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IDENTIFICATION AND ASSESSMENT OF TECHNICAL INFORMATION REQUIREMENTS FOR DEVELOPING COASTAL EROSION MANAGEMENT STRATEGIES

Proceedings of a Workshop
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INTRODUCTION

Background

In response to erosion and flooding problems encountered along the south shore of Long Island, the New York State Department of State, Division of Coastal Resources and Waterfront Revitalization and the Long Island Regional Planning Board are in the process of developing a shoreline development management plan that is cognizant of coastal erosion conditions for this area. The preparation of the plan is to include an examination and analysis of the environmental, economic, land use and regulatory factors affecting development and erosion control decisions along the coast for the purpose of formulating a comprehensive, coordinated response to chronic flooding and erosion conditions on the south shore.

In conjunction with this effort, a series of three workshops is being held to bring together experts in coastal processes and engineering to examine erosion problems encountered along Long Island's south shore and possible means available for dealing with these problems from a technical perspective. More specifically, the individual workshops have been designed to focus on 1) identifying the generic physical data and information needed to develop a sound coastal erosion management program, 2) identifying the technical data presently available for the south shore, and 3) if possible, using these data to discriminate among the various available erosion control strategies for regional reaches of the coast in terms of potential effectiveness and impacts.

The intent of these workshops is to provide technical information that will assist government officials and other interested parties in identifying, assessing, and selecting appropriate erosion management strategies for a particular area. This report summarizes the findings of the first workshop in this series.

Workshop Goals

The specific goals of this meeting were to:

1) Define the technical information needed to identify, develop and evaluate sound erosion management strategies.

2) Identify the specific data required to provide the necessary information.

3) Delineate why that information is needed and, to the extent possible, how it would be used.

Procedure

To achieve these goals, four international experts in the field of coastal processes and engineering were invited to participate in the first workshop (See Appendix A). Prior to the meeting, the participants were provided with a preliminary list of potential technical information needs as well as a set of generic objectives for a hypothetical erosion management program. Using these materials as a starting point, the participants were asked to develop a list of information they would require to make a technical recommendation concerning the type of erosion control measures best suited for an ocean coastal region. (Background materials on the procedure used are provided in Appendix B.)

At the meeting, the information requirements identified by the participants were presented and discussed by the entire group in light of the workshop goals listed above. To help illustrate the practical applications of this information, the group was also asked to consider several hypothetical situations typical of erosion management problems found along the coast and specify the information they would need to develop an informed response to the particular situation and, to the extent possible, how this information would be used.

The results of the group's efforts are reported in the following sections.

OBJECTIVES OF AN EROSION MANAGEMENT PROGRAM

The purpose of this workshop was to identify the information needed to make a preliminary technical evaluation of the most appropriate erosion management strategy or erosion control alternative for an area. This process depends to a large extent on the anticipated objectives of an erosion management program. These objectives, usually developed as a part of the overall management plan for an area, are often decided on the basis of socio-economic factors which were well beyond the scope of this meeting. However, because an understanding of the objectives of an erosion management program is essential to the technical planning considerations that were the primary focus of this workshop, the group agreed to assume that any program would have the following objectives when it was necessary to do so in order to continue discussions. (Note: the following statement describing general program objectives was developed primarily by Dr. Dean, whereas the section on specific program objectives was derived, in part, from information provided by the Long Island Regional Planning Board.)

General Program Objectives: A management program should seek to maximize the broad public interests and benefits along the south shore of Long Island, for present and future generations. While respecting the rights of the upland property owners, the program should, where practicable, seek to restore natural processes, maximize public access, minimize storm damage and reduce or eliminate inequities which exist or could result from various activities under the program.

In recognition of the dynamics of coastal processes and the evolving use patterns along the shoreline, the program should be updated every 10 years with the modified elements of the program subject to public hearing review and comment prior to adoption.

Ultimately, the program should be used to consider and develop recommendations on a case-by-case basis for all permit activities which have the potential of modifying the sand flows and littoral processes along the south shore including, but not limited to: coastal protection structures, beach nourishment, bypassing at inlets, and closing new inlets. Where appropriate, the program should be proactive in developing plans.

Specific Program Objectives: More definitive program objectives may include:

1. Maintain and enhance as necessary the beach/dune system of recreational beaches. The relevant concern is primarily the width of the beach but would also include the quality of sand, the state of the dunes, and amenities such as access and facilities.

2. Hold the shoreline position and maintain the shore's general configuration in urban areas. "Urban area" will be defined by the Planning Board based on the permanent population density, the type of housing, the degree of commercial use, the infrastructure (streets, sewers, etc.) and perhaps other similar criteria.

