Public recognition of the coast as critical to the regional economy.

- Effectiveness of public education in clarifying that we are part of the problem and the solution.

- Fundamental change in nature or dynamics of problem solving process: the possibility that NIMBY-ism will be replaced by negotiation on the basis of enlightened interests, not positions.

Global Warming and Sea Level

- Global climate change; ozone hole issues; increase in skin cancer; effect on beach use.

- The rate of sea level rise; will it be accelerated?

- The frequency and intensity of storms; will they increase?

Insurance

- Nature of flood insurance "reform" legislation.

- Insurance availability.

- Insurer solvency.

- Federal insurance policy changes.

- More stringent prohibitions on federal flood insurance.

Law

- Status of "Taking Law": a change might allow regulatory or outright takings in certain situations without compensation.

- Status of ownership of lost or reclaimed land: if State rebuilds land lost to erosion, is the property owner entitled to anything less than 100% ownership?

- Municipal home rule law: federal or state pre-emption of the local zoning or other laws in connection with beach hazard areas.

- Real property taxes: right of a landowner to stop paying real property taxes after his/her land is washed away (and the possibility that a substantial loss in tax revenue where such a practice becomes widespread).

- Voting rights of those who have lost property (access to property) due to erosion: does a landowner whose property is lost to erosion retain the right to vote which accompanies the residency (or former residency)?

- Responsibility for reclamation: if landowner retains title to land washed away by a storm, does he/she bear any financial responsibility for reclamation work?

- Lapsing of ownership interests for failure to use land: can the state deprive property owners of land rights for their failure to build where land remains underwater or at risk for a significant period of time?

- Rights to public services: can the state justify providing different levels of public services (e.g. fire and police protection, water and sewer services) to mainlanders than to beach residents?

- Banking and secured creditors interests: what are the rights of a creditor who holds a security interest in property under water? (Is such a creditor entitled to a priority over interests of the state which reclaims the land?)

- Title insurance: where land is washed away and then re-established, is there a break in the chain of title?

- Legal impacts of remediation efforts: what liability (tort or otherwise) can be extended to the State for environmental and other damage to

private or public property caused by efforts to remediate beach erosion?

- Sovereign immunity: will the state be liable for incidental damage to the shoreline caused by remediation efforts (e.g. the construction of jetties possibly causing damage to beach areas downdrift of littoral currents).

Other

- New recreational fads/technologies may change coastal use patterns.
- Fuel shortages may affect coastal use patterns.
- Permitting policies regarding bulkheading -- wood/steel/concrete.
- State of technology: artificial reefs, inlet by-passing, etc.
- Availability of basic knowledge needed for rational decision-making.
- Public acquisition of ocean front property.
- Displacement of water-dependent uses.
- More stringent water quality standards for shellfish harvesting areas.
- Introduction of exotic species through ballast water and other mechanisms.
- Potential backlash against policies for protection of rare and endangered species.
- New transportation ports (jet, ferries, etc.)

EXHIBIT 2

Steps in Scenario Development

STEP 1 — **Identify and Explore the Driving Forces.**

STEP 2 — **Identify Pre-Determined Elements and Critical Uncertainties.**
Driving Forces, Pre-determined Elements and Critical Uncertainties Give Structure to our Exploration of the Future. (These were done by participants before the conference; see Exhibit 1).

STEP 3 — **Select Several Themes that Cover the Plausible Range of Possible Futures.**
This was done before the conference; see Table 1.

STEP 4 — **Spinning the Scenarios.**
The task of each scenario team is to weave the driving forces, pre-determined elements and critical uncertainties together to produce a rich story **consistent** with the assigned theme.

The same sets of driving forces, pre-determined elements and critical uncertainties will behave (interact) differently according to the plot (theme); the theme will flip some "critical uncertainties" into pre-determined elements.

LONG ISLAND'S COASTAL CONFERENCE

REPORTS OF

SCENARIO THEME TEAMS

MOTHER KNOWS BEST

TEAM I

"MOTHER KNOWS BEST"

Facilitator:	*Robert Nuzzi, Suffolk County Department of Health Services*
Resource Scientists:	*Nicholas K. Coch, Geology Department, Queens College, CUNY*
	Timothy Kana, Coastal Science & Engineering, Columbia, S.C.
	Norbert P. Psuty, Rutgers University
Rapporteur:	*Christine Campbell, Marine Sciences Research Center*

It's 11:00 a.m. on the 4th of July weekend in the year 2020, the temperature is 92° and the humidity is almost as high.

Robert Moses Causeway has been closed to southbound traffic because the remaining beach area and associated parking lot on the barrier island accessible to the public from the causeway has been filled to capacity since 6:00 a.m.

The scene is similar at Jones Beach where only a fraction of the once expansive beach area is now accessible. Various town beaches on the barrier islands fronting the south shore lagoonal system, if they exist at all, are of limited accessibility.

Most of the infrastructure, including Ocean Parkway was destroyed by a combination of rising sea level, subsiding land mass, and the occurrence of the increased number of severe storms that were more or less expected by climatological experts around the close of the second millennium. In fact, on average, shoreline loss amounted to about 100 feet around the entire coast of Long Island, although it was significantly less than that on the mainland of the south shore.

Resort areas on Long Island's south fork, where the ocean beaches are on the mainland and are still reasonably accessible (or can be made so) and are having a banner year. In fact, this may be the only area where the loss of a recreational and tourist economy has not been extremely damaging. The area, which pretty much has a monopoly on ocean beaches, has, in accordance with the law of supply and demand, been able to command extremely high prices for real estate and rentals. The South Fork does, however, bemoan the loss of the Montauk Light house which slipped ignominiously into the sea some years ago.

What homes are left on the barrier beach (many were destroyed by the rising sea and coastal storms) are mainly inaccessible as the navigational channels formerly plied by the boats going to the island have silted in to the point where only the shallowest draft boats are capable of reaching the barrier island, or,

for that matter, of being docked at the mainland or navigating the south shore canals within which they were once located. There seems to be the possibility, however, of hovercraft type vessels allowing increased access to the island. For now, though, it is difficult for people with property on the barrier island to protect it from abuse and misuse by intruders. In addition, a considerable amount of damage, both structural and environmental, has been caused over the years by the flotsam and jetsam of homes that have been tumbled into the back bay area. The loss of homes has obviously impacted the local tax base.

Damage to the barrier islands, including increased washovers and occasional inlet formation, has also put the mainland at greater risk and, in fact, a number of waterfront homes have been destroyed with others being moved further away from the waters edge where possible. Shoreline mainland infrastructure has also been impacted. Southside and Good Samaritan Hospitals have been forced to take expensive measures to prevent the possibility of water damage to their physical plants.

Because navigation channels have not been maintained, most recreational boaters and fishermen (all except those with shallow draft boats, canoes, etc.) have given up Long Island as a boating area and the loss to the local economy has been staggering. Commercial fishermen have similarly left the area because of the difficulties of navigation and dockage.

Similar problems of navigation have occurred in north shore harbors, with similar results.

Bluff erosion and the consequent loss of property have been a serious problem on the north shore. In addition, Eatons Neck on the west and Orient on the east have become islands after the washovers at Asharoken and Orient Harbor respectively.

These, and similar problems, have led to some serious changes in land-use policy regarding construction in high risk areas. There is still considerable debate, however, about the prudence of allowing homes to be built, or repaired, in these areas and the question of the rights of the property owner remain complex.

There has, however, been a significant amount of rezoning and expensive public acquisition of lands to prevent development in high risk areas. Displaced shoreline inhabitants had to be relocated which, in some cases, required the rezoning of once single-family areas to multiple family areas in order to accommodate them. The social disruption has been quite painful and many people have left Long Island entirely.

Many of the industries that rely on water transport have left the area. LILCO in Port Jefferson Harbor, has been forced to build a pipeline for oil delivery.

The changes to the living marine resources are difficult to assess. There appears to be more habitat for certain species such as the piping plover and other shore birds, simply because of the decreased disturbance of the beach areas. It is, however, difficult to say anything about the shell and finfisheries. Historically, very often one fishery has been replaced by another after environmental changes have occurred. For instance, a once thriving oyster fishery in the south shore bays was replaced by a hard clam fishery.

