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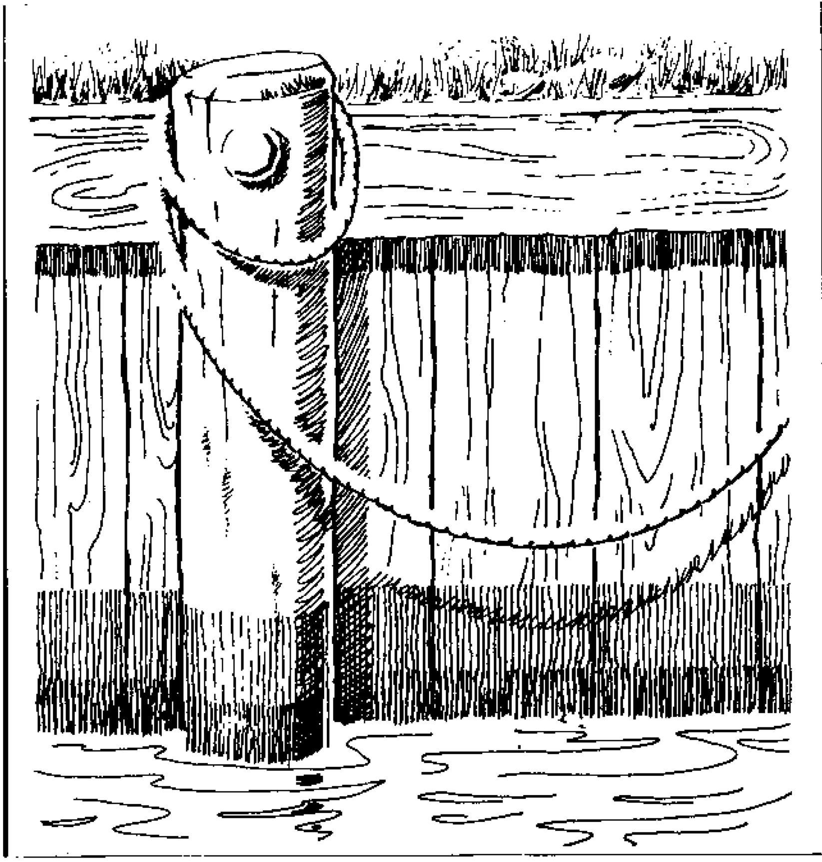

General Planning Considerations for Small-Scale Coastal Structures

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NEW YORK SEA GRANT INSTITUTE

This manual is part of the Coastal Structures Handbook Series. The series is being prepared for the New York Sea Grant Institute by the Geotechnical Engineering group at Cornell University, coordinated by Fred H. Kulhawy.

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GENERAL PLANNING CONSIDERATIONS

FOR

SMALL-SCALE COASTAL STRUCTURES

by

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by

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This report will constitute a chapter in a manual entitled, "Analysis, Design and Construction of Coastal Structures". This manual is being prepared for the New York Sea Grant Institute by the Geotechnical Engineering Group at Cornell University, and is being edited by Fred H. Kulhawy and Philip L.-F. Liu.

PREFACE

The analysis, design, and construction of coastal structures is of great concern to a broad cross-section of the population living near major fresh and salt water bodies. Realizing this concern, the New York Sea Grant Institute instituted a project to develop a manual to assist a variety of user groups in addressing the problems associated with the development of coastal structures and coastal facilities. Although the engineering community will find the manual to be of use, the focus of this manual has been to develop a simplified user's guide which focuses on the analysis, design, and construction of small-scale coastal structures. The emphasis has been on understanding the structures and their behavior, minimizing higher level mathematics, and presenting design charts and design examples for smaller scale structures, typical of those of importance to a small community and the individual homeowner. Large-scale developments should be handled by design professionals with expertise in the field.

This project was initiated in late 1977 by the New York Sea Grant Institute and has been developed by the School of Civil and Environmental Engineering at Cornell University. The project was initiated by Drs. Fred H. Kulhawy and Dwight A. Sangrey. Dr. Sangrey left Cornell before much progress was made, and subsequent work has been supervised by Drs. Fred H. Kulhawy and Philip L.-F. Liu.

Under the auspices of this project, the following reports have been prepared and submitted to New York Sea Grant:

1. "Regulatory Processes in Coastal Structures Construction", August 1979, by Susan A. Ronan, with the assistance of Dwight A. Sangrey (a brief draft which has been superceded by this transmittal).

2. "Coastal Construction Materials", November 1979, by Walter D. Hubbell and Fred H. Kulhawy

3. "Environmental Loads in Coastal Construction", November 1979, by Walter D. Hubbell and Fred H. Kulhawy

4. "Analysis, Design, and Construction of Pile Foundations in the Coastal Environment", April 1981, by Francis K.-P. Cheung and Fred H. Kulhawy

5. "Breakwaters, Jetties, and Groins: A Design Guide", March 1982, by Laurie A. Ehrlich and Fred H. Kulhawy

6. "Analysis, Design, and Construction of Bulkheads in the Coastal Environment", May 1982, by Thomas M. Saczynski and Fred H. Kulhawy

7. "Docks, Piers, and Wharves: A Design Guide", January 1983, by William S. Burgess, Jr. and Fred H. Kulhawy

This transmittal is the eighth submitted.

8. "General Planning Considerations for Small-Scale Coastal Structures", December 1983, by Jonathan H. Freese and Fred H. Kulhawy

This last report completes the manual.

ABSTRACT

The siting of a small-scale structure in the coastal environment requires use of a well-defined planning methodology. This study outlines one such planning process, with emphasis on the development and evaluation of alternatives.

The planning of coastal structures will require some understanding of natural coastal environmental processes and the possible effects a given structure may have on these processes. These considerations are discussed with regard to coastal beaches, bluffs, and tidal and fresh-water wetland areas. The evaluation of possible cost and benefit trade-offs will be of use to the planner for assessing which of several alternatives is the most satisfactory. A summary of site and construction considerations is provided to prepare the planner for possible trade-off decisions or construction problems which may be faced.

Many activities are regulated in the coastal environment and may require permit(s) from local, state and/or federal authorities. The final section of this study provides the basic justification for such regulations, a description of what types of structures or activities will require a permit, and a discussion of permit application procedures for the respective agencies.

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CHAPTER 1

INTRODUCTION

This study has been conducted to develop a guideline manual to assist in the planning of small-scale coastal structures. To facilitate use of this manual by a variety of users, the discussions herein are deliberately broad-based, particularly regarding the planning considerations and environmental concerns. As such, this manual should prove useful to local government planning boards, private business concerns, including engineers and contractors, and property owners planning small-scale coastal facilities.

Town or regional planning commissions may use this manual for both the establishment of local guidelines and the planning of public facilities. The planning of land use regulations such as recreational, residential, and industrial zoning ordinances will require consideration of coastal environmental concerns. The planning of public coastal projects such as recreational areas, boating access sites, and erosion control structures will also be aided.

Private sector groups who will find application for this manual include planners of marinas, commercial fishing facilities, or other boating concerns, and of small industrial developments. The planning of such projects will utilize the discussions of environmental processes and impacts, construction considerations and permit agencies, and permit application procedures.

This manual is organized to guide the planner from the formulation of design goals to the completion of project construction. Chapter 2 is a description of the basic planning cycle. The methodology presented is not fixed and inviolate. The planner may wish to use other methods or variations of the one presented, but any planning process will incorporate similar features. While the planning cycle described could be used for many types of projects, examples are provided of its particular applications to the coastal environment.

Because of the environmental impacts of proposed construction, the next two sections are devoted to environmental concerns. Chapter 3 is a description of the coastal environment in its natural form, including the biological and physical processes and their interactions. Because this manual is intended for planning in either fresh or saltwater regimes, Chapter 3 also presents a contrast of some of the environmental, planning, and construction concerns particular to each regime. Chapter 4 discusses the impact of construction and development in the coastal zone. Permitting agencies will act to control and mitigate against possible negative environmental impacts, so the planner must consider all means to reduce these impacts.

Chapter 5 provides a discussion of both the costs and benefits which may be associated with a planned structure. Comparisons of design alternatives will aid the planner in selecting the best alternative to accomplish the project goals.