3. Maintain and stabilize existing inlets and provide for adequate by-passing of sand across the inlets to downdrift beaches. (What constitutes "adequate by-passing" is discussed on page 10 of this report.)

4. Prevent new inlets from forming. This objective is designed both to protect the investment associated with existing stabilized inlets and to avoid potentially adverse changes in the back-bay environments such as salinity changes that might affect shell fishing or enhanced bay flooding.

5. Maintain and enhance existing dune systems.

6. Minimize damage due to coastal flooding.

7. Prevent adverse downdrift effects due to existing or proposed erosion control measures and/or other coastal activities or practices.

Program Implementation: To implement an erosion management program on a technically sound and legally defensible basis, it will be necessary to collect, maintain and continue the acquisition of certain data and information on the natural coastal system which relate to appropriate program decisions. These data needs are detailed below. In general, they define shoreline changes, land use, the physical characteristics of the coast and the phenomena responsible for changes in the natural systems, primarily waves.

Basically, this technical and physical information is needed for four principal reasons:

1. To define the problem, including estimates of erosional risk, storm vulnerability and the expected degree of natural restoration after an erosion event for different areas.

2. To provide a sound technical basis for legally defending management and regulatory decisions.

3. To more accurately calculate cost/benefit ratios and better assess risks associated with a proposed project. The benefits will be largely defined by the management policy, but estimating the cost of a proposed project requires a relatively detailed design and this can only be done with adequate site-specific data.

4. To understand the causes and effects of the observed shoreline behavior. This is necessary in order to estimate the effectiveness and potential impacts of any proposed solution (i.e., the probability of success). Our understanding is embodied in a model of shoreline behavior. This could be a conceptual model or a mathematical model, but some degree of quantification is essential. Site-specific information is needed to calibrate and to use the models as a tool for better assessing management decisions.

TECHNICAL INFORMATION NEEDS AND REQUIREMENTS

The technical and physical data and information required to develop and evaluate erosion management strategies can be grouped into three broad, interrelated categories: characterization of coastal features and changes, physical forcings affecting coastal changes (i.e. waves, water levels, etc.) and land use patterns and trends. The specific information related to each of these categories is delineated below along with an assessment of the data required to obtain the information and, where possible, suggested methods or recommendations for acquiring this data. (Group discussions on the informational needs were based largely on a table of data requirements provided by Dr. Kraus (Appendix C).)

Characterization of Coastal Features and Changes

An assessment and quantification of the physical characteristics and the changes occurring in a coastal area is essential in the development and evaluation of erosion control strategies. These changes include variations in the position and configuration of the shoreline and in the volumetric sediment budget in an area. The assessment of these changes actually involves two levels of effort. The most basic level of information needed to begin developing an effective approach to erosion management is usually derived from direct measurements of the extent and magnitude of the effects of erosion on the coast. This fundamental level of information is outlined in this section. To strengthen and improve decision making capabilities, the results of these efforts (along with some additional data) can then be used to interpret and develop a better understanding the complex interactions of the coastal processes and conditions controlling sediment transport and causing erosion. The topics requiring this higher level of effort are described in a separate section under the heading "Shoreline Processes" (Appendix D).

The basic information required for characterizing coastal features and changes include:

1. long-term and short-term trends in shoreline migrations
2. magnitude of shoreline changes caused by storms
3. volumetric changes occurring along the shore
4. volume of dune erosion and rate of dune rebuilding
5. effects of existing structures.

The data needed to obtain the above information include:

1. sequential shoreline positions through time
2. sequential beach/dune/offshore profiles (to the closure depth)
3. shoreline orientation
4. description of the regional geologic setting including sediment grain size distributions
5. historical dune volume changes
6. volume of ebb and flood deltas at inlets
7. overwash frequency and volume.
8. inventory of shoreline protective structures including;
    a. location, size and orientation
    b. porosity, permeability, refection and transmission characteristics
    c. location, volume and schedule of beach fills, dredging and sand mining operations
    d. aerial photographs, plans and surveys associated with these projects.

The information on coastal changes is needed to:

1. Define the erosion problem with respect to time and location and to make a preliminary assessment of the

level and type of effort required to mitigate erosion trends. For example, in a particular area, a documented high chronic rate of shoreline recession over the long term would indicate that utilization of beach nourishment may not be cost effective and that retreat or a structural response would be required to mitigate problems associated with erosion. Conversely, a low long-term recession rate could indicate the local sediment budget is only slightly out of balance and that beach renourishment may be an effective measure of erosion control.

2. Forecast the range of expected shoreline changes at a site in order to:

   a. establish appropriate, legally defensible setback requirements. (It was pointed out that the profile and historical shoreline change data collected by the state of Florida have been used successfully in defending the state against legal challenges regarding erosion setbacks and regulations.)
   b. properly select, design and locate structures
   c. calculate beach renourishment intervals.