By and large, however, the changes wrought by Mother Nature over the past 27 years have not treated Long Island, as we know it, kindly, and has resulted in a drastic upheaval of our socioeconomic system.

MOTHER REVISITED

It was the consensus of the group that letting Mother Nature take her course, without any intervention, was clearly not in the best interests of Long Island.

The group decided that it would be better to work with nature where possible "in identifying and implementing strategies to conserve important values, uses and functions of Long Island's coastline and near-coastal environments" which is actually Scenario Theme IV.

Strategy implementation must be "site-specific." That is, different strategies might be applied to different areas and no one strategy is likely to be good for all areas.

SOME SUGGESTED STRATEGIES

I. Maintenance dredging of inlets, channels and harbors with *appropriate* use of dredged material or *safe* disposal of material and repair of breaches as deemed necessary.

Appropriate use could include beach nourishment and wetland construction.

There was the feeling that the economics of dredging had to be improved and this could involve studies to characterize and map sediment types so that we would know what type of sediment is being dealt with at any given time, and to what use it might be properly put.

The effects of different mining strategies should be assessed.

In an effort to simplify the permit process and speed things up when required (the present problem of the breach in Moriches Inlet was used as an example), there was some sentiment for coordination of operations by a "Regional (Nassau-Suffolk) Control Board." It should be noted that there was also a minority opinion on this matter.

Mechanisms to finance required projects should be in place.

Monitoring and periodic maintenance is preferable to putting off maintenance.

II. Improved sand bypass systems.

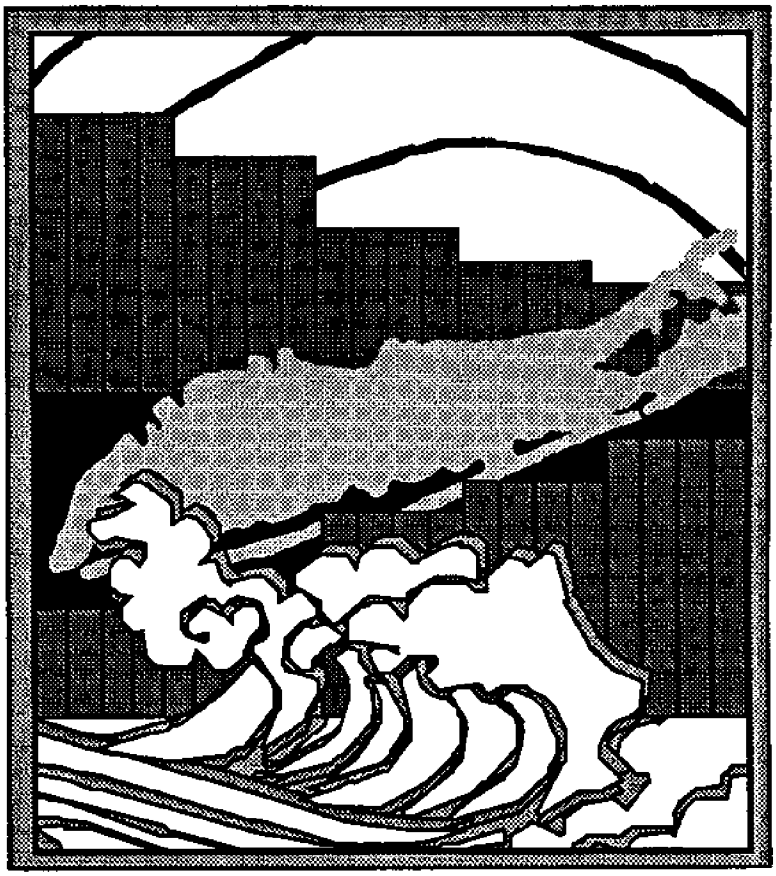
III. Natural solutions for erosion control should be encouraged, e.g. dune plantings, wetland plantings. The investigation and use of environmentally benign "throw-away" material for beach stabilization and nourishment should be encouraged.

IV. There was a general feeling that bulkheading should be discouraged but that research on the design and construction of groin fields should be encouraged.

V. Methods for the offshore attenuation of energy and other new technologies should be investigated.

VI. There should be careful monitoring and strict regulation of off-road vehicles and the construction of bicycle paths along the beach should be considered.

VII. Increased public education on "environmental correctness" is required.



BETWEEN A ROCK & A HARD PLACE

TEAM II

"BETWEEN A ROCK AND A HARD PLACE"

Facilitator:	*James Gesualdi, Cahn, Wishod, Wishod & Lamb,*
Resource Scientists:	*James Allen, National Park Service*
	Victor Goldsmith, Hunter College
Rapporteurs:	*Jiong Shen and Rafael Nino Lopez, Marine Sciences Research Center*

The theme dictates that only way for Long Island to cope with a rising sea, storms, coastal erosion and flooding is to armor the shoreline using a rich array of shore parallel and shore perpendicular hard structures.

LONG ISLAND 2020. From Sound to Sea, still the place to be? Well, yes, but perhaps not exactly the place we had earnestly hoped it would be when we first convened here twenty-seven years ago (in 1993) and decided that the only way to secure the best future for Long Island's coasts was to build, build, build.

The last three decades have passed quickly, perhaps more quickly than the first three hours of our initial scenario planning session back in April, 1993. Since that time, I have ended the treatment for, and recovered from, my experiences as a group facilitator; Amy Fisher was released from prison and married 17-year-old Joseph Buttafuoco III; Jim Larocca has managed to stay fit and tan; Jerry Schubel has perhaps lost half a step and he is now contemplating retiring as President Hillary Clinton's Coastal Czar.

The changes in our Long Island community, and in particular our coastal areas, have been dramatic and mixed. Happily, the rich array of hard structures or armaments which are the dominant feature of Long Island's coasts have "successfully" stabilized the shoreline. In so doing, Operation Shoreline Shield also fueled Long Island's transformation from the depths of the economic troubles of the 1990s. As detailed herein, these monuments to humankind's ability to intervene against natural forces have not been free from problems. Before analyzing the consequences Operation Shoreline Shield has visited upon us, an overview of our construction program is necessary.

Operation Shoreline Shield was the most massive hard structure-oriented shoreline preservation program ever instituted in the United States. Three categories of structures (and one non-structural method) were employed: (1) shore parallel structures including revetments, bulkheads and seawalls; (2) shore perpendicular structures including groins and jetties; (3) off-shore structures including breakwaters, artificial reefs and submerged berms; and (4) beach nourishment. Other structural fixes initially considered, but never adopted, included artificial seaweed and shoreline terracing.

Beginning on the Atlantic border of Long Island's South Shore, Operation Shoreline Shield deployed the following armaments:

1. South Shore
   a. Montauk bluffs (and bluffs elsewhere)
      Shore parallel hardening system and off-shore breakwaters which resulted in sand accumulation.

   b. Coastal Ponds/Hamptons
      Complete existing groin field (westward)
      Begin off-shore reef system which terminates at the western end of L.I.

   c. Inlets
      Dredge inlets, maintain jetties, by-pass existing inlets.

   d. Other vulnerable areas (e.g., Ocean Parkway)
      Seawalls, widen beach and build up dunes.

2. South Shore Bays
   a. Floodgates at all inlets to control storm surges.

3. North Shore
   a. Bluffs
      Shore parallel hardening system featuring bulkheads and off-shore artificial reefs.

   b. Embayments/Spits
      Gabions.

   c. Inlets
      Dredge inlets, maintain jetties, by-pass existing inlets.

   d. Other vulnerable areas (e.g., Asharoken Avenue)
      Seawalls
      Bridges, Causeways (Asharoken Avenue to be traversed by the Ray Cowen Causeway)

4. Peconics

Similar to North Shore program depending upon site.

As stated previously, Operation Shoreline Shield has "succeeded" in stabilizing Long Island's coasts. Operation Shoreline Shield also created jobs, enhanced property values in coastal and near coastal areas, and spurred greater development and population growth in those areas.

Other significant consequences, primarily costs, include the following:

1. South Shore
   a. Life's no beach? -- Beaches do remain throughout portions of the south shore because of the off-shore reef system but other problems were created.

   b. Degraded shoreline esthetic due to the ravages of our armaments.

   c. Increased long term costs
      (1) Structural Management and Maintenance
      (2) Administrative/Bureaucratic/Regulatory nightmare (making Ray Cowen's tenure at DEC seem like a day at the beach).

   d. Uncertainties (re. exact changes)
      (1) Habitat/Wildlife changes
      (2) Commercial Fisheries (likely adverse impact from reef).
      (3) Recreational Activities (changed fishing including improved sports fishing, no surfing, more diving).
      (4) Public Access.