Chapter 6 presents a summary of site-specific geotechnical, environmental, and construction considerations, which are grouped into site and construction considerations. A broad range of considerations is presented so that their application to a specific project may be left to the judgment of the planner. Through study of an individual project, the planner will develop additional considerations, as well as extensions or variations of those presented. This chapter is merely a tool to guide the planner in evaluating all aspects of the particular structure.

Chapter 7 describes the regulatory agencies governing coastal construction in New York State, and presents a guide to the permit application process.

Chapter 8 summarizes the work, and the appendices which follow list the specific types of coastal activities which will require permits.

CHAPTER 2

PLANNING PROCESS

The planning process is a strategy in which a project is formulated so that the best or optimal solution is used for design. The optimal solution may not always be the most economical, durable, or aesthetically pleasing one but, by combining these and other considerations and allowing for trade-offs of various advantages and disadvantages, the "best" alternative may be chosen. The resulting design must be site-specific, and must account for the particular environmental, social, economic, and regulatory aspects of the site. A design which is optimal for one coastal location may be under-designed or inappropriate for use at another location.

The general planning process for engineering projects is applicable to the design of small-scale coastal structures. The following description of this process will focus on coastal structure planning.

2.1 Rational-Comprehensive Planning Model

The ideal planning process is a cyclical one, in which the results of past decisions are used to improve the design continually. One such planning cycle is known as the Rational-Comprehensive planning model. It consists of five phases: formulation of goals, generation of alternatives, evaluation of alternatives, implementation, and monitoring (Hobbs and Doling, 1981). The first four elements of the cycle involve the initiation, planning, design, and construction of a coastal structure. The last phase reflects the long-term nature of the planning cycle.

For a project such as the development of a town zoning plan, the feedback provided by monitoring will show if the original goals are being met satisfactorily, or if unexpected and undesirable side effects are being realized. For coastal structures, monitoring will provide information concerning the effectiveness of the design, and the durability of the project, as it is subjected to the forces of nature in the coastal environment. The following discussion of each facet of the planning cycle will illustrate its usefulness for coastal structure planning.

2.2 Formulation of Goals

The first step in any planning cycle is the formulation of goals. The planner must define clearly the objectives of the project at the start, for several reasons. Clear statement of the goals will ensure that changes in goals, or in the needs of the users, will be recognized and be accommodated by updating the design in a timely fashion. Otherwise, the need for such changes may go unnoticed until the completion of construction, when it may be too late to make economically feasible adjustments.

A second aspect of goal formulation is allowing the non-planner or prospective user to consider the stated goals and to comment on them. This is particularly relevant for the case of a local planning board whose goals may be the creation of a park, municipal boat launching facility, or beach protection system. A group of planners may not hold the same views and values as members of the general public. A statement of goals and consideration of comments raised by members of the target community may point out some aspects of the plan which will be important to the user population, but which had not occurred to the members of the planning committee. They may find that a majority of the general population is opposed to the stated goals and therefore the plan can not be deemed to be in the public interest.

Similarly, private landowners may assess the reactions of neighbors or other affected parties by stating their goals at a time when slight modifications to those goals might easily be made, to prevent later disagreements over the completed project. The assimilation of outside input to the planning process during its early phases is more economical than modifications to a project during construction or after completion.

The third reason for the formulation of goals is that it forces the planner to establish the characteristics of the target population. These include both the current population and expected growth rates, and the needs and desires of the user community. This approach will help prevent under-designing of a coastal project by not allowing for population or area usage increases, or over-designing by failure to recognize that further population growth will be restricted because of land unavailability or zoning regulations.

A clear statement of the planner's goals will also allow early assessment of the permits which may be required prior to construction. This approach will allow the planner to judge how best to complete the structure with a minimum of permit application complications.

The planner must be specific in the statement of goals. For instance, a goal of "stopping beach erosion" is admirable, but too general. The goal statement should specify which beaches and which sections of each beach most need to be protected. Furthermore, it should define whether the goal is limiting erosion to an acceptable rate or "stopping" it, a costly if achievable goal. The narrowing of these objectives requires information on long-term erosion rates along each beach, and the relative value of each beach measured in terms of: (1) present or possible future structures sited on or behind it, (2) recreational, aesthetic, and ecological value, and (3) other site-specific factors.

The importance of careful formulation of goals can not be overstated, as it requires thorough consideration of the purpose of the project, allows for input by agencies other than the planner, and results in a clarified outline to guide the rest of the planning process.

2.3 Selection of Alternatives

Following a clear definition of intent, the planner develops reasonable alternatives for achieving the objectives. These alternatives may consist of different designs, choices between locations, types of building materials, or other variables.

The number of feasible alternatives may be large. For instance, beach erosion control might generate several alternatives, including no action, bringing in fresh sand to replace the eroded quantity (beach nourishment), planting vegetation to retard erosion, constructing erosion control systems, or moving the structures threatened by erosion. These are both structural and non-structural alternatives to solve a specific problem.

The alternative of no action might be chosen in a plan to control channel sedimentation or coastal erosion. While this alternative initially might seem to be the most economical, the resulting yearly maintenance and repair costs from coastal erosion can be significant and often make this alternative unacceptable.

While many alternatives may be considered, inherent constraints make some difficult or impossible to attain. The constraints may be physical, such as access problems which prevent the transport of large precast concrete sections to an erosion control project site, or they may be regulatory, such as restrictions against the disposal of dredging spoil on wetlands. These and others narrow the range of alternatives.

The selection of alternatives may consist of the assessment of different locations, as in the planning of a marina. A tool for locating and examining alternative sites is the sieve map (Hobbs and Doling, 1981). This technique involves delineation of unsuitable locations on a map of the coastal area under study. The unsuitable areas might be: (1) too steep for easy site grading, (2) situated on a flood plain, (3) already developed right to the shoreline, (4) too difficult to supply with water or wastewater connections, (5) too far from large developed areas to ensure a user community, or (6) too far from deep water or a soft bottom channel which could be dredged. The mapping of constraints such as these reduces the field of choice and suggests better sites by elimination. This type of analysis is quick and easy to perform, but it assumes that all constraints are fixed and insurmountable, and allows no distinction between major and minor ones. A good site eliminated because it would require extensive site grading is shown the same consideration as another site requiring major dredging, with all the accompanying problems of dredging permit applications and spoil disposal. This problem of equal weighting for unequal restraints becomes particularly relevant when all areas along a coastline are eliminated and there are no "ideal sites" available. Site selection is a trade-off between constraints, and a more detailed technique is needed to select the best choice.

A more detailed approach is the threshold analysis. In its strict form, it involves the identification of major thresholds to development which can be overcome by capital investment (Hobbs and Doling, 1981). This tool could be used for site selection by evaluating the development cost for each prospective location, which is added to the basic cost of the facility. This facilitates selection, on an economic basis at least, of the best site. This method may also be applied to the selection of alternatives at a specific site, such as the costs of different erosion control measures. This approach will allow economic comparison of schemes and may indicate that two combined schemes are less costly (and more effective) than a third. Of course, factors other than economic ones also should be considered in planning a coastal structure.

In selecting alternatives, the planner must be as imaginative and broad-minded as possible. The optimal solution to a problem is rarely the first one that occurs, and is often realized only by comparison with other options. However, caution must be exercised in the development of alternatives, because an inordinate amount of time and money could be spent trying to consider every possibility.

2.4 Evaluation of Alternatives

The previous section discussed techniques for generating alternative design schemes, based primarily on economic considerations. However, other factors which have an influence on plan selection must be considered as well. These include environmental, geotechnical, site access, and regulatory considerations. Each of these is discussed in later sections.

The process of evaluation of alternatives is the consideration of design factors regarding the alternatives, allowing eventual selection of the optimal plan. There is no ideal method to determine which alternative to decide upon; there are only techniques to provide perspectives on the choices.

Information gathering will be needed to make a decision concerning the final project design. For a given site, a survey will be needed to assess the initial topography, ground conditions, drainage patterns, and grading requirements. A soil survey will gather information on soil profiles, soil engineering characteristics, and depth to bedrock. The extent of the survey will be guided by the importance of the planned structure. For an erosion control problem, data will be needed to assess long-term erosion rates at the site or along adjacent shores. The price and availability of prospective building materials, such as stone for a breakwater or pressure-treated timber piles for a residential structure, will have to be determined for the particular region. These investigations are an inherent cost of the planning process. They will be initiated by the designer of the structure, who may either be the planner or an engineer contracted by the planner.