3. Identify the sources of sand feeding the longshore transport system and potential sources of beach fill material.

4. Identify and improve our basic understanding of the cause and effect relationships associated with erosional problems.

5. Model the impacts of storm events.

A system for collecting the data and information required should include the following characteristics.

1. Historical data (maps, aerial photographs and National Ocean Survey (NOS) T-sheets) should be utilized to document and quantify trends in shoreline position through time.

2. A system of monuments to serve as the base line for beach profile surveys should be established at a maximum spacing of one mile along the coast (closer spacing may be required in dynamic areas such as inlets or areas of particular interest). Arrangements should be made to ensure all surveys are done in as short of a time span as possible and, preferably, within a two-week period or less (i.e., as near synoptically as possible). Surveys should be done twice a year (near the time of the maximum summer beach and six months later or near the time of minimum beach widths) and after extreme storm

events. Profile measurements should extend from landward of the dune (or bluff crest) seaward to a point offshore equal to the closure depth (essentially, the depth at which profile changes are negligible), which was estimated to be at a depth of approximately 50 feet MLW on Long Island. Presently, Florida maintains such a system with over 3,400 monuments spaced at 1000 foot intervals along its entire shoreline at a cost of approximately $250,000. Experience in Florida, California, South Carolina and other areas where such coastal survey work is presently being done suggests the costs for performing the surveys may range between $1000 to $2000 per line per survey. The costs associated with developing and maintaining a coastal survey system are minimal compared to the importance and usefulness of the data obtained through these efforts.

3. Aerial photographs should be taken on a seasonal basis (i.e., winter and summer). The overflights should be scheduled for the mornings (before the sea breeze starts) at times between low and mid tide and should, if possible, be coordinated with the surveys described above to provide ground truth measurements. In Florida, the photos are digitized to facilitate their use at a cost of approximately $200 per mile. In addition, these photos are used by the Florida Department of Transportation to develop 2-foot contour maps of the dunes which can be used to estimate storm vulnerability and coastal sediment sources.

4. A coastal database should be implemented to compile, maintain, and provide access to the collected physical data as well as information on coastal protective structures, dredging and beach nourishment activities, and other factors described in the following sections. It must be recognized that for this effort to be useful a considerable commitment will be required to maintain the database. However, the potential benefits of such a program should exceed the required effort. In Florida, a database or archive of all coastal data has been established, and it is used extensively by government agencies, planners, consultants, developers and engineers, as well as tax assessors and insurance companies. It is funded as a line item in the state budget.

Physical Forcings Affecting Coastal Change

The information on coastal features and changes presented in the previous section defines and quantifies the effect of erosion along the coast. However, the causes of these changes are the waves, variations in water levels, and storms that impact the coast. Since these are the main physical processes driving sediment transport which, in turn, determines the coastal response, information on these factors is also necessary to properly evaluate potential erosion management strategies.

The information needed on physical forcings include:

1. statistics on wave height, period, and direction
2. measurements of the amount of land subsidence and an estimate of the rate of eustatic sea level rise
3. storm surge heights and frequency.

Data requirements to obtain this information include:

1. local wind (or atmospheric pressure) and nearshore bathymetry data for hindcasting wave climate
2. wave gauge records
3. tidal records
4. long-term water level measurements
5. leveling surveys to estimate land subsidence.

This information would be used to:

1. calculate potential longshore sediment transport rates and directions, including frequency and persistence of transport
2. estimate the magnitude, impacts and recurrence intervals of storms for cost/benefit and risk analysis
3. calculate the perturbation of the sediment budget at inlets to determine sand bypassing requirements
4. interpret the causes of shoreline changes in order to predict possible future conditions
5. estimate time required for new inlets to close naturally
6. develop design criteria for structural and nonstructural responses to erosion control including:

    a. lifetime of beach fill projects, which is related to the wave height to the "minus-five-halves" power
    b. height, length and spacing of groins
    c. spacing, orientation and location of offshore breakwaters
    d. material strength requirements.

7. develop more accurate models to assess and predict impacts of various control alternatives.

In terms of the physical processes, waves are probably the single most important cause or factor affecting erosion in most areas. For this reason, information on wave climate is of primary importance in developing sound erosion management strategies. Although wave data hindcasted from wind records is available for the east coast of the U.S., the accuracy of this data is somewhat limited (especially in terms of directional information) since it was done with a technique that is now 15 years old. To obtain the most accurate wave data, the group suggested that two wave gauges (one near Montauk and one near the western end of Long

Island) should be maintained over the long term. It was noted that Florida maintains 12 gauges around the coast at an approximate annual cost of $30,000 each. The U.S. Army Corps of Engineers estimates the cost of operating a wave gauge for a year at $60,000 and in other areas has entered into cost-sharing agreements with local entities to deploy gauges. A 30-year hindcast done with the most up-to-date technique would cost about as much as maintaining a wave gauge for one year. These hindcasts should be calibrated with real wave data from gauges. In general, updated hindcasts of wave data would be very useful for many purposes, but the development of an effective management program would require the installation of permanent wave gauges in the future.