2. South Shore Bays

a. Decreased water circulation, long term decrease in water quality due to absence of flushing effect of storm surges and new inlets.
b. Long term adverse impact on fisheries.
c. Possible recreational losses.

3. North Shore
   a. Increased beaches remain from off-shore reef systems.
   b. Tidal wetland changes.
   c. Habitat/Wildlife changes.
   d. Possible erosion of inlets.

4. Peconics
   Similar to North Shore consequences depending on site.

Overall, although Operation Shoreline Shield has helped us weather the previously devastating Operation Shoreline Storms, we have not created a Long Island many of us find as desirable as the one we knew last century.

LESSONS LEARNED

Fortunately, however, our experiences have taught us the following lessons.

1. We need to further study the dynamic forces which affect our coastal and near coastal environments. More comprehensive analysis and monitoring of these forces will enable us to better address the real problems plaguing our shores.

2. A more balanced approach, utilizing a blend of natural and engineering solutions would probably prove the most effective means for being good stewards of our shores.

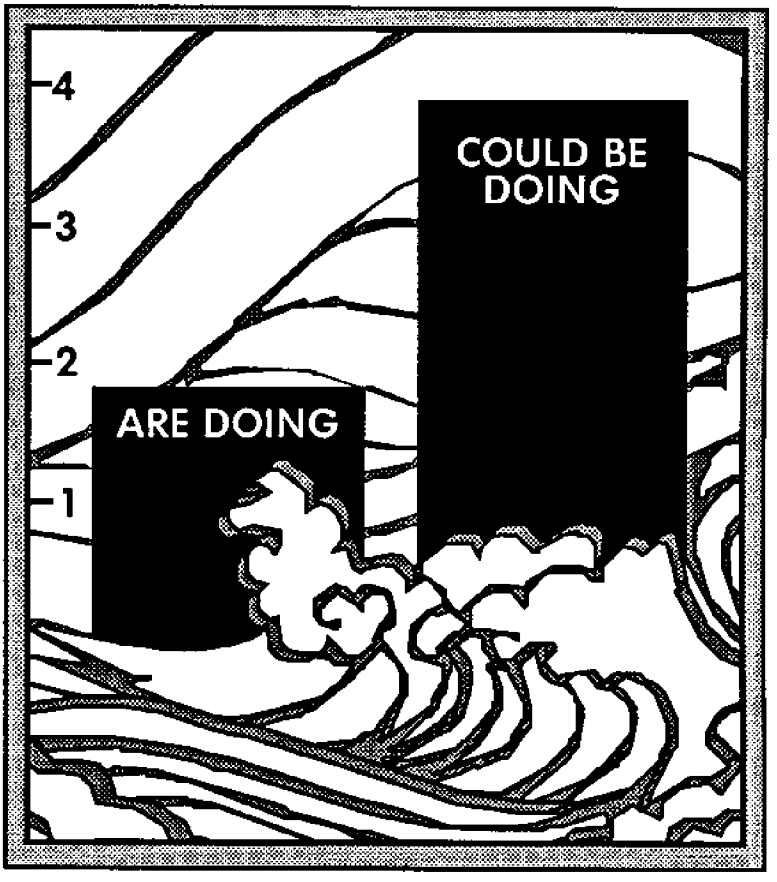
3. A greater commitment to action, including interim action in crisis situations,[1] is necessary. This includes better interagency and intergovernmental cooperation as well as

[1] E.g., in the event of a new breach it should immediately be filled until an enlightened decision can be made as to how best to respond.

interdisciplinary expertise. (Better public education and stronger public will in support of essential programs is also critically important.)

4. Unsuitable new development should, where financially and legally possible, be re-directed away from coastal areas. Where cost-effective, existing development in coastal areas should be protected.

5. We should not be paralyzed by our lack of knowledge in some areas but, rather, encouraged by our creative capabilities. Consequently, in appropriate circumstances (e.g., the development of an artificial reef), we should employ experimentation as a means of developing new solutions.



WE HAVE NOT YET BEGUN TO FIGHT

TEAM III

"WE HAVE NOT YET BEGUN TO FIGHT"

Facilitator:	*William Wise, Marine Sciences Research Center*
Resource Scientists:	*Henry Bokuniewicz, Marine Sciences Research Center*
	Fred Wolff, Hofstra University, Hempstead, NY
Rapporteur:	*Jeanne Gulnick, Marine Sciences Research Center*

Long Island Coastal Commission
20th Annual Meeting
State of the Coast Summary

The Hyatt at Stony Brook
3-4 February 2020

Introduction

The Long Island Coastal Commission's 20th Annual Meeting was held at the Hyatt Hotel on the campus of the University at Stony Brook, 3-4 February 2020. The following summary of Long Island's coast was presented at the meeting by the Executive Director of the Council. In her remarks, she places the major issues occupying the meeting in an historical perspective on the evolution of the management of Long Island's coast and coastal resources.

Remarks of Executive Director

Long Island's coast and coastal resources are of undeniable importance to the economy and the lifestyle of the region. This has always been the case. Throughout most of the period since European colonization, however, the management of these public places and resources did not keep pace with their evolving use and the stresses that this use presented. This began to change in the middle years of the 1990's, when a number of coastal crises and related events occurred that demanded a new approach to coastal resource use and management on Long Island: catastrophic fishery declines; a series of devastating storms, culminating in the frightful hurricane of 1995; a 40% rise in crude petroleum prices brought on by the Egyptian-Syrian war in the Middle East; a state Constitutional Convention that, inter alia, seriously diminished the authority of local municipalities in land use regulation and zoning. These events highlighted the need for a more coherent and forward-looking response to the needs of the coast. From our present perspective, I believe you will agree that this response has, in fact, been forthcoming. We have done much better by our coast in the past twenty-five years.

Perhaps the single most important element in the transformation over the past twenty-five years in the way Long Island's coast is managed has been the Long Island Coastal Commission itself. Established in 1997 by the State Legislature, it has been remarkably successful in devising and implementing management actions that have struck an effective balance between our society's interest in preserving coastal resources and using them.

For example, many of the man-made structures that were present at the beginning of this century in designated high hazard areas along the coast are gone, removed either by the ravages of wind, wave, and time or intentionally demolished between 2000 and 2005. We have successfully preserved those sections of the coast that were ecologically-sensitive or hazard-prone. But, we have not abandoned the entire coast. Those areas of intense development, private or public, that were seen as invaluable and necessary to protect have, in large part, been protected. There is a continuing cost associated with modification and improvements to the various coastal protection devices, but it is a cost we as a society are willing to pay.

Even a cursory review of our Long Island coast will reveal that, for the most part, we have been successful in shifting the bulk of the use of our coast and waterfront to those that are truly water-dependent. All uses have an impact on our sensitive coastal environments; it is important that our waterfront be home only to those uses that cannot exist away from the water. Equally important, development along our coasts is now more concentrated, "clustered" in the planning vernacular. This has produced great efficiency savings in the cost of providing these facilities and businesses with water, electricity, roads, sewer systems, and related infrastructure necessary for their operation. It has also prevented our coast from succumbing to the sprawl that has engulfed the rest of Long Island.

One of the troubling issues facing Long Islanders in the latter part of the last century was how to provide access, physical access, to the coast for all who wished to be there. In the past twenty-five years, we have seen a tremendous sea change in how this issue has been addressed. Part of the response, in which the Commission played a major role, has been the expansion of public transportation to coastal beaches, parks, etc. I don't think there is any place in

the United States where so many people can get to the coast so easily and at reasonable cost. We have not entirely weaned ourselves from the private automobile, but the economic realities of $3.50/gallon gasoline costs cannot be ignored.

At the coast itself, the Commission has the authority to require public access to be included in any and all private development. You have used that authority frequently and to good effect.