The threshold analysis described above is a useful tool for weighing the cost of various designs against the level of coverage or protection each provides. The analysis shows the planner which will be the most economical plan to achieve the stated goals. A broader and more flexible methodology is the cost-benefit analysis.

The cost-benefit analysis was originally developed for making investment decisions in which all costs and benefits of a chosen action may be given a monetary value to weigh the overall balance of each alternative. In planning for structures in the coastal environment, the use of a cost-benefit analysis is more difficult, as assignment of monetary values is a matter of judgment, but it is still a valuable decision-making tool. The process entails the assessment of a monetary value to all of the negative (costs) and positive (benefits) aspects of a particular alternative. The various alternatives can then be compared to determine which offers the most for the least capital outlay.

Costs may include the cost of the planning processes, payment of engineers and technicians to perform site surveys along with laboratory evaluation of results, and the cost of construction and materials for the facility. Costs which are more difficult to assess include changes in coastal water quality, reductions in fish and shellfish populations, and loss of wetlands, beaches, and scenic areas.

Examples of benefits are the halting and possible reversal of beach erosion, aesthetic pleasures of living in a coastal residential structure or making use of a coastal recreational facility, increased property values, and an increase in land usage and revenue for a community. Obviously, many of the benefits are difficult to quantify, being largely aesthetic in nature. Two individuals would assign them different values, both in an absolute and relative sense. A prospective coastal homebuilder might set the aesthetic pleasure of living in a home on a shoreline far above the loss of the wetlands area filled for the building site.

Many costs and benefits extend into the future. The costs include the alternative future uses for a site which are forsaken if the plan is implemented. The use of a site for a marina precludes its use for residential construction. The benefits of an alternative will be consumed over the life of the structure, so that a structure with a short design life offers fewer benefits than a design with a longer life (Hobbs and Doling, 1981).

The costs and benefits of each alternative are assigned a monetary value, or are at least identified as positive and negative aspects, if no value is assignable. This allows the planner to compare the total cost or total benefits of each alternative to decide which provides the best combination. The cost-benefit analysis therefore provides a way to compare alternatives on an equal basis.

The costs involved in formulating and analyzing a large number of alternatives may become substantial. To avoid undue expense, the planner may want to adopt the technique termed "satisficing" by Hobbs and Doling (1981). In this approach, the selection of alternatives is preceded by the definition of a set of minimum standards of acceptability. Any alternative which meets the criteria may be a satisfactory plan and the formulation of several satisfactory alternatives is sufficient to move on to the evaluation of each and the selection of one.

The planner compares the selected alternatives by threshold analyses, cost-benefit comparisons, or other methods, and makes a decision on which alternative will best meet the project goals. The planning cycle allows re-evaluation of any planning step at any time, increasing the flexibility of the cycle and helping to ensure that the final design best accommodates the original need. Having selected the best alternative, the planner is now ready to implement it.

2.5 Implementation

This phase of the cycle consists of designing the planned facility and executing its construction. As with the physical parameter site investigations, the actual design and construction will generally be performed by professionals contracted by the planner. They will furnish a complete design for the chosen coastal structure and will hire and supervise the contractors who construct the facility. A complete design and construction guide for all possible small-scale coastal structures is beyond the scope of this study, but later sections will present some of the geotechnical, ecological, and structural considerations applicable to most coastal construction projects.

The planner should not relinquish control of the project during the implementation of the plan. On the contrary, the planner should guide the project through to completion, accepting the ideas and expertise of the designer and contractor, but maintaining influence to ensure that the project is constructed as envisioned, fully meeting the goals established.

Most coastal construction in New York State will require a permit from one or more sources, including the local government, the Department of Environmental Conservation (DEC), and the U.S. Army Corps of Engineers (ACOE). These permits must be applied for and be granted prior to construction. The types and locations of coastal structures requiring permits will be discussed later.

The completion of construction of the coastal structure signals the end of the active phase of the planning cycle. The planner has recognized a problem or need, formulated a set of goals to meet the need, generated and evaluated several alternative methods of achieving the goals, and implemented the best alternative to cope with the original problem. This does not signal the end of the planning cycle, however. The resistance of a shoreline structure to the severe weathering effects of the coastal environment, and its success in meeting the design goals, may only be observed over an extended time. A continuing effort of monitoring and data gathering will be needed to judge the effectiveness of the design and indicate the need for improvements.

2.6 Monitoring

Monitoring is an important part of the planning process. It involves inspection of the coastal structure and its immediate surroundings on a regular basis to assess the performance of the design. For erosion control structures such as bulkheads or revetments, monitoring may include measurement of sand levels along the beach by such means as permanently fixed calibrated stakes, a regular photographic record of the beach and structure, regular inspection (particularly after storms) of the toe of the structure for scouring and movement, and inspection of the ends of the structure to see if erosion of adjacent shorelines is causing flanking of the structure (erosion behind the ends).

Monitoring of jetties, breakwaters, and groins which extend from the shore, or other structures located offshore, may include regular inspections for toe scour and a photographic record (taken at a similar tide level) of the beach showing accretion and erosion of sand on either side of the structure.

Monitoring of marina facilities, residential structures, and boating facilities may include periodic inspection of all steel or wood piles for corrosion or rotting, inspection of all connections and exposed surfaces following a storm, checking for foundation soil erosion and wind damage, and ice damage in the spring.

Monitoring serves several important purposes. It reveals design shortcomings which make the structure vulnerable to attack by the environmental forces at work along a shoreline. It provides a continuous feedback as to whether the original goals are being met by the design and, if they are not, may suggest how the design might be adjusted to meet the goals better. In the case of a repeated design, as in a community plan to protect a large reach of shoreline with a groin field, monitoring helps prevent the repetition of poor design or construction effects by detecting them in the first structures built. Monitoring helps to detect unforeseen and often unwanted consequences of the chosen design, which may be severe enough to warrant design modification. Finally, monitoring helps dictate the maintenance schedule which must be followed to maintain the effectiveness of the structure. Unfortunately, post-construction monitoring is often given insufficient emphasis by the planner. This often leads to repetition of design flaws or failure to correct a design or construction flaw in a timely manner.

2.7 Summary

The Rational-Comprehensive planning model is a tool. It provides a format for a step-by-step analysis and design of coastal structures to meet the needs of the user. Various stages of the cycles may be given a larger or lesser role in accordance with the needs of a specific project.

The planning cycle presented here is intended to guide the planner in producing a design which acknowledges the many factors and considerations of the coastal environment. The formulation of goals leads to a definition of the intent of the project, aiding the planner in deciding which aspects of the project are most or least important, should a trade-off decision be required. The formulation and evaluation of alternatives entails the examination of several possible solutions, presented in ways which allow the planner to select the design best-suited to the project goals. The implementation of this design should result in a coastal structure which fully meets all of the project goals. Monitoring and information gathering will reveal whether or not it meets these goals, as well as dictating the need for and frequency of maintenance and repair.

The following sections of this study deal with the factors to be considered in the planning of small-scale coastal structures.

CHAPTER 3

NATURAL COASTAL ENVIRONMENTAL PROCESSES

The influence of small-scale structures on the coastal environment must be evaluated within the context of the natural fresh and saltwater coastal ecosystems and environmental forces. These interacting natural systems are complex and require a detailed evaluation. This chapter is just an introduction to the subject which should give the planner a basic understanding of the importance and sensitivity of the natural coastline, and the need for protecting it when planning a coastal structure. The principal shoreline features considered are shown in Figure 3.1.