Land Use Patterns and Trends

A technical evaluation and assessment of any erosion control strategy must also consider the uses and activities occurring within and adjacent to the project area. Distinctions between land uses along the coast must be recognized and incorporated into the selection and design process since these factors will, in most cases, influence the level of resources to be allocated for a project and limit the range of control options available. (It would be inappropriate, for instance, to select and evaluate a structural approach for erosion control that severely limits access to a site that serves primarily as a recreational beach.)

Data and information needed which relate to land use and the development of land use plans include:

1. identification and location of land use types;
    a. housing density and type (year round/seasonal)
    b. commercial uses
    c. open space
    d. intensity and type (e.g., bathing, fishing, surfing, etc.)
    e. intensity and type of use at inlets
2. description of existing infrastructure
3. beach access requirements and associated amenities (i.e., restrooms, parking, food service, etc.)
4. demographics (existing and saturation populations)
5. plans for future development or changes in land use.

This land use information can be used to:

1. select and design erosion control alternatives that are compatible with present desired uses and/or accommodate potential future uses
2. calculate the economics of the shoreline uses for cost/benefits analysis

3. evaluate the performance of existing methods of erosion control. Existing structures may be considered as models for estimating the efficiency and impacts of potential future approaches.
4. develop and evaluate emergency evacuation plans.

APPLICATIONS OF IDENTIFIED INFORMATIONAL NEEDS

To provide examples of how the information needs identified during the meeting might be used in the decision making process, the group was also asked to consider several generic, hypothetical situations that typify common coastal erosion management issues found along ocean coasts and briefly discuss what they would like to know in order to evaluate and respond to these situations. The situations presented involved the management of a coastal inlet, the proposed construction of a bulkhead on an ocean beach to protect a structure and the proposed armoring of the toe of a coastal bluff. A brief summary of the major points brought out in these discussions is presented below.

Coastal Inlets

Because inlets can exert a dominant influence on the processes affecting coastal changes, the first situation considered was the development of an erosion management strategy related to an ocean inlet. Many of the most severe coastal erosion problems are the result of the interruption of sand transport patterns at inlets and/or poor sand management practices at artificially maintained inlets. As a result, most of the discussion on this topic focused on the need for sand bypassing.

It is imperative to make arrangements to provide for the bypassing of sand from the updrift to downdrift side of inlets. At existing inlets, historical shoreline migration rates showing the degree of downdrift recession after the inlet formed could be used in conjunction with profile measurements to estimate the quantity of sand that would be needed to replace that lost as a result of the disruption of the longshore transport by the inlet. This information, in conjunction with recent profiling surveys, could then be used to evaluate the amount of sand that should be artificially bypassed in order to provide the downdrift area with a supply of sand equal to that entering the updrift area in the vicinity of the inlet. The information on inlet processes described in the "Shoreline Processes" section (Appendix D) could also be used to refine these estimates by providing a more detailed analysis of the specific pathways, sinks, and sources of sediment in the area and a better estimate of the amount of sand naturally bypassing the inlet (a difficult number to determine). The results of this type of analysis could then be used to modify bypassing requirements and help identify the most efficient techniques for bypassing.

In the case of new inlets, several steps should be taken: a) a preliminary estimate of the longshore transport rate should be made using wave data and/or the rate of sand impoundment by nearby structures; b) this information should be used to develop a sand bypassing program (As a general guideline, arrangements should be made to begin bypassing sand at a rate equal to at least half the estimated net longshore transport rate, however, the exact percentage would depend on the particular situation and is open to modification based on other information that may be available for the site.); c) the downdrift shoreline response should be monitored using profiles and aerial photos; and d) the amount of bypassing should be adjusted based on the volume changes registered by the monitoring program to minimize downdrift erosion problems. However, it must be recognized that the downdrift shoreline could be influenced by processes other than those associated with the inlet, so an attempt must be made to discriminate among the different potential causes when assessing the results of the monitoring program.

Bulkhead Construction

The second situation discussed involved the installation of a bulkhead to protect a private home on the open ocean coast against storm damage. In response, the participants identified a number of questions that should be answered before such a project is allowed. For the sake of brevity, we have tried to group the related questions into categories (listed below) and, where possible and necessary, provide a very brief explanation of why these questions were asked (i.e., how the answers would be used in the decision making process). Reference is also made to the different types of data, previously identified by the group, that could be used to answer these questions.