The havoc and human misery wrought by the Hurricane of '95 led to the establishment of a truly effective coastal disaster response and management plan. The civil unrest that followed in the several days after the storm, though perhaps mild when compared with other street fights this Nation has seen, served us all a real "wake-up call." We now have in place a system of scientific information gathering and analysis that can anticipate the occurrence of major natural disasters in Long Island's coastal region, the probable effects of various storms, and where these effects are likely to be most severe. Equally important, we have a management and response plan and capability that allows governmental decision-makers and agencies to take the appropriate steps to minimize storm effects and to mitigate those that do occur.

Water quality continues to be a concern of Long Islanders, the public and environmental managers alike. Here again, although problems remain, we have made tremendous strides in achieving our general goals and objectives. Once a serious constraint to other uses of our coastal environment, such as fishing and swimming, ambient marine water quality around Long Island no longer is at or near the top of everyone's list of major coastal problems for the New York Metropolitan Area. This has not been an overnight achievement. The reversal of the generally declining water quality scenario of the 20th-Century really began in the late 1960's and early 1970's, when EPA initiated its wastewater treatment capital upgrade program. This was succeeded in the 1980's and 1990's by the National Estuary Program, which did much to lay out the prescription for other water quality problems plaguing our coastal waters, particularly those associated with non-point sources. The major achievement since the turn of the century has been the identification of and commitment to discrete water quality goals in different parts of our marine coast. We decided

that western Long Island Sound could not achieve the cleanliness of the Race. The relatively pristine water quality of our eastern Long Island bays was seen as too valuable to lose; retaining water quality is nearly always cheaper and easier than recovering it. Important shellfishing areas that were closed in the latter portion of the last century are now again open to shellfishing. You can swim again, legally, at most of the historic public beaches around Lower Bay of New York Harbor. Our inner harbor areas remain problematic in terms of water quality, and will continue so for the foreseeable future. By and large, however, water quality no longer limits other uses of our marine and coastal environment.

Marine commercial and recreational fishing went through a catharsis of sorts in the mid-1990's. At that time, fishery stocks worldwide, and locally, had been seriously reduced through the combined effects of overharvesting and pollution/habitat alteration. By the end of that decade, both commercial and recreational fishermen realized that something must be done to save the fisheries. Building on this consensus, the management of our coastal fisheries went through a decade-long period characterized by extreme restrictions on catches. About 2010, our fisheries and fishing industries took on their current complexion. Stocks of target species have been mostly rebuilt and appear stable, except the yellowtail flounder, a once-important commercial species that never recovered. Active commercial and recreational fisheries exist, but they are much more tightly regulated and controlled than was the case when the Commission was founded. We have fewer commercial and recreational fishermen than in earlier years, but the "boom and bust" cycle that characterized fisheries in the last century has been broken.

Finally, the great storms of the mid-1990's prompted a great debate among Long Islanders from all walks of life about the fundamental perspective and policies that are appropriate to managing the Island's barrier beaches. Some advocated massive attempts at protection and an attempt to slow down or stop the natural dynamic processes active on these beaches. Others advocated pulling away from the barrier beach, letting Mother Nature take her course. Perhaps predictably, neither of these extreme views won the field. However, as a result of this debate, changes were made to more tightly regulate development of these areas. Some development was sacrificed as too expensive

to protect. However, the fundamental policy arrived at was to make every attempt to preserve these barrier islands as a natural and important component of the overall coastal ecosystem of Long Island's south shore. The islands, the South Shore bays, the mainland shoreline, and the ocean are components of an integrated system. Lose the barrier beaches and the system is disrupted, or perhaps collapses. We have chosen to do what is necessary, within our limited ability, to secure the future of our barrier beaches.

I want to express my appreciation to the Commission for its fine work over the past year. Perhaps the picture that I have just painted is too rosy. I think not, however. The world doesn't lack for problems and these problems all get plenty of attention. It is important to highlight our collective successes in dealing with societal problems. The recent history of how Long Island manages its coast and coastal resources contains a number of success stories. These successes have stemmed from two principal improvements in the approach we have taken to management: we have made a sustained commitment to securing and then using the best scientific and technical information we have about our coastal environment and, as a society, we have achieved a working consensus among the many interests represented around our coasts on what is the optimum mix of uses of these resources, including their conservation and protection, and then translated that consensus into specific management actions targeting that optimum mix. We need to recognize and appreciate these facts if we are to sustain this consensus as we approach and deal with the problems of today and tomorrow. Thank you for your time. I'm looking forward to working with you in 2020.

P E O P L E & N A T U R E

A Partnership for sustainable development
of Long Island's coastline and
near-coastal environment

TEAM IV

"PEOPLE AND NATURE: A PARTNERSHIP IN SUSTAINABLE DEVELOPMENT"

Facilitator: *Robert Kent, New York Sea Grant*

Resource Scientists: *Robert Cerrato, Marine Sciences Research Center*

Jay Tanski, New York Sea Grant

Rapporteur: *Trudy Bell, Marine Sciences Research Center*

The year 2020 is very different from the day we gathered in June 1993 to explore the future of Long Island's coastline. The young students who were in our room then are proud of how the world changed as a result of the outcomes from that conference. Rather than ignoring nature or waiting for some catastrophe and then wondering what to do, people decided that the time had come to form a partnership with nature. People would no longer feel separate from nature, but rather active players working with nature to build a world that helped satisfy their needs, while protecting natural resources. At the meeting someone said, "Hey, we are a part of nature, too," and they were very, very excited.

Being a part of nature meant to the group taking responsibility, getting involved, making plans, implementing those plans and monitoring their actions for success.

People started asking questions. What would my life on Long Island be like without beaches to enjoy? How did our waters get so dirty, and does it have to stay that way? Why are so many of our beaches closed to swimming and shellfishing? Meanwhile, they looked at the state of their economy, and wondered how they were going to make a living. Defense spending was drying up fast, and there was no future in growing Long Island potatoes or ducks.

Someone said, "Hey, look at this place, our Island Home. This could be one of the last great places! People from all over the world could come here to enjoy abundant seafood, beautiful beaches, and wildlife like sea turtles and whales."

And so they went about setting up some goals for themselves. Access would no longer be a problem, and they would be able to get to the beach easily, but the carrying capacity of the land would be respected. New industries would develop, with a sustainable economy that protected the environment and provided jobs. Water quality would improve, with more swimmable and fishable waters right in the local neighborhood. Shellfishing and finfishing would rebound. Endangered species would be taken off the endangered species lists, and habitats would be protected.

Next they asked themselves: "What prevents us from reaching these goals? What has to change?" They identified several critical limiting factors. Public sentiment would have to be mobilized. Everyone would have to get involved and committed to environmental protection and sustainable living. Next, government would have to be streamlined so that it could respond quickly to what needed to be done. A new revenue source to fund the work that needed to be done would have to be established, and this would have to be a constant and reliable source of money. Research and extension education programs would have to be strengthened, so that people would have the best available information on which to base decisions. For each particular environmental problem, people would need to know what was happening, what needed to be done, and then they would have to have the will to do it.

Public sentiment was seen as the driving force to accomplish the tasks the people set forth for themselves. They wanted everyone to get involved in their own local watershed, and to take responsibility for it. Dedicated people would see to it that government helped them get the job done. People would see to it that government funding was available, and they would often match their own local money with state and federal money. Since everyone would realize that their livelihood depended on a clean and healthy environment, they would pressure government to work for environmental protection. A booming tourism economy would help to generate the tax base needed.

Government would finally learn how to work together in partnership gridlock and agency inefficiency would end.

The people set up bench marks to see if their plans were working. They planned to evaluate the success of their environmental education programs to determine what people were learning, and if the education was motivating people into action. Water quality and fish and wildlife populations would be monitored to see if goals were reached. The impacts of their actions on the tourism economy would be closely watched. When goals weren't being reached or problems arose, people would respond quickly with changed plans, and quickly take new actions.

In 2020, and old coastal codger was sitting on the beach, thinking to himself.

"When I was a boy, Long Island was a wonderful place. There was lots of open space, beautiful beaches, no traffic. Mother Nature surely knew best back then, for She created this beautiful Island Home of ours.

When I was middle aged, Long Island had lost its charm. The beaches were eroding, the fish and wildlife were almost gone, the water was polluted, the economy was stagnant, and people were moving away. It was as if people were at war with nature.

But now, as an old man, I see people have formed a partnership with nature. They work with nature, to take care of their needs and nature's needs."