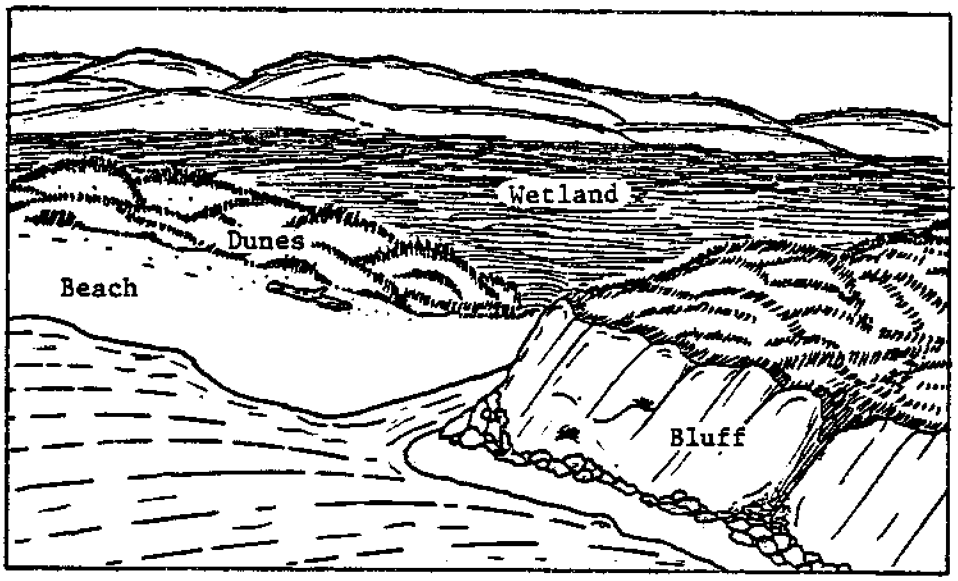


Figure 3.1 Sketch of coastal zone showing beach, dune, bluff and wetland areas

3.1 Natural Beach Nourishment

The beach environment is a dynamic, changing system. It is in a continual state of erosion and deposition, receding and advancing depending on which factor is dominant. Beach sand in temperate climates typically is composed mainly of quartz, one of the most durable minerals on earth. This sand is derived from inland weathering and erosion and has been transported to the coast to feed the beaches by two primary mechanisms, rivers and glaciers.

Rock masses are weathered and broken down by water, ice, plants, wind, and other forces. Water transport of the eroded material carries rock, sand, silt, clay, and suspended matter downstream. Sand carried to the mouth of the river is generally deposited in bars or shoals at the mouth, and may be transported along the shoreline by the littoral currents described below. Suspended silts and clays are deposited farther out in the lake or ocean. Figure 3.2 is a schematic cross-section of this sorting process.

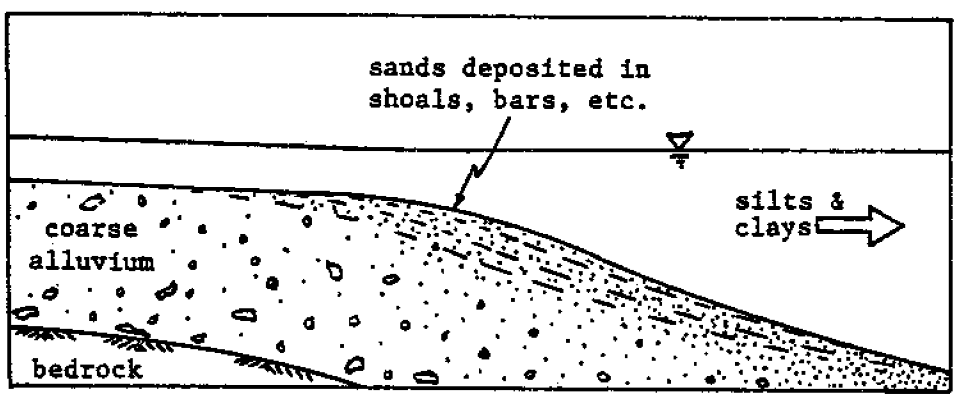


Figure 3.2 Sketch of river mouth profile showing soil distribution by grain size

In many northern hemisphere regions such as the North Atlantic and the Great Lakes, sand has also been transported to the shore by glaciers, in a mixture of boulders, rocks, gravel, sand, silt, and clay known as glacial till. The till was emplaced by the advancing glaciers in a densely packed deposit called a basal moraine and by the receding glaciers in a loosely packed ablation moraine. Some moraines remain as present day bluffs along a shoreline or may be eroded by inland rivers which transport the sands and gravels to the shore. The glaciers which formed Long Island left such bluffs along both the north shore and the northern rim of the South Fork out to Montauk (Heikoff, 1980). Bluffs also form as a result of sea level changes or land uplift. As a coastal bluff is eroded, its material is carried by littoral transport to nourish adjoining beaches.

The primary causes of bluff erosion, shown in Figure 3.3, are the run-off of precipitation, groundwater seepage, and storm tides. Factors which increase the erosion rates include steepening of bluff faces, lack of vegetation, and a narrow, unprotected beach at the foot of the bluff (Heikoff, 1980). This erosion is a natural means of replenishment for the down-current beaches.

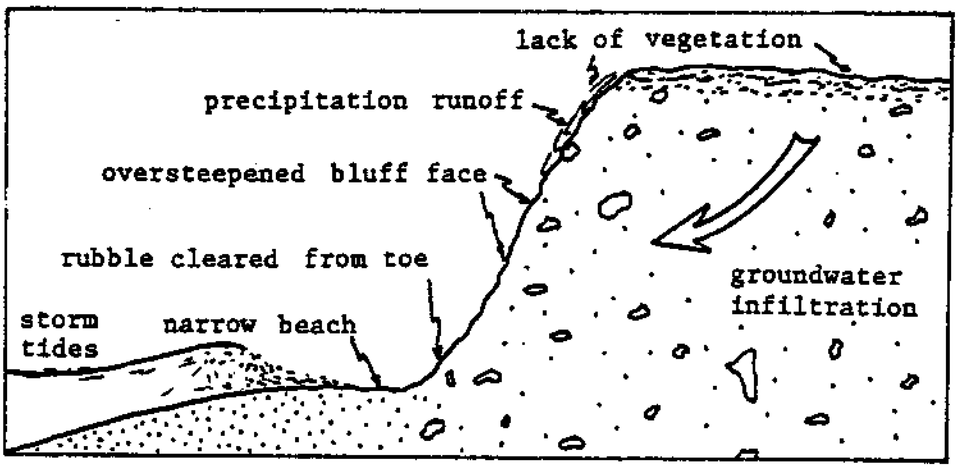


Figure 3.3 Sketch of bluff profile showing causes of bluff erosion

The beaches closest to an eroding bluff are made up of the coarsest materials: coarse sands, gravel, or cobbles. These coarse materials are the hardest for the currents to transport. More distant beaches receive increasingly finer sands, which can be carried more easily by the littoral currents (Heikoff, 1980).

3.2 Littoral Transport

Waves tend to strike a reach of shoreline at an acute angle. This angle may be seen to possess two components of movement, one straight in toward the shore, the other along it. Both are shown in plan view in Figure 3.4. These components, viewed separately, can be seen to move sand in two directions. The wave and surf action tend to move sand on or offshore, depending on the wave type. High steep waves and higher tides tend to erode and pull the sand offshore, as during winter storms. Sand is transported away from the beach and is deposited in a sand bar parallel to the shore (Heikoff, 1980). Low waves of longer period during the summer months tend to move the material back to the beach and rebuild it (Coastal Engineering Research Center, CERC, 1977).

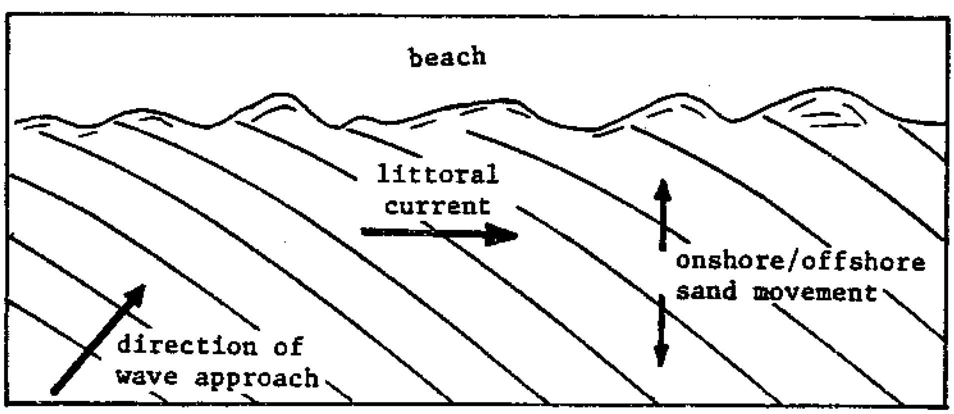


Figure 3.4 Plan view sketch of littoral current and onshore/offshore sand movement

The component of wave action parallel to the beach also induces sand movement, but along the beach, rather than at right angles to it. This current is called a shore or littoral current, and the sand moved is called littoral drift. The strength of this current may vary from day to day as wave height and angle of approach vary. In general, the direction of transport varies seasonally.