Basically, six general classes of questions should be answered:

1. What is the cause of the erosion problem resulting in the need for the structure? Is there a public works project or other structure updrift exacerbating the problem? Is the structure filling a gap between other structures? Will it advance the line of building? In general, these are management related questions that would be answered by the data described in the land use section. It was noted that if the reason for the structure was the erosion caused by a public works project updrift then special allowances may be considered for the sake of balancing public and private interests. This information could also be used to perhaps identify means of mitigating the updrift cause of erosion, thus, precluding the need for the structure.

2. Is the shoreline experiencing long-term retreat? At what rate? When will the shoreline reach the structure? The answers to these questions can be obtained from the analysis of the long-term shoreline trends described in the section on coastal changes. This information allows

one to project the long-term impacts of the proposed action especially in terms of its potential effects on future beach width. If the shoreline shows chronic landward migration, the stabilization of the back beach area could result in a narrowing of the beach as the shoreline moves landward. If the water line migrates landward of the structure it could have adverse impacts on adjacent properties that may be unacceptable or require mitigative measures. If, on the other hand, the shoreline is relatively stable, the impacts associated with the potential narrowing of the beach over the long term would most likely be minimized or eliminated.

3. What is the active beach profile or short-term variability of the beach? How frequently will storms expose the bulkhead, and to what extent will it be exposed? By preventing erosion of the dune or upland during storms, will the structure be depriving the beach and adjacent areas of sand thus aggravating erosion? The information from beach profile surveys, water level measurements, wave observations and studies of the regional geology (sediment grain size distributions) provide the answers to these questions.

   These answers are important for several reasons. In certain areas, erosion of the upland or the dune (depending on the topography and composition of the material) may provide sand to the adjacent areas through erosion during storms. If this is the case, the bulkhead, by preventing the movement of this material, may cause a local sand deficit equal to the volume of sand that would be lost if the structure was not there. This in turn may adversely affect adjacent areas by depriving them of material they would normally receive during extreme conditions. Where this volume of sand is a significant component of the local sediment budget, the installation of the bulkhead may be conditioned on stipulations that require the owner to mitigate potential adverse impacts by artificially placing a quantity of sand equal to that lost to the system on a yearly basis, as is done in certain situations in Florida. (Florida is developing a technical manual on procedures used to estimate the volume of material required for mitigation measures for shore hardening structures.) Where the dune volume is minimal or upland erosion is not a significant source of suitable sediment (due to volume or composition) these impacts on adjacent areas could be minimal and the project may be warranted.

   A knowledge of the changes in shoreline configuration (from profile measurements) in response to physical factors (waves and waterlevel variations) could be used to predict how often the structure would be exposed and provide an estimate of the potential impacts on the beach and adjacent areas over time. This information could then be employed to develop appropriate set back requirements for locating structures to minimize adverse impacts. Obviously, this type of information would also be beneficial in developing structural design criteria (toe penetration requirements, height, strength of materials, etc.). (A recently-published special issue of the Journal of Coastal Research entitled "The Effects of Sea Walls on the Beach" edited by Kraus and Pilky covers the interaction of shore hardening structures with beach processes and related topics in some detail.)

4. What magnitude of a storm is the house (i.e., the structure to be protected) designed to withstand? What is the specific purpose of the structure (to protect the house or dune)? In Florida, if the house is built to 100-year flood standards (Federal Flood Insurance requirements), shore hardening is usually not permitted since the house by itself should withstand a major storm without the structure. It was also noted that shore hardening devices generally are not favored for the protection of dunes only and may not be warranted if that is the stated objective. These structures may be a viable alternative to protect older houses that don't meet present flood standards. In Florida, if the structures are allowed, they are required to be placed as close to the house as possible (usually landward of the dune if there is one) and, depending on the particular situation, may have to incorporate mitigative measures such as toe scour protection. This determination is based on the type of analysis of the site conditions described in Section 3 above.

5. Will the structure inhibit the recovery or growth of the dune by interrupting the aeolian sediment transport? To accurately assess this impact the information described in "Shoreline Processes" section (Appendix D) under dune formation and aeolian processes as would be needed and could be used to help determine if the proposed action would adversely affect dune building processes and to what extent, what structural changes might be made to ameliorate the condition and whether artificial dune restoration would be necessary and what level of effort would be appropriate.