And the old man was pleased.

AN OVERVIEW OF CONCLUSIONS AND RECOMMENDATIONS FOR WHICH THERE WAS A CONSENSUS

MAINTENANCE/REPAIR

- Tailor strategies for managing Long Island's coastline to each specific coastal segment. There is no universal solution. Some segments might be left natural; others will require different combinations of soft solutions (e.g. beach nourishment, dune building and wetland creation) and protective structures (e.g. bulkheads, gabions, groins, jetties and offshore bars).

- Assess the effects of existing hard structures and the best way to incorporate them into future strategies.

- Dredge important channels and harbors routinely; develop beneficial uses of the dredged material in comprehensive strategies of coastal management -- beach nourishment, wetland creation, etc.

- Bypass sand at inlets by putting sand back into the littoral drift system on the downdrift side of the inlet.

- Maintain the integrity of the barrier island system by filling new breaches quickly after they occur and by identifying and strengthening areas of incipient breaches. (This should not be confused with a strategy to try to keep the barrier from migrating. It is not.)

RESEARCH

- Promote the development of shore protection alternatives which incorporate new technologies and concepts. Support research on the appropriate application of such alternatives to lead to better-informed decision making. Promote investigation of methods designed for offshore attenuation of storm wave energy without adversely affecting the aesthetics coastal zone.

•Identify and characterize sand sources for beach nourishment and breach repair both onshore and offshore.

•Develop numerical models which incorporate appropriate components of forces acting upon Long Island's shoreline system to better understand the dynamics of the coastal environments and to gain insight into the effects of changes in those forces.

•Explore the use of environmentally-benign recycled and secondary materials for beach stabilization and nourishment.

CENTRALIZED DATA/INFORMATION

•Create a comprehensive data base for information storage and retrieval to improve and inform the policy decision-making process. Monitoring and research programs would feed into this centralized information center, providing current, locally relevant, technically-valid and unbiased information for policy-makers, scientists and other interested parties.

MONITORING AND ASSESSMENT

•Establish a routine coastal monitoring program to chronicle the state of the region's beaches and near-coastal environments. The monitoring program should be designed to identify both the occurrence and magnitude of short-term fluctuations as well as long-term trends. The program must include monitoring of the wave climate, beach profiles, tidal elevations, and water quality parameters for the near-coastal environment.

•Develop indicators to measure changes in water quality, in fish and wildlife populations, in public awareness and action as well as in the tourist industry.

GOVERNMENT

- Develop an effective response plan to anticipate, and, where appropriate, to mitigate the effects of natural and human-related emergencies and disasters in coastal areas.

- Streamline government regulations so that appropriate action can be taken in a timely way to conserve natural and societal resources and money.

- Enhance interagency and intergovernmental cooperation and coordination to provide a greater commitment to action.

PUBLIC EDUCATION

- Activate research and educational programs so that decisions are made with the best available information.

- Assign stewardship responsibility for each watershed to the appropriate mixture of jurisdictional levels; match local money with state and federal revenue to maintain required programs.

- Educate the public about realities, choices, consequences of Long Island's coast; enhance the sense of "environmental stewardship," mobilize public sentiment; mandate environmental education.

FINANCIAL STRATEGIES

- Develop new industries for Long Island with an emphasis on sustainable growth to insure that a healthy environment translates into a healthy economy.

- Create a substantial and stable revenue source (an Environmental Assistance Fund) to fund repairs and maintenance, research and monitoring efforts and to provide emergency assistance.

- Use local/private funds to leverage federal and state support.

•Explore other sources of revenue, such as increasing beach user fees; establishing special tax districts based on coastal uses/needs; providing financial incentives/disincentives for home and business owners; instituting a levy on development projects in coastal region and a coastal protection income tax check-off.

LAND USE

•Make fuller use of innovative land ownership arrangements -- create more realistic financial and insurance arrangements based on risk and exposure and develop far-sighted policy concerning rebuilding in coastal hazard areas.

•Enhance public transportation to Long Island's coast. This should become a high priority issue to discourage reliance on private automobiles and to provide increased access.

CLOSING REMARKS

J.R. Schubel

Driving to Jones Beach this morning from Stony Brook, I took the Sagtikos Parkway to the Ocean Parkway. I couldn't help but be reminded of how rich Long Island is in the diversity of its coastal environments.

Other states and regions put together incentives and political pressure in pursuit of the other white meat -- pork -- to create expensive laboratories and facilities that allow scientists and engineers to ask important, new, exciting questions. The Super Conducting Super Collider in Texas is the ultimate example of this strategy, but there are numerous others: The Christopher Columbus Center in Maryland, and The Hatfield Center in Oregon are but two other examples. Both are coastal in their orientation.

We have a unique laboratory, one that no amount of pork could create. It is the Long Island environment. We have the greatest diversity of natural coastal environments of any comparable area in the United States, probably in the world. Maryland has half of Chesapeake Bay, and a short stretch of ocean front at Ocean City, Maryland. Virginia has the other half of Chesapeake Bay and a little more ocean front. We have Long Island Sound, Great South Bay, the Peconic-Flanders Bay system, New York Harbor, the Hudson-Raritan estuary, Shinnecock Bay, Moriches Bay, Jamaica Bay, the harbors and bluffs of the forgotten North Shore, barrier islands, wetlands, long uninterrupted stretches of beautiful beaches. We have three estuaries in the National Estuary Program. No other State has more than two, nor will it.

We also are rich in environment problems; in environmental challenges. All the world's coastal and environmental problems are expressed in this region with clarity and urgency. The steep gradient in environmental stresses reflects the distribution of population and society's uses and abuses of these environments.

These two factors -- diversity of natural coastal environments and the diversity and intensity of uses and associated stresses -- make Long Island one of the

world's truly outstanding laboratories for developing, testing and demonstrating strategies to allow humans to live in harmony with their environment.

If Long Island -- all of it -- were a state, it would be the 10th most populous state in the Nation. If it were a nation, it would rank in population among the top 50% of all nations in the world today. If political LI -- Nassau & Suffolk counties -- were a state, it would rank 29th in population. Its 2.6 million people would give it a population about four times that of Delaware or Alaska. In fact, we have more dogs than Delaware has people. Oh by the way, Arkansas with less than 2.4 million ranks 33rd among the 50 states in population.

How do these wonderful coastal environments and their living resources contribute to the Island's economy and to our quality of life? Enormously! They make Long Island distinctive. Long Island's tourism industry is worth more than $2.3 billion per year. More than 70 percent of the Island's tourism is related directly or indirectly to coastal environments. Each year Long Island gets about 24 million visitors. In 1991, Long Island's travel/tourism-related industries employed nearly 92,000 people -- more than the electronics, instruments and aircraft industries combined. In addition to all the golf courses, tennis courts, theaters, hotels, restaurants, Long Island has 429 yacht clubs and marinas.

What an opportunity! What an unexploited opportunity!

We have another advantage. We are a high tech Island; home of the Brookhaven National Laboratory, the Cold Spring Harbor Laboratory, the University at Stony Brook, Long Island University, Polytechnic University, ... the Long Island Research Institute and lots of high technology companies. To entrepreneurs, problems become opportunities. Long Island has lots of environmental problems -- lots of environmental opportunities -- and lots of entrepreneurs.

We often use the environment, and its sensitivity, as a reason why we can't accommodate business and industry on Long Island. There are many kinds of

industries Long Island can not and should not have here. But, there are others that we not only can accommodate, but that could contribute to our economy and to our environment; industries that our environment is ideally suited for and for which they are ideally suited. I am thinking particularly of environmental industries; industries that are focussed on activities to conserve and, when necessary, to rehabilitate the environment. Economic development and environmental protection -- sustainable economic development and environmental protection are NOT incompatible. Sustainable development can be defined as development that allows the present generation to meet its needs without compromising the ability of future generations to meet theirs. You may recall that Pogo once observed that "Some opportunities are so large they are insurmountable." Long Island's opportunities are large, but they are not insurmountable.

Long Island should take the lead in developing the knowledge and technologies needed for development of innovative and effective solutions to the region's, the nation's and the world's major environmental problems. Long Island should also take the lead in applying those advances here on the Island. We should take the lead in attracting industries which are pioneers in the development of technologies to monitor the environment, to protect it, and when necessary, to rehabilitate the environment -- all aspects of it.