The net rate of drift is the net amount of sand passing a particular point on the shoreline in a year. If 300,000 cubic yards of material is transported in one direction along the shore and 100,000 in the other direction, the net rate is 200,000 cubic yards in the predominant direction. Values of net rate along the Great Lakes shorelines are generally less than 150,000 cubic yards while on the ocean coast they may range from 100,000 to two million cubic yards per year (CERC, 1977). Therefore, the problems caused by interrupting the littoral drift normally will be greater for ocean than lake shorelines.

Littoral currents cause sands to be carried from river mouths and eroded moraines or other bluffs to supply beach material for shorelines many miles away. If the two main sources of beach replenishment, river transport and bluff erosion, are eliminated by coastal construction or absolute erosion control, the beaches dependent on them will starve. The erosion of the beaches would not be balanced by the replenishment offered by river transport and bluff erosion, and the beaches would dwindle in size as the forces of erosion and littoral transport carried off the sand.

The phenomena of littoral currents and sand transport occurs along virtually any shore, salt or freshwater, and must be considered in the planning of any coastal structure which will extend from the shore and interrupt the current.

3.3 Natural Beach Environments

Beaches undergo natural long-term changes of shape through processes of erosion and deposition. Significant erosion may only occur for a few days out of each year during periods of heavy wave action or during major storms which recur on the order of decades. Some California beach shorelines have migrated in excess of a thousand feet in historic times. Although slow erosion may occur at all times, a large storm may cause more erosion in a brief time than extended periods of normal wave action. Beaches may retreat up to a hundred feet or essentially disappear during the course of a single storm (California Resources Agency, 1977).

Dunes are natural sand barriers which act to resist erosion and are located immediately behind the beach. The foredune, or primary dune, is that closest to the beach. It provides the major storm resistance, and is rather sparsely vegetated, being covered with varieties of beach grass. The dunes behind it are called the rear or secondary dunes. These may be active, migrating because of wind forces, or stabilized, with large plants and trees established on them (Clark, 1980).

Dunes offer storm protection in several ways. Their height above the beach provides a barrier to storm surges. They act as a source for replenishment of sand which may be slowly eroded from the beach by normal wave action or quickly carried off by storms and hurricanes. The sand removed from the beaches and dunes during a storm is often deposited offshore in a bar parallel to the shoreline. The extra sand on the lower and submerged sections of the beach helps to break the storm waves further out, dissipating their energy and reducing their potential for further eroding the upper beach (Clark, 1980). In more temperate weather, sands are redeposited on the beach and blown landward to replenish the dunes. Beach grasses gradually grow to stabilize and enlarge the dune against the next storm.

The interacting processes of erosion, deposition, and sand transport which create and maintain beach systems are sensitive to alterations by manmade structures. The planner must consider probable effects of a coastal structure with respect to protection of the beaches and the structures sited behind them.

3.4 Wetlands Environments

Fresh and saltwater wetlands are among the most concentrated and biologically active areas along the coast. They may be defined as areas of land which are fully flooded most or all of the year and are vegetated by plants which have a tolerance for these conditions. Both fresh and saltwater wetlands serve many biological, chemical, and physical purposes in the coastal zone.

Wetlands in their natural state have a large capacity for the absorption of flood waters. Seasonal high waters or storm surges are retained and released slowly into coastal basins, as the wetlands serve to buffer adjacent lands against flooding. Large quantities of silt carried by flood waters are trapped by the mat of vegetation as the water passes through the wetlands. Soluble and suspended pollutants such as fertilizers and domestic wastes may be substantially removed by biological activity and filtration as the water passes through the wetlands system. The chemicals are assimilated by the plant materials or consumed by the aerobic and anaerobic bacteria in the saturated soil and organic material.

A wetland area serves as an important biomass generator. The thick vegetation cover of a wetlands area converts dissolved inorganic compounds and carbon dioxide into plant matter, which may be viewed as stored energy. As the plants die and fall into the water, they are decomposed by bacteria, creating a rich organic stock for shrimps, crabs, worms, snails, and other small animals. These are in turn eaten by larger fish, birds, and other animals higher on the coastal food chain (Clark, 1980). About half the plant tissue created in wetlands is delivered to coastal waters to provide the base of the aquatic food chain (Teal, 1962).

Commercial fish populations are somewhat dependent on wetlands as a base of the food chain. A direct causative relationship has been shown between marsh area and fish population, as judged by fish harvest per acre of fishable coastal waters adjoining a marsh. A study of a North Carolina estuary showed a fifty percent decline in the life support capability of the estuary after destruction of the associated marsh (Williams, 1975).

Wetlands fill many additional needs in the shoreline ecosystem. Both fresh and saltwater wetlands serve as habitats for many varieties of birds and animals, providing nesting, feeding, and resting grounds. These habitats provide excellent sites for research and education, as well as for recreational bird and animal watching.

In saltwater wetlands, the zone between the vegetation and the low tide mark generally consists of tidal mud flats. These flats are also a rich habitat, providing feeding grounds for fish or crustaceans at high tides, shore or wading birds at low tides, and are sources of clams or baitworms for human use (Clark, 1980).

Wetlands also provide sanctuary and habitat to a wider range of bird and animal species than any other shoreland environment. However, they are easily destroyed by filling or draining. The danger of wetlands loss has prompted laws controlling construction on wetlands or on lands adjacent to them. Construction is generally permitted only on proof that the benefits of the proposed alterations to the wetlands outweigh the damage imposed and that the proposed work is necessary to realize these benefits. In general, the planner would be well-advised to avoid the selection of fresh or saltwater wetlands as a building site if any reasonable alternative may be found.

3.5 Contrasts of Freshwater and Saltwater Environments

Fresh and saltwater coastal environments have many similarities. However, some characteristics of one are lacking in the other, or are manifested differently. A comparison of such characteristics should guide the planner and illustrate the affect that each type of environment will have on a particular project.

Potability

The first contrast is that saltwater is saline and therefore non-drinkable. A body of freshwater in its natural form is generally drinkable, and many shoreline municipalities consume lake water after minor treatment. A water well, drilled along a freshwater coastal zone will, barring groundwater contamination problems, produce drinkable water. The supply is essentially inexhaustible, given sufficient recharge by rainfall. In a saltwater coastal zone, however, the fresh potable groundwater floats on the denser saltwater. The extent of saltwater intrusion is limited by the volume of freshwater above it. Overpumping of wells in a marine coastal zone will allow further intrusion of saltwater and eventual contamination and loss of the well. The planner in a saltwater coastal area must consider the current burden on the local groundwater system, past and present contamination problems of local wells, and the future cost of losing a well, when selecting the method of water supply to a site.

Weathering

A second consequence of the salinity contrast between fresh and saltwater is in their weathering effects on construction materials. Saltwater provides a more corrosive environment than freshwater, and will corrode exposed ferrous metals and non-anodized aluminum. Plain carbon steel may last only five years in a saline environment. Concrete is one of the more durable saltwater construction materials, but care must be given to ensuring that the proper type is used for salt or freshwater conditions and that the reinforcing material is properly shielded from contact with moisture. Corrosion and weathering in the saltwater environment is aggravated by the presence of tides. The twice daily fluctuation in water levels with resulting wet/dry cycles tends to speed corrosion of metals or deterioration of wood. In addition, wood must be protected against marine borer attack.

Water Level Variations

Patterns of water level change differ in several ways between freshwater and marine environments. The daily and monthly tidal variations which occur in the ocean coastal zone often are undetectable in smaller freshwater lakes. Seasonal variations which may induce flooding and destruction of low-lying lake property are not evident in marine shorelands, except in areas within or adjacent to estuaries. Long-term changes in ocean levels relative to the land contribute to beach recession, such as approximate rises of nine and eleven inches per century, in New London, Connecticut and New York City, respectively (Hectis, 1972). These rises are not evidenced on freshwater shorelines, because with few exceptions, all such shorelines are above mean sea level.