6. What is the local and neighboring land use? Commercial or residential? What are the uses of the beach and who needs access (fishermen, bathers, etc.)? Will the structure inhibit the access or use? This information relates both to the land use data and the potential changes in the beach mentioned in 2 and 3 above. It would be used to determine if the structure would significantly change the configuration of the beach (in terms of beach width, for example) and, if so, the

relative impact of the changes on the present use. It could also be used to help identify potential mitigative the construction of right-of-ways or cross-overs.

Although the situation considered here involved the installation of a specific type of shoreline hardening device (a bulkhead), in general, the type of questions asked and the information needed to answer these questions would also be required to evaluate the other types of shore hardening devices commonly used in coastal areas.

Armoring of Coastal Bluffs

The last situation considered was the proposed armoring of the toe of a coastal bluff with a revetment to protect an individual upland structure. Because there are a number of similarities between this type of project and the previously described situation involving bulkheading, many of the same considerations would be applicable. In particular, the information related to categories 1, 2, 3 and 6 above, would be pertinent. However, there are also some fundamental differences between the two situations that require additional considerations and information. Among the more important differences noted were the following: 1) unlike the dunes, bluffs are a relic feature and cannot be expected to recover after an erosional event, 2) the erosion of bluffs may have a more important role in the sediment budget (depending on their size and composition) than the role of dune erosion, and 3) the erosion processes on bluffed coasts may be significantly different than those occurring along other parts of the shore.

In addition to the questions and information described in the discussion on the bulkhead, the following types of questions should be considered in assessing a proposal to armor the toe of a bluff:

1. Is the structure addressing the primary cause of erosion? In many cases, other factors such as groundwater may be a more dominant cause of erosion than undercutting at the toe in bluffed areas. Although a geotechnical analysis would be required to make a full analysis of the exact processes causing the erosion and their relative magnitude, some measure of the importance of undercutting may be obtained by examining profiles and aerial photographs. Recession of the toe over the long term or the presence of scarps at the base of the bluff after storms would tend to indicate wave undercutting is occurring and some type of toe protection might be necessary to slow down the erosion. If processes acting within or on the bluff face are the cause of the erosion, coastal engineering structures at the toe would have little effect. This analysis could also help identify possible factors such as lawn watering, septic leakage, etc. which may be exacerbating the problem and could be rectified relatively easily.

2. What is the rate of erosion and the height of the bluff? What is the composition of the material? How rapidly is material eroded from the bluff removed from the beach? Information from profiles, historic recession rates and data on regional geology described in the section on coastal changes (page 5) along with the data identified in the "Shoreline Processes" section (Appendix D) under bluff erosion would be required to answer these questions. This information and data could be used to determine if the bluff is indeed supplying the type of material needed to maintain the beach and longshore transport sediment transport system and, if so, at what rate. If the erosion of the bluff is not supplying a significant source of the type of material found along the downdrift beaches or in sediment transport system because of the composition (i.e., the material is too fine or the material is too large to be moved by the processes acting in an area) or the volume eroded (due to a low recession rate or the height of the bluff) then these impacts would probably be minimal and the project may be justified. However, if the erosion bluff is a significant source of beach-sized material the proposed armoring may have adverse impacts on surrounding areas. This information could also be used to develop mitigative measures such as requiring the applicant to supply a quantity of beach compatible material from an upland equal to the volume lost due to the armoring.

3. Could the structure to be protected be relocated or setbacks established to preclude the need for the structure? Information on the bluff composition, profile (height) and lot size would be required to determine a prudent setback and whether relocation is feasible.

4. Where along the bluff does the erosion occur? Does the beach have to be eroded before the bluff is attacked? This information could be obtained from post- storm surveys and/or aerial photographs, wave and waterlevel data, and data on regional geology. It was pointed out that in some areas of California, the erosion of bluffs during storms often occurs at a point below the elevation of the beach after the beach has been removed by the waves. If this does happen in an area, armoring of the toe of the bluff above the elevation of the active beach profile, as is often proposed, would provide little benefit, and special consideration would have to be given to the design of the structure in terms of required depth of penetration.

APPENDIX A

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APPENDIX B

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Gentlemen:

The first workshop on Long Island's south shore erosion problems and management alternatives is scheduled to start at 1:00 PM Friday February 24 at the Tampa Hyatt Regency. We are writing to provide you with a little more information on how we foresee the format of the meeting and to solicit any comments or suggestions you may have.

As you know from previous conversations, the purpose of this particular meeting is to more clearly define the type of technical information and physical data that are necessary to make rational, informed decisions regarding the selection of the most appropriate erosion control strategy for a coastal region. In other words, if you were asked to make a recommendation concerning the type of erosion control that is best for a certain ocean coastal region, what questions would you need answered and how will the answers affect your decision?