We should take the lead in transforming advances in science and technology into strategies to demonstrate how humans -- lots of them -- can live in greater harmony with their environment. We should lead by example!

Stan Lundine
Lieutenant Governor

I want to thank you, Jim (Larocca) and Jerry (Schubel) for organizing this informative conference.

And special thanks to the Long Island Association and to the Marine Sciences Research Center for providing this forum.

You all deserve tremendous credit for taking part in this venture. I know most of you were here late last night. Believe me, your hard work does not go unnoticed or unappreciated. I salute you for recognizing that entire industries -- tourism and fishing, for example -- are at stake. We share a common awareness that our quality of life depends on the quality of Long Island's coast.

Three years ago Governor Cuomo asked me to chair his Task Force on Coastal Resources. Our assignment was to develop a long-term strategy for protecting and restoring the natural and cultural resources of our coast. We consulted with business leaders, government officials, fishermen, boat and marina owners, and beach lovers. We came up with a set of solid recommendations that we presented in November of 1991.

In the last year and a half we've made significant strides in implementing those recommendations. In some cases action was urgently needed. However, much remains to be done.

Environmental Assistance Fund

The "Environmental Assistance Fund" legislation now making its way through the State Legislature sprang from one of our recommendations.

The Fund would establish a long-term, dedicated and dependable source of revenue for improving the environment and promoting economic development projects. Eligible projects and programs would include recycling, infrastructure rehabilitation, sewage treatment facilities, parks and trails,

harbor management, historic preservation and local waterfront revitalization programs.

This legislation deserves and needs your active support. Please urge your State Legislators to get behind the "Environmental Assistance Fund." We need that bill, and we need it now.

Regional Coastal Management Programs

Our Task Force also recommended refining the State's Coastal Management Program to reflect the specific circumstances and needs of each region of the State. Last October, I announced that the State's first regional coastal management program will set development and resource protection standards for Long Island Sound. I expect a preliminary draft of the Long Island Sound plan to be released for public comment by September.

The Coastal Task Force encouraged the kind of debate that gets results. I'm glad to see the debate continuing. Forums like this, and leaders like you, help refine our vision for the future.

And we're much better able to respond to new challenges. Last December, a Nor'easter hit Long Island hard. Suddenly we had a lot of questions: "Are we doing things wrong? How can we improve our approach? What do we want from Long Island's coast?"

Our Coastal team made sure those questions were heard. The Governor responded by establishing a "Task Force on Coastal Erosion," chaired by Gail Shaffer and Tom Jorling. You've heard from Secretary Shaffer and Commissioner Jorling during this conference. I won't add to what they've already said about the work or their task force.

However, I'd like to highlight two recommendations in the Task Force's interim report on which the Governor was quick to take action. The Governor has directed the Department of Environmental Conservation to contract immediately with the Marine Sciences Research Center at SUNY Stony Brook to conduct a detailed survey of the coastal barrier. This study will allow us to

identify those areas that may still be vulnerable to breaching from high tides or waves.

And I should note that due to strenuous lobbying on the part of Governor Cuomo and his staff, the Army Corps of Engineers is now filling the breach at Westhampton.

In addition, the Governor has directed DEC to expedite the review of permit application from villages or groups of shore front land owners for emergency construction of dunes in front of residential areas.

Budget problems and a killer recession are forcing government agencies to do more with less. It can take longer than we'd like to get things done. But the Governor and I recognize that government must act quickly. Our coast is threatened from many directions -- pollution, rapid growth, and natural forces. We don't need the additional threats of wasted time and of conflict and confrontation. It's important that we work with each other, not against each other.

With fewer resources at our disposal, solutions aren't as available or as easily implemented as they once were. Developing and a vision for protecting our coastal resources will take a collective effort... by you, by our State, and by your 2.6 million neighbors on Long Island.

The people who run Long Island's villages, cities and towns, as well as those at the county, state and federal levels, are your partners in this effort. No one can do it alone. But together, we can do it all.

Civic organizations, schools, chambers of commerce, government, advocates, businesses and workers... we all have a role to play.

In the words of the Governor's Task Force, it's "Your Coast, Your Choice, Your Future."

Thank you.

APPENDIX A

COASTAL EROSION ON LONG ISLAND: A BRIEF OVERVIEW OF THE SHORELINE TRENDS AND THE FORCES SHAPING OUR COAST

by

Jay Tanski
New York Sea Grant Extension Program

Long Island's coast is a dynamic environment, constantly changing in response to natural processes and human activities. Proper management of this important resource requires a good understanding of the factors controlling erosion and the impacts they can have on different coastal areas.

This factsheet provides a brief description of what we know about erosion on Long Island, based on the best available technical information. The areas considered are Long Island's South Shore ocean coast, its North Shore, and its Peconic and South Shore bay systems. While by no means an extensive treatment of the subject, the information presented here is intended to familiarize the reader with the major trends and technical issues associated with erosion and erosion management. The following topics are discussed:

1. **FACTORS CONTROLLING SHORELINE EROSION**
2. **LONG-TERM SHORELINE CHANGES**
3. **SHORT-TERM SHORELINE CHANGES AND EFFECTS OF STORMS**
4. **SAND BUDGETS AND TRANSPORT PATTERNS**
5. **CHANGES IN SEA LEVEL**
6. **INLETS**
7. **EFFECTS OF COASTAL STRUCTURES**
8. **DUNE DYNAMICS**

For easy reference, the major points of each topic appear as bullets followed by a brief discussion.

1. FACTORS CONTROLLING SHORELINE EROSION

- **Sediment or sand supply.**
- **Waves and currents (especially during storms).**
- **Sea level changes.**
- **Human activities.**

Like all coasts, the behavior of Long Island's shore is dependent on four major factors: 1) the supply of sediment or sand available for beach building; 2) the level of wave and current energy impinging on the coast which is largely related to storm intensity and frequency; 3) short and long-term changes in sea level; and 4) human activities in the coastal zone that alter or disrupt natural processes or sand transport.

These factors interact in complex ways and over different time scales making erosion a difficult process to fully understand and manage. The relative importance of each factor in determining shoreline behavior varies depending on the particular stretch of coast being considered.

2. LONG-TERM SHORELINE CHANGES

- **Shoreline moving slowly landward over geologic time (1,000's of years).**
- **Some portions of barrier haven't migrated in 500-1,000 years.**
- **Movement variable over 100's of years; on south shore mostly slow recession (<1-2 feet/year) with some stable and accreting areas.**
- **Highest rates of erosion/accretion (up to ± 20 feet/year) often found near inlets and other structures.**
- **North shore of Fire Island eroding at <1 foot/year but little known about Peconics or North Shore.**

South Shore. Over geologic time (thousands of years) all of Long Island's shorelines have moved landward in response to rising sea level. Barrier islands on the South Shore retreated or migrated northward as the ocean rose.

However, this barrier island migration is not a continuous process. Geological evidence indicates that some portions of the South Shore barrier islands have not migrated for the last 500 to 1,000 years.

Compared to many other coastal areas, the South Shore of Long Island is relatively stable. Measurements of shoreline change over the last 100 years or so show that the average erosion rates are usually less than 1 to 2 feet per year, for the most part and that some areas are actually stable or accreting. In many cases the long-term changes occurring along the coast are too small to accurately measure with available data and techniques. The highest shoreline erosion rates, which may exceed 20 feet per year, are often found near stabilized inlets and other man-made structures, such as groins, and are the result of interruptions in the natural sand transport processes along the coast.

North Shore and Bays. Earlier studies suggest the North Shore has been receding at an average rate of 1 to 2 feet per year over the past century. Measurements show shoreline changes ranging from 5 feet of erosion per year to 2 feet of accretion per year, depending on the site. Since these studies were done using relatively rudimentary measurement techniques and limited data, so the results are subject to wide margins of error.

Changes in the bay shorelines of the barrier islands are usually small and irregular. For the most part, the northern shore of Fire Island has exhibited an erosional trend of less than a foot per year since the late 1800's. There are no reliable estimates of shoreline change rates available for the South Shore mainland or Peconic Bay shorelines.