Storm surges are common to both fresh and saltwater coastlines. Storm attack and erosion are generally more severe in the marine environment. Ocean coastlines may be subject to both heavy winter storms and hurricanes. Storm surge, a rise in water levels above the normal tide, is caused by direct wind action, atmospheric low pressure zones, heavy rainfall, wave and swell transport of water, and other factors. Reported values of storm surge range from two to eight feet along the New York/New Jersey coastline (Pore and Barrientos, 1976). The timing of the peak surge with respect to the tides is important. If the maximum surge occurs at high tide, it will cause severe flood damage, while the same peak surge at low tide might not exceed the normal high water mark. Principal causes for storm surge in lakes are heavy rainfall and storm winds. High winds, exerting both shear stresses on the water surface and pressure differences on the leading and trailing sides of waves, have induced rapid water level rises of up to eight feet on the Buffalo shoreline of Lake Erie (Blust, 1978).

Erosion and littoral drift vary in magnitude between freshwater and marine shorelines. Net rates of littoral drift for ocean coasts range from equality to an order of magnitude greater than values for freshwater shores. This reflects the differences both in storm magnitudes and general wave energy between the two systems.

Ice Effects

Freezing of a lake surface will occur even on exposed shorelines for temperatures consistently below 32°F. Saltwater surface waters will freeze, but only in sheltered areas or under extremely cold conditions. Lake ice will continue to thicken with prolonged cold weather; a maximum thickness of solid lake ice of twenty-four inches has been reported in Buffalo, New York (Aune, Beaudin, and

Borrowman, 1957). Lake harbor protection structures may become covered with twenty to twenty-five feet of ice driven by jams or by continued freezing of wave wash. In addition, ice freezing and thawing action may break up the rock or concrete construction material, or ice may remove large boulders by transport in an ice floe (Wortley, 1978).

Small coastal structures may be severely damaged by ice action. Piling and the structures they support may be subjected to shear forces by wind and current driven ice sheets. A pile may also experience dragdown forces because of the weight of ice, or uplift forces as the water level and ice rise. Fluctuations in water level from storm surge may exert forces on an ice-locked pile to pull it up slightly. As the soil beneath the pile collapses and fills the created void, the pile will not drop back down; instead it is continuously jacked upward. By spring thaw, it may be structurally useless. Ice formations may have a similarly damaging effect when they occur in marine environments, with the added factor of tidal fluctuations which will aggravate further both ice loading and uplift problems.

3.6 Summary

Coastal environments in their natural form constitute an interacting system of contrasting land features, sensitive to artificial changes from coastal construction. The sediments on which beaches depend are derived from transport by rivers from inland sources or erosion of bluffs. The sediments are carried to the beaches by littoral transport, which also carries the sand away from the beaches should the supply become intercepted or eliminated.

Fresh and saltwater wetlands are, per unit area, the most productive natural environments in the world. They serve as a habitat for a wide variety of birds and animals, as well as producing a large stock of biomass on which coastal fish and shellfish populations are dependent. Wetlands also have the physical capacity to absorb large quantities of water during periods of flooding, protecting adjacent areas. Protection and maintenance of these vital environments is a must in the planning process.

The coastal planner must also have a firm understanding of the similarities and differences of salt and freshwater environments. This is needed to select the best and safest alternative for a project in either regime, and to assess the validity of transferring technology from one coastal environment to the other.

CHAPTER 4

IMPACT OF COASTAL CONSTRUCTION AND DEVELOPMENT

Naturally occurring coastal processes are dynamic systems of erosion and deposition in temporary equilibrium. The advance and recession of beach lines or the erosion of bluffs are of little direct consequence in undeveloped coastal regions, but may be costly or disastrous when they affect manmade coastal facilities. Structures intended to curb such natural processes may sometimes aggravate them or result in unwanted side effects, and construction or filling in wetlands may damage or destroy them.

This section will examine the effects that various types of coastal structures have on the shoreline environment. Measures which may be necessary to mitigate these effects will also be discussed. A concerted effort should be made by the planner to anticipate and mitigate all significant environmental impacts in the design and construction of a coastal facility.

4.1 Bluffs

A bluff in the coastal environment is in a continual state of erosion. A bluff of sound rock material may undergo negligible erosion, but bluffs of soft rock or glacial till may erode rapidly. The erosion rate is controlled by such factors as slope angle, material density and strength, groundwater conditions, types and amounts of vegetation, width of beach, and degree of exposure.

The erosion of a bluff may be increased by the construction of structures along its summit. Such construction often involves the clearing of natural vegetation from the land behind the bluff, allowing increases in the rate of infiltration of rainfall which previously had run off, and loss of the binding properties of the vegetation. To ensure a "good view," some developers have cleared all trees and bushes right to the edge of the bluff, leaving no buffer zone of natural vegetation. Loss of the buffer zone greatly increases the potential for erosion, gullying, and slope failures of entire sections of the top of the bluff. Erosion and landslide potential are also increased if vegetation is removed from the face of the bluff, or if the rubble is cleared from its toe. These factors will reduce the stability of the bluff so that the addition of the structure and fill weight may lead to a slope failure.

Bluff erosion is difficult to control. If a short section of bluff is completely stabilized to protect one structure, flanking by erosion of adjacent bluff faces will probably occur. If instead a large section of bluff were fully protected from erosion, the consequent beach recession might induce damages far in excess of the value of the protected structures on the bluff.

The best way to cope with erosion when siting a structure on a bluff is to make allowances for it. The long-term erosion rates of the bluff may be determined by a number of methods, including the comparison of dated photos of the bluff with its present configuration or interviewing and comparing the observations of long-term area residents. In addition, studies of erosion rates are available in the literature, such as the Drexhage and Calkin (1981) study of bluff recession along the New York shoreline of Lake Ontario. The comparison of several methods allows the planner to estimate the average yearly bluff recession rate. This is multiplied by the planned design life of the structure to calculate the required minimum setback distance from the bluff. A residence which is designed for sixty years of use on a bluff receding at one foot per year must be at least sixty feet back from the current bluff face or it may one day have to be moved or abandoned. This setback should be compared to the applicable DEC setback regulations (Appendix II) and the larger of the two should be used in the design.

The importance of bluffs as sources of sediments is increased as rivers are altered by the construction of inland dams. The dams are constructed for flood control, hydropower generation, and other reasons, with the side effect of reducing the flow of sediments to the lake or ocean, because of sedimentation upstream of the dam. The seasonal floods which had previously swept large amounts of sediment downstream are also controlled by the dams. The loss of such natural sources of sediment may have serious consequences for the beaches which had been supplied (California Resources Agency, 1977).

4.2 Beaches

Beaches are constantly undergoing erosion and deposition through both onshore/offshore and shore-parallel sand movement, as described previously. Structures which extend from the shore into the water tend to interrupt the littoral current. These structures include: (1) jetties, erected on one or both sides of a river mouth, harbor, or other breaks in the shoreline to prevent sedimentation and blockage of the opening; (2) groins, which are built out from a beach or other shoreline for erosion control and beach growth; and (3) breakwaters, which are designed to provide shelter from wave activity.

The effect of these structures which extend out from the shore is to cause an accumulation of sediments on the up-current side of the structure, from which the littoral drift approaches, and a scouring or removal of sediments on the down-current side.

Jetties

While jetties and groins are supposed to interrupt the littoral current, the consequences of their use may not be acceptable to down-current property owners. Jetties are erected at a break in the shoreline to force the littoral current to drop its sand load and prevent the silting, sedimentation, or migration of the inlet. One jetty is placed on the up-current side of the inlet, and a second jetty may be constructed on the down-current side. The up-current beach will grow as a result of deposition until the sand spills around the end of the jetty, but the drift will have been diverted offshore so much that it will be returned to the beach considerably down-current of the jetties, if at all. As a result of the interruption of the littoral current, the beach immediately down-current will undergo recession as erosion and scour remove the sand (See Figure 4.1). For example, the Corps of Engineers estimated that the beach just down-current of the Shinnecock Inlet jetty system on Westhampton Beach, Long Island, receded 500 feet between 1940 and 1960 (Heikoff, 1980). This situation will generally necessitate the use of sand bypassing or periodic replenishment of sand.