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One of the first questions might be "what are the objectives of the management plan?" Although this workshop is primarily concerned with identifying the more technical informational needs, the process used to make a preliminary evaluation of the feasibility of any erosion control alternative also depends on the desired objectives of the project. These objectives are often decided on the basis of socio-economic factors rather than technical criteria. While these socio-economic factors must be considered in planning, an in-depth treatment of the associated issues is well beyond the scope of this meeting.

So, after much deliberation, we thought the most efficient way to focus our discussions would be to have the group consider a generic, hypothetical shoreline situation and a general set of objectives that the selected erosion control option should achieve. For the purposes of discussion, we will assume that the managers have the following objectives:

1. Maintain the recreational beaches
2. Hold the shoreline position in urban areas
3. Maintain and stabilize existing inlets
4. Prevent new inlets from forming
5. Maintain existing dune formations
6. Prevent back-beach flooding
7. Prevent adverse downdrift effects due to the method employed in any area.

If you were approached to recommend an erosion control strategy, what would be the first questions you would ask? We expect the information you might want would include some of the items listed on the attached page. Although the situation described is somewhat vague, it is probably similar to some of those you have actually encountered in your work.

We hope that you can find some time before the meeting to give some thought as to the process you would use and the specific type of technical information you would require to make a preliminary determination of which erosion control alternative(s) would be most promising.

As you think about developing your list, we would like you to consider to the following points:

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1. To the extent possible, we want to concentrate on _technical_ information needs.

2. We are trying to identify the most suitable or appropiate strategy in a general sense, rather than trying to design a specific structure for a particular area. In a particular situation, which option (e.g., bulkheads, nourishment, groins, etc.) is most likely to warrant the effort needed to explore a detail design?

3. We are interested in knowing how a particular piece of information might be used in the decisionmaking process and identifying the minimum amount of information necessary.

4. What form or format should the information be in to facilitate its use.

When we meet in Tampa, we hope that each of you would discuss the physical information you need identified and briefly touch on how that information would be used. Based on these preliminary dicussions the group would then focus on how changes in the objectives of an erosion control plan might affect the type of information required.

By the end of the second day, we hope to produce a comprehensive list of the type and amount of technical information and physical data that is needed to make an informed decision on the most suitable erosion control strategy for an area given a range of possible objectives. This list will then serve as a basis for the second workshop which will concentrate on determining on what data is available for the south shore of Long Island and identifying informational gaps.

So far, that is our agenda. We would appreciate hearing any comments, suggestions and/or criticisms you may have. Also, if you have any questions or would like additional information regarding either the content or logistics of the meeting please don't hesitate to contact us (Henry (516) 632-8674; Jay (516) 632-8730.

We look forward to seeing you in Florida.

Sincerely,

Henry Bokuniewicz Jay Tanski

HB:JJT/mj

POTENTIAL TECHNICAL INFORMATION NEEDS

While by no means complete, the following is an example of some of the types of physical and technical information that may be required to make a preliminary determination of the most appropriate methods for controlling erosion in an area.

1. Shoreline Type (barrier island, headland, etc.)

2. Historical Shoreline Trends

   -long-term recession/accretion rates
   -short-term recession/accretion rates

3. Shoreface Form and Variability

   -beach/dune topography
   -equillibrium/storm profiles
   -seasonal profile variations
   -shoreface volume changes
   -depth of profile closure
   -offshore bar location/size/variability

4. Sediments

   -grain size composition/variability
   -sediment transport rates, volumes, directions
   -sediment sources/sinks

5. Long-term and Extremal Sea Conditions

   -tidal range
   -magnitude and recurrance intervals of storm surges
   -long-term average wave climate (height, frequency, direction)
   -extremal wave climate (height, frequency, direction)

6. Type, location, and effects of man-made structures

7. Location and sediment dynamics of existing inlets.

APPENDIX C

First Workshop on Long Island's South Shore Erosion Problems
February 24-25, 1989, Tampa, Florida

Discussion contribution from N. C. Kraus listing basic data required for shoreline change modeling for evaluation of alternative shore protection designs. (excerpted from Hanson, H., and N. C. Kraus, 1989, Technical Report CERC-89-__, "GENESIS: Generalized Model for Simulating Shoreline Change," Report 1, Reference Manual, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, Miss., in prep.)