3. SHORT-TERM SHORELINE CHANGES AND THE EFFECTS OF STORMS

- **Position of shoreline may move 270 feet during a typical year.**
- **Large amounts of sand removed very quickly during storms.**
- **On south shore, beaches usually recover quickly (within a month) after typical storm.**
- **No reliable measurements of impact of severe storms; natural recovery may take years.**

•Few, if any, measurements of short-term changes in North and South Shore mainland or Peconic Bay.

South Shore. In the course of a typical year, the position of shoreline along the South Shore may change by as much as 270 feet as the beach grows and erodes in response to local processes. Because these short-term changes can be so much larger than the long-term shoreline changes, it is often difficult, if not impossible, to accurately measure long-term trends unless the shoreline is experiencing very high rates of accretion or erosion.

Short-term changes in the beach width and the amount of sand on the beach are largely due to storms. Storms can remove large volumes of sand from the beach above the water line very quickly. However, limited survey data indicate beaches usually rebuild fairly quickly, generally within a month after most storms.

Unfortunately, no surveys have been taken during periods of intense storm activity. We don't really know how quickly beaches respond to and recover from severe storms like those that occurred in December 1992 and March 1993. Presently, there are no actual measurements of how much sand was lost due to these storms. Although much of the sand removed from the upper beach may still be in the underwater portion of the nearshore beach system and could eventually return by natural processes, there are no quantitative data to confirm or disprove this theory. Anecdotal evidence from East Hampton suggests it took over seven years for the shoreline to recover from the Ash Wednesday storm of 1962.

North Shore and Bays. There are vitually no measurements of short-term beach changes for the North Shore or the Peconic and South Shore bay systems. Given the less energetic wave climate in these areas one would expect the changes to be similar to, but of a lesser magnitude than, the changes found along the ocean coast. Beach recovery may also be slower (and not as complete) because of the reduced wave energy generally available for moving material in this area.

4. SAND BUDGETS AND TRANSPORT PATTERNS

- **Net transport of sand from east to west along South Shore at rates ranging from 100,000 to 600,000 cubic yards/year.**
- **Origin of this sand not well known but probably includes: bluff erosion, offshore sources, and erosion of the shoreline itself.**
- **Longshore transport of sand vital to maintaining beaches.**
- **Direction and rate of longshore transport of sand highly variable along other shorelines, usually less than 100,000 cubic yards/year.**

South Shore. Waves hitting the shore create currents which carry sand parallel to the coastline in the surf zone. Although this sand can move in any direction on a given day, depending on the direction of the waves, normal conditions on the South Shore generally result in a net transport of sand from east to west in most years. This "longshore transport" has been described as a river of sand picking up and depositing material on the beach as it moves along the shoreline. The net transport rate increases from 100,000 to 300,000 cubic yards per year at the east end of the Long Island to 600,000 cubic yards at Fire Island and then decreases to about 400,000 cubic yards near New York City.

Although this material was originally thought to come entirely from erosion of the bluffs at Montauk, more recent studies indicate bluff erosion alone can't supply all of the sand found moving along the shore. Other possible sources of sand to the longshore system include offshore deposits of sand and erosion of the mainland and barrier beaches themselves. Reliable estimates of the relative contribution of each source are not available at this time.

The flow of sand is critical to maintaining the shoreline. In most cases, our most severe erosion problems are the result of disruptions of the longshore transport of sand due to either natural processes or human activities.

North Shore and Bays. On the North Shore longshore transport rates are much lower, typically less than 100,000 cubic yards per year. The direction of transport is also variable due to the irregular coastline. Generally, material is transported away from headlands. In some cases, this results in the coast being compartmentalized. Unlike the South Shore, where long stretches of

coast are linked by the strong longshore transport processes, on the North Shore activities in one compartment may have minimal impact on an adjacent area because of the complicated sand tranport patterns. Conversely, some of these compartments may behave like closed systems so certain actions could have substantial impacts on the shoreline within the compartment.

Most of the material in the North Shore coastal system comes from erosion of the bluffs. Erosion appears to supply considerably more sediment than is found in the longshore transport system, indicating that most of the material eroded from the bluffs is transported offshore and lost to the deeper waters of Long Island Sound.

Like the North Shore, sand transport patterns in the Peconic and South Shore bays are highly variable in terms of magnitude and direction due to the irregularity of the coastline. Although no actual estimates have been made, the amount of sand in the longshore system of these bays is probably considerably less than that found along the North Shore due to the lower wave energy.

5. CHANGES IN SEA LEVEL

- **Present rate of sea level rise is 0.01/year (1 foot/century).**
- **May increase to 0.02-0.03 feet/year due to global warming (3-8 inches by 2020).**
- **Sea level rise accounts for relatively small percentage of observed erosion along ocean and North Shore compared to other factors.**
- **Increased rate of rise may pose more problems along by shorelines due to inundation of low lying areas and potential effects on wetlands.**
- **Storms with 30 year return periods may cause water levels to rise 4-8 feet in a few hours.**

South Shore. Over the past one hundred years, sea level in our area has been rising at the rate of about 0.01 feet per year. Available data indicate that the percentage of the total erosion occurring along the South Shore attributable solely to long-term sea level rise is of secondary importance compared to other factors acting on shorter time scales.

Global warming may increase the rate of sea level rise to 0.02 to 0.03 feet per year over the next 20 to 30 years according to the latest estimates. This could result in water elevations in the year 2020 that are 3 to 8 inches higher than present. However, over the next 30 years, predicted long-term increases in sea level if they occur, would probably have a relatively small impact on the actual observed rates of shoreline change compared to the magnitude of the erosion problems associated with other factors such as storms and human-induced disruptions in the coastal sand transport system. From a planning perspective, the submergence of flat, low-lying areas around the bays due to increases in sea level may be a more critical problem than ocean-front erosion.

Short-term changes in sea level associated with storms are more dramatic than the projected long-term trends. Storms with return periods of 30 years can raise water levels 4 to 6 feet above normal elevations in just a few hours causing extensive erosion and flooding in coastal areas.

North Shore and Bays. While projected increases in sea level may make sections of the coast more vulnerable to erosion, the impact will be small compared to other causes of erosion over the next 30 years, especially in those areas experiencing severe erosion problems now. However, flat, low lying areas within the bays may be subject to submergence and increased flooding over time as sea level rises. This will not be as much of a problem along the portions of the coast with bluffs due to the relatively steep slopes in those areas.

Coastal wetlands are also affected by long-term sea level rise. If sea level rises faster than sediments are deposited, marshes can be inundated and lost. If deposition and sea level rise are in balance, marshes may be able to migrate landward if there is room for them to retreat.

On shorter time scales, storms with return periods of 30 years could cause water levels to rise 8 feet above normal in some areas of Long Island Sound and 4 to 6 feet in the Peconic and South Shore bays.

6. INLETS

- •Six stabilized inlets on South Shore exert a dominant influence on shoreline change because they disrupt natural sand transport processes.
- •Inlets can trap millions of yards of sand causing extremely high erosion rates in adjacent areas.
- •Impact of inlets appears to increase from east to west on the South Shore.
- •Artificial bypassing of sand at inlets may be needed to mitigate impacts.
- •New inlets may cause dramatic changes in the South Shore bay and coastal mainland environments.
- •Stabilized inlets on North Shore and bay shorelines cause increased erosion/accretion but effects are more localized.

South Shore. There are 7 major inlets along the South Shore, including the new inlet at Westhampton formed by the storms of the 1992-1993 winter. Six of these inlets are stabilized by jetties and used for navigation purposes. These features exert a dominant influence on the behavior of the shoreline by interrupting the natural longshore transport of sand along the coast. By trapping or diverting millions of cubic yards of material from the beach system, these inlets cause some of the most severe erosion problems found along the shoreline. Based on long-term shoreline changes, the impact of each of the individual inlets becomes more substantial from east to west along the South Shore.

In Florida, it has been estimated that 80 to 85 per cent of the erosion along the coast is due to inlets. A similar situation probably exists on Long Island. The impacts of inlets can be mitigated by initiating "bypassing" programs where material is artificially moved from one side of the inlet to the other to restore the natural flow of sand.