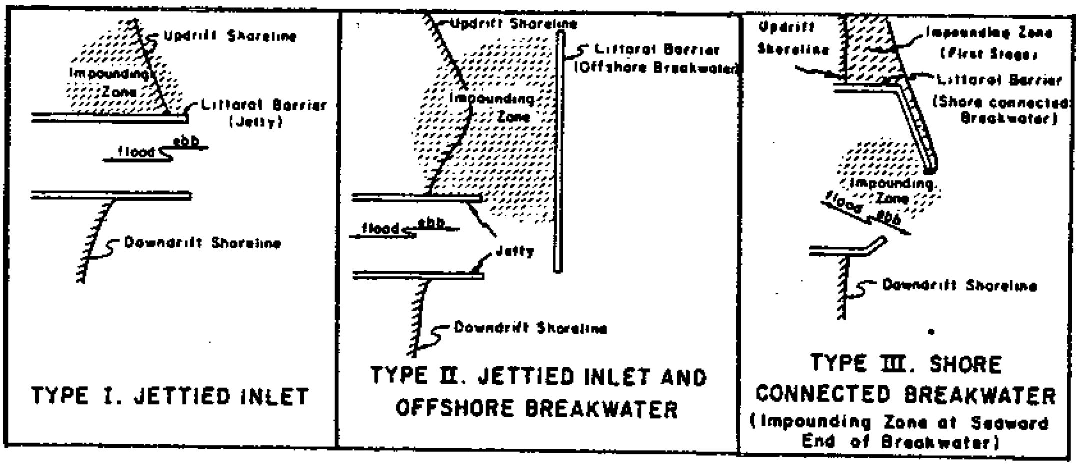


Figure 4.1 Shoreline modification because of jetty construction (Watts, 1966, P. 802)

Bypassing

Mechanical bypassing is the process whereby the sand dropped by the interrupted littoral current is collected for transport and redeposition on the down-current side of the inlet, providing a mechanical replacement for the littoral current. The bypassing may be achieved by land-based dredging plants fixed in place near the upcurrent beach, floating dredges, or land-based vehicles. The land-based system is the hydraulic equivalent of a vacuum cleaner, which is fixed in place far enough from shore to avoid becoming landlocked by sand, but not so far out as to fail to intercept the littoral flow. Floating dredges collect the sand hydraulically or mechanically for transport to the undernourished areas. The selection of which is the best method for a given project will depend on the specifics of the site, such as depth across the inlet or ease of land transport. The planner must consider that some form of sand replenishment will probably be necessitated by a jetty project, through bypassing or periodic beach nourishment with sand obtained from other sources.

Groins

Groins have an effect similar to jetties, although the goals differ. They are constructed perpendicular to the beach, on the down-current side of a beach owner's property. The purpose of the groin is to trap sand and build up the owner's beach. A group of groins spaced along a reach of shoreline, known as a groin field, may be constructed to stabilize a long section of beach. The groins are effective at trapping sand and allowing expansion of the protected beach, but the beach down-current from each groin and from the groin field may become severly eroded, as shown in Figure 4.2. This effect may be reduced by depositing sand in the protected zone immediately after construction of each groin. The littoral current would still be diverted around the groin, but less sand would be trapped and the impact down-current from the groin would be lessened. The planner must consider the legal consequences of starving the neighbor's beach to protect and enlarge his own.

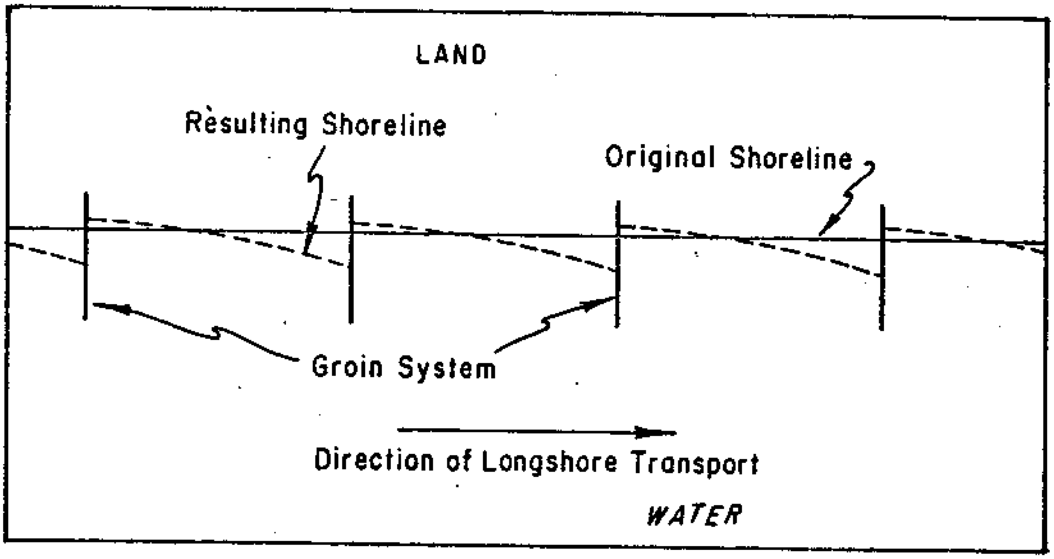


Figure 4.2 Shoreline modification by groins (CERC, 1977, p. 5-35)

Breakwaters

A breakwater may alter the deposition patterns of sand in the protected area, possibly creating the need for mechanical beach sand replenishment or bypassing.

Some measurable impacts are made on the shoreline ecology by the construction of these types of structures. Breakwaters have been observed to interfere with the migration of salmonid fry, which would not venture around the obstruction into deeper waters travelled by larger predators. The percentage of fine soils such as silts and clays increased in the bottom soils on the sheltered side of a breakwater, possibly inducing changes in the distribution, types, and concentrations of resident animal species (Shanks, 1978).

Bulkheads and Revetments

Beach structures designed to curb the removal of soil materials by erosion may similarly have unwanted side effects. Bulkheads and revetments are constructed out of rock, concrete, or other materials on the upper beach, parallel to the shoreline, to protect property or building foundations from wave attack. These structures are effective for deflecting wave run-up, but waves which break regularly on the face of the structure may cause toe scour, undermining the structure or promoting beach erosion and slope steepening. Severe storm waves which overtop such a structure will be contained by it and may wash out the backfill as the water drains laterally.

The placement of a single section of bulkhead may actually increase the erosion rate of adjacent unprotected shores and allow flanking of the bulkheaded shoreline. The planner should therefore consider the implementation of a single integrated structure in combination with neighboring beach owners (Dames and Moore, 1981).

4.3 Dunes

As stated in previous discussions, dunes are a major element in the natural control of beach erosion. Construction on the dunes which requires removal of natural vegetation and/or excavation of the dunes will probably lead to storm damage problems, both for the structure and for the lands behind the dune. Construction in and through the dune zone, especially the foredune area, must be avoided if possible. Many local zoning regulations currently forbid construction in primary dunes. For instance, the town of Easthampton, New York, amended its zoning ordinance in 1975 to regulate all structures, except for pedestrian walkways, on lots in the western part of the town fronting on the Atlantic Ocean. The structures must be located at least 100 feet inland of the contour line fifteen feet above mean sea level. If the existing primary dunes do not reach this elevation, they must be built up to the fifteen foot level using sand brought in from other sources, then be planted and fenced (Heikoff, 1980). DEC regulations also control the types of construction permitted in primary and secondary dunes, as discussed in Appendix B.

4.4 Wetlands

The flat, wide open nature and relatively low market value of the coastal wetlands environment has, in the past, made them a choice building location, both for industrial and residential development. The absence of large trees reduced clearing requirements and the site needed only to be drained or filled to prepare it for construction. The fill was often supplied by the dredging of channels to provide boating slips. Wetlands seemed to be ideal natural building sites and were so used. Between 1964 and 1971, approximately 4300 acres of tidal wetlands in Suffolk County, Long Island, were lost. This constituted over twenty-five percent of the total county tidal wetlands. Most of this land was used for construction of residential subdivisions for some 80,000 residents (O'Conner and Terry, 1972). Similar long term alteration of freshwater wetlands along the New

York shore of Lake Champlain is shown on Table 4-1. The total number of residences in three wetlands of combined area of 2700 acres rose from six to sixty in thirty five years (New England River Basins Commission, 1979). Similar expansion of development into wetlands may be observed elsewhere.