Table 4
Data Required for Shoreline Change Modeling

Type of Data	Comments
Shoreline position	Determination of the shoreline trend. Shoreline position at regularly spaced intervals alongshore by which the historic trend of beach change can be determined.
Offshore waves	Time series or statistical summaries of offshore wave height, period, and direction.
Bathymetry	Bathymetry for transforming offshore wave data to values in the nearshore at regularly spaced interval alongshore.
Structures and other engineering activities	Location, configuration, and construction schedule of structures (groins, jetties, detached breakwaters, breakwaters, seawalls, etc.). Porosity, reflection, and transmission characteristics, as appropriate. Location, volume, and schedule of beach fills, dredging, and sand mining.
Regional transport	Sediment budget for the area; identification of littoral cells; location and functioning of inlets; discharges from rivers; wind and wind-blown sand.
Regional geology	Sources and sinks of sediment; grain size distribution; regional trends in shoreline movement; subsidence; sea level change.
Tide	Tidal range; tidal datum.
Extreme events	Large storms (waves, surge, beach erosion, failure of structures, etc.); inlet migration, opening, or closing; river discharges; earthquakes.
Other	Wave shadowing by large land masses; strong coastal currents, such as the Gulf Stream; etc.

APPENDIX D

Shoreline Processes

The information and data needs presented in the body of this report represent the most basic or fundamental technical knowledge required to begin developing a sound coastal erosion management plan. Collectively, they can provide a basis for decision making. However, the certainty with which erosion risks can be estimated and the impacts of proposed actions can be predicted depends not only on the availability of site-specific data but also on a basic understanding of the interaction and effects of the complex and variable coastal processes operating along the shore. An effective, comprehensive plan must also incorporate the most up-to-date knowledge of the processes involved. For this reason, any proposed management plan should also include provisions for utilizing the acquired physical data to assess and quantify the phenomena affecting shoreline changes. Of particular importance are those processes influencing sediment dynamics and regional and local sand budgets, some of which are listed below. A proper evaluation of these topical areas requires a skillful interpretation and analysis of the type of data described previously. More rigorous investigations of the following phenomena associated with the transport of sediment will often be critical in adequately assessing proposed erosion management alternatives in certain areas.

Longshore sediment transport

Data needed:

a. shoreline orientation
b. wave statistics
c. location, volume, size characteristics of sand deposits (sources)
d. sand trapping rates at structure.

Uses:

a. identify and minimize impediments to the longshore sand supply
b. characterize reversals in the transport
c. calculate the lifetime of nourishment projects
d. estimate sand by-passing needs around structures and inlets
e. evaluate the performance of existing structures
f. estimate the rate of inlet shoaling or closure.

Cross-shore sediment transport (including seasonal cycles, storm effects and long-term flux)

Data needed:
a. sequential bathymetric profiles
b. wave and current data
c. sediment grain size and distribution

Uses:
a. calculate the impact of extreme events on the sediment budget
b. estimate the rate of recovery after storm erosion
c. siting of structure such as breakwaters or groins whose relation to the bar is important
d. identify sources or sinks of sand for the beaches.

Inlet processes

Data needed:
a. history of occurrence and migration rate from charts and aerial photographs
b. volume and rate of growth of ebb and flood tidal deltas
c. wave refraction in the vicinity of inlets
d. tidal prism and cross-sectional areas
e. current patterns and velocities.

Uses:
a. evaluate potential sources of sand for renourishment and identify offshore sand sinks
b. decide on the need to artificially close or stabilize new inlets
c. estimate the amount and frequency of sand by-passing required at inlets
d. examine the hydraulic interaction of multiple inlets
e. evaluate role in barrier island migration processes.

Dune formation and aeolian processes

Data needed:
a. geomorphology (size, composition, form) of existing dunes including vegetation
b. meteorological data (precipitation, evaporation, local winds)
c. beach conditions (grain size, berm elevation, tides).

Uses:
a. quantify role of dunes in the sediment budget
b. calculate the amount of wind-driven sand

supplied to inlets (shoals are sometimes formed by wind-driven sand in inlets)

c. evaluate feasibility and need for dune reconstruction or renourishment for erosion and flood protection

d. estimate impact of structures or other actions on dune building processes.

Bluff erosion

Data needed:

a. heights and recession rates

b. composition

c. groundwater seepage

d. frequency of collapse.

Uses:

a. estimate the role of bluff erosion in supplying sand for longshore transport

b. assessing the effectiveness of armoring the bluff toe to prevent erosion (if groundwater seepage is the dominant erosive mechanism other protective measures, such as drainage systems might be needed.)

Morphodynamics (the identification of bars, shoals, shore-connected ridges, ebb/flood tidal deltas rhythmic beach features, etc. and associated processes)

Data needed:

a. aerial photographs and sequential bathymetric records

b. grain size distribution.

c. wave and current climate

Uses:

a. evaluate their role as sediment reservoirs in the coastal sand budget or conduits for sand transport

b. calculate rate of transport around inlets.

Overwash processes

Data needed:

a. distribution and morphology of former overwash platforms

b. volume of sand moved in overwash events.

Uses:

a. calculate the amount of sand removed by

b. estimate the rate at which platforms are provided for marshes
c. identify and quantify role in barrier island migration.