New inlets formed during storm events are a major concern because they may cause significant changes in the bay and mainland areas, as well as along the ocean shore. Potential impacts associated with new inlets or breaches include:

- Increased tidal ranges and storm water level elevations in the bays which can cause increased flooding and erosion on the mainland.
- Changes in the physical and environmental characteristics of the back bay, such as salinity, temperature, circulation and shoaling patterns which may affect biological resources such as finfish and shellfish.
- Increased ocean shoreline erosion due to trapping of sand from the longshore system.
- Increased shoaling at existing stabilized inlets.

Presently, we do not have the information necessary to accurately quantify the magnitude of these potential changes. While some may be relatively small, or actually have beneficial impacts, others may have major impacts on traditional uses of the South Shore bays and mainland coast.

North Shore and Bays. Stabilized inlets often cause increased erosion and accretion on adjacent shores, but the effects are generally more localized. The formation of new inlets is less of a concern due to the lack of true barrier-island systems with extensive lagoon environments.

7. EFFECTS OF COASTAL STRUCTURES

•Two types of erosion control structures commonly used: "shore-perpendicular" (groins and jetties) and "shore-parallel" (bulkheads, revetments and seawalls).

•69 major groins and jetties found on South Shore.

•Groins can be effective at stabilizing/maintaining beach, but may cause problems in adjacent areas of disrupting flow of sand if not used properly.

•Shore parallel structures may be benign or may adversely affect the beach depending on physical conditions and long-term shoreline trends at the particular site.

South Shore. Two types of erosion control structures are commonly used on Long Island. The first type consists of the long, thin groins and jetties that extend out in the water and function by trapping or holding sand to form a

protective beach. These are often referred to as "shore-perpendicular" structures.

Because sand generally flows from east to west along the South Shore, material often is trapped on the east side of these structures. Since shore-perpendicular devices interfere with the longshore transport of sand, they can cause severe erosion problems on adjacent shores, (usually, but not always, to the west on the South Shore) if they are built or sited incorrectly. The severely eroded area west of the 15 groins at Westhampton that breached during the past winter's storms is an example of the impact groins can have when not properly constructed.

In certain situations, however, these structures may also help maintain a recreational beach and provide upland protection if used properly. There are 69 major groins and jetties along the South Shore. The 48 groins at Long Beach have helped slow down erosion and preserved the beach in front of this heavily-developed area. At Westhampton, the beach created by the groin field has protected the area immediately behind the structures from even the worst storms.

This other type of erosion control device found on Long Island is the shore parallel structure. This includes bulkheads, seawalls and revetments that are built parallel to the shore usually behind the beach, and that function by armoring the upland against wave attack.

These structures probably have minimal impact on the behavior of the shoreline over very long time scales (geologic time) because of their limited area of coverage and expected maximum lifetime. However, they may cause substantial short-term, localized impacts on the beach if used in certain areas. The potential for adverse impacts depends primarily on the conditions at the site and long-term shoreline trends in the area, as well as on the design and specific location of the structure. Studies have shown that at some sites these structures can provide protection for the upland during storms without harming the beach. In other areas, however, especially those experiencing chronic recession, hardening the shoreline may adversely affect the beach and adjacent areas unless mitigative measures are also undertaken.

North Shore and Bays. Although, generally smaller, the types of structures used in these areas are the same as those found on the South Shore. While the potential impacts associated with these structures are also similar, the magnitude and extent of the impacts are more limited due to the smaller size of the structures and nature of the shoreline processes. The available data indicate that due to variations in bluff composition, the rate at which sand is supplied to the shore, and sand transport patterns along the shoreline, some bluff areas could be stabilized without adversely affecting the beach. If, however, the bluffed coastlines is completely stabilized and no mitigative action is taken, the beach would lose its primary source of sand and gravel.

8. DUNE DYNAMICS

- **Large, continuous dunes can provide protection from storms.**
- **Many dunes destroyed during past winters' storms.**
- **Natural rebuilding relatively slow; may take years or even decades to rebuild if relying solely on natural processes.**

South Shore. Large continuous dunes can provide protection against flooding and wave attack for upland areas. Although dunes along the South Shore, may be as high as 40 feet, the dunes in some areas have been completely leveled by the recent storms. The extent of the damages has not been measured systematically, but preliminary surveys show that the maximum elevation of the barrier island in some locations is less than 5 to 6 feet above mean sea level. Natural dune rebuilding processes operate relatively slowly. If left solely to nature, it may take years or decades for South Shore dunes to recover, and, in some cases, they may never reach their former size unless artificial rebuilding measures are also undertaken.

North Shore and Bays. In general, the dunes in these areas are not as extensive or large as those along the ocean coast due to the narrower beaches and smaller supply of suitable sand. These smaller dunes may provide a degree of protection along low lying coastal areas, but their reduced size can limit their effectiveness in preventing erosion damage during more severe storms. Again, natural rebuilding of damaged areas may be relatively slow.

APPENDIX B

LONG ISLAND COASTAL CONFERENCE

ATTENDEES

Diane Abell	Fire Island National Seashore
Gino Aiello	Hempstead Conser/Waterways
James Allen	National Park Service
Frank Amoroso	Nixon, Hargrave, Devans and Doyle
Susan Antenen	The Nature Conservancy
George Apostolakos	Ethan C. Eldon Associates
Robert Appell	Town of Babylon I.D.A.
Harry Bahrenburg	Con Edison
Ruth Balkin	Hempstead Conser/Waterways
Maurice Barbash	Longwood Company
Susan Barile	Allstate Insurance
T.J. Barratta	Town of Southampton
John Bartow	Dept. of State - Coastal Mgmt.
Trudy Bell	Marine Sciences Research Center
David Berg	Cultured Aquatics
David Berkovits	Port Authority of NY and NJ
Stephen Beyer	Bancker Construction Corp.
Charlotte Biblow	Rivkin, Radler and Kremer
Joseph Birgeles	Port Authority of NY and NJ
Henry Bokuniewicz	Marine Sciences Research Center
Charles Bowman	Land Use Company
Diane Cameron	Consolation Nursing Home

Christine Campbell	Marine Sciences Research Center
Susan Lehman Carmichael	NYS Parks, Rec. & Hist. Preservation
Hon. Angie Carpenter	Suffolk County Legislature
Raoul Castaneda	Town of Babylon I.D.A.
Robert Cerrato	Marine Sciences Research Center
Vincent Cioci	Neighborhood Network
Donald Clavin	Senator Levy's Office
Nicholas Coch	Queens College
Boyd Compton	Concord Environmental, Inc.
Raymond Cowen	NYS Dept. of Environmental Cons.
Robert Crafa	Friends of the Bay
Brian Culhane	NYS L/C on Water Res. Needs
Thomas Cullen	King Kullen Grocery
Bert Cunningham	Howard Blankman
James Cunningham	Cornell Coop. Extension - N/C
Mark Cuthbertson	Payne, Wood and Littlejohn
Kenneth Cynar	N/C Executive Office
Louis D'Ambrosio	Glen Cove Mayor's Office
Rameshwar Das	East Hampton Waterfront Adv. Com.
Peter Dermody	Fanning, Phillips and Molnar
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Gregory Greene	Cashin Associates
Joseph Gregori	Nationwide Cellular Service
Henry Greve	Greve & Schmidt
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Hon. Thomas Gulotta	Nassau County Executive
Eileen Gurley	Okeanos Ocean Res. Foundation
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Patti Hall	Long Island Association

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Hon. Gilbert Hanse	Town of Babylon
Bev Harris	Long Island Association
Sister Audrey Harsen	Consolation Nursing Home
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Steve Jannace	Berkman, Henoch, Peterson
James Jerome	Jerome Associates
Comm. Thomas Jorling	NYS Dept. of Environmental Cons.
Richard Jurczak	Buchanan Marine
Timothy Kana	Coastal Science & Engineering
Lawrence Kelly	McGraw-Hill, Inc.
David Kend	Limited Ads Limited
Robert Kent	N.Y. Sea Grant Extension Prog.
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Darrel Kost	NYS Dept. of Transportation
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Irving Like	Reilly/Like/Tenety/Ambrosino
Susan Long	Costello Marine Contracting
Wanda Lopez	New York State Assembly

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Jim Morge	Power Up Suffolk
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Nancy Solomon	Long Island Traditions
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George Stafford	Department of State
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Robert Steneck	Town of Huntington
Gerard Stoddard	L.I. Coastal Alliance
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Lawrence Sullivan	National Flood (NY-NJ)
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