TABLE 4-1

NUMBERS OF RESIDENTIAL STRUCTURES ON FRESHWATER WETLANDS
NEW YORK SHORELINE OF LAKE CHAMPLAIN

DATE	KINGS BAY, CHAMPLAIN, NY (978 ACRES)	MONTY BAY BEEKMANTOWN, NY (531 ACRES)	AUSABLE MARSH AUSABLE, NY (1184 ACRES)
1939	0	6	0
1962	6	8	0
1974	11	28	21

(New England River Basins Commission, 1979, p.46)

Many construction and development techniques on wetlands are destructive to the wetland environment. If alteration of wetland water levels destroys the plants which require a saturated soil environment, the numerous animal populations may be forced to find new sanctuary, and the character of the wetland is changed permanently. By reducing the plant population, the capacity for absorption of seasonal flood waters is reduced. Buildings in adjacent areas which had relied on the wetlands for storm protection may then become more flood prone. In addition, lowering of the water table may cause permanent subsidence of the ground surface, also increasing storm flood potential (Clark, 1980). The dredging of channels for residential development of wetlands was often accompanied by the placement of spoil onto undredged areas, to fill and raise the land surface. This directly eliminates the plant life through burial and allows the highly organic soil and other pollutants to be rapidly leached into the canals by rainfall.

The modern awareness of the value of wetlands has led to the enactment of regulations to protect wetlands from construction or fill placement which would significantly alter them. Minor construction on wetlands or the development of adjacent areas may also have a significant impact and may be restricted. A roadway which occupies only a small portion of the total area of a wetland that it crosses may create an effective barrier to tidal flows and drainage, causing stagnation of blocked areas (Clark, 1980).

The low elevation of wetland environments causes groundwater flow from adjacent lands of higher elevation to be directed toward and into the wetland. If the adjacent areas are over-developed, or the developments have inadequate septic tank and leach field systems, a significant amount of pollutants leached into the groundwater will be funneled into the wetland. Contaminated surface water run-off has, in the past, been discharged directly into a wetlands area or into a stream or estuary which passes through a wetland. The pollutants imposed on the wetland environment may exceed its ability to assimilate them.

The biological populations of the wetland are also affected by development of adjacent areas. The more sensitive bird populations also may be driven off by noise pollution from nearby developments, roadways, or industry. Significant changes in quality of the wetlands water also may affect both land-based and aquatic organisms.

In short, many wetlands environments are burdened by the combined detrimental effects of coastal development, and may not be able to absorb the effects of new construction directly on or adjacent to them. Construction on wetlands is no longer generally permitted, but a developer might still make use of a site containing some wetlands. The planned structure may be sited on the upland portion of the parcel, reducing fill costs and leaving the natural wetlands to enhance the aesthetic value of the site. The relative costs of installing roadways and utilities may be reduced further by clustering the development on the uplands, if local zoning ordinances permit.

Roadways should be routed around wetlands if possible. If the roadway must pass through a section of wetland, it should either be elevated on piles or constructed with numerous openings for free water transfer beneath the road (Clark, 1980).

In general, the only structures permitted on fresh or saltwater wetlands for planners in the private sector are small, light duty pile supported structures such as pedestrian walkways, observation platforms, boathouses, docks, and wharves. Where construction of a planned coastal project will cause unavoidable destruction of certain areas of wetlands, an equal or greater amount of wetlands will be, or should be, required to be developed. Use of dredge spoils or other fill and replanting of appropriate plant species can restore damaged wetlands or create new ones (Clark, 1980).

4.5 Summary

Any coastal structure will have some impact on the environment in which it is placed. The planner must try to minimize these impacts, or the project will be altered or restricted by the appropriate regulatory agencies.

Bluff erosion must not be restrained entirely at the expense of down-current beaches, but conversely the use of improper construction methods may cause disastrous increases in erosion. Any coastal structure which interrupts the littoral flow may affect down-current beaches, inducing owners of such beaches to build similar sand interceptors, passing the loss of sand on down the coastline. Wetlands may be destroyed or altered by a variety of construction methods such as filling, draining, or dredging. This will result in loss of the benefits they provide, including wildlife habitats, biomass generation and flood protection.

It is the mitigation of such impacts which the regulatory agencies will encourage, and the planner must assess the possible impacts the particular project might impose, prior to application for the required permit(s).

CHAPTER 5

TRADE-OFFS IN COASTAL CONSTRUCTION

The use of cost-benefit analyses to select the alternative which best meets the desired goals was presented in Chapter 2. The following summary of some of the possible costs and benefits of a general coastal project will aid the planner in assessing the full range of these considerations for a specific project.

5.1 Costs

The costs of a coastal project are all items or quantities which are given up or spent to achieve the desired goal. Some may be assigned a monetary value, while others are of an aesthetic nature whose value is a subjective matter. The latter items might not be assigned a monetary value by the planner, but must be considered in making a planning judgment. Costs of assignable monetary value include planning, design, land purchase, site investigation, permit applications, materials, construction, maintenance, and insurance.

Planning

The cost of planning a small coastal structure may be minor compared to the total cost of the structure, but it may also be the most important. An effective planning process may pay for itself in savings by allowing selection of the best design to meet the site requirements, rather than using a "cookbook" design intended to be used over a broad range of conditions. Conversely, the planner may waste money by examining an unreasonably large number of alternatives to be sure of finding the optimal one, or planning may take so much time that the original problem worsens to a critical state, and becomes more costly to cure.

Design

The actual design of the coastal structure normally will be developed by an engineer and/or architect, who will be contracted by the planner but may also be the planner. The design will reflect the chosen planning scheme but may incorporate variations in materials or exact configuration to accommodate safety and durability constraints. The engineer will rely on prior experience with the available materials, construction practices, and successful projects to formulate a design which is a trade-off between safety, economy, and the planner's wishes. By comparing alternative designs with their individual costs, the engineer aids the planner in selecting the design which provides the best cost/safety compromise while satisfying the design goals. The use of the engineer's expertise is not inexpensive but, as with the cost of careful planning, it is money well-spent for a valuable structure or one on which costly structures rely.

Land Purchase

The purchase of land for siting of the coastal structure may be a major project expenditure. Prices will depend on the value and uses of adjacent land and surrounding regions, as well as the availability, usefulness, and aesthetic qualities of the land. The most economical land may not be the best choice. For example, a marina planner may choose to purchase a more expensive parcel of land which is difficult to develop to be sure that the marina will be located in easy reach of the user population.

Site Investigation

The design process requires an investigation of the prospective building site. The first step may be the surveying of the site. A two or three person survey crew may stake out the property bounds for future reference points, gather data to construct a topographic map of the site, and stake out points selected by the engineers for soil borings. The crew may locate later the corners of the structure prior to construction. For breakwater or jetty projects, the survey may include assessment of the near-shore underwater topography to allow estimation of the quantity of material needed for the project.

The next phase of site reconnaissance will often be a soils investigation. A series of soil borings and rock corings may be made at strategic locations beneath the future structure to establish the types and variation of soils across the site as portrayed by soil profiles, soil strengths, depth to bedrock, and rock quality. Soil strength and permeability may be determined by field tests as each boring progresses, or by performing more elaborate tests on retrieved samples in a soil testing laboratory. These tests will provide a measure of the physical properties of the soil in qualitative and/or quantitative terms, depending on the complexity (and consequent cost) of each test. These tests are needed to determine the minimum requirements for the structure stability and calculate the factor of safety of the design.

A large site and project may warrant the use of geophysical techniques to determine the subsurface bedrock topography and depth to groundwater. Depths to bedrock will be needed to assess the costs of excavation and foundations. Groundwater levels may be determined more accurately with piezometers (monitoring wells) emplaced during soil boring operations. The groundwater elevation will be correlated with laboratory or in-situ soil permeability values to estimate the extent of groundwater problems. Sampling of groundwater will yield the concentrations of salt and contaminants which may affect the selection of materials and protection treatments.

Site soil investigations are vital to the design process. Without these investigations, overly conservative design parameters will be assumed. However, if the designer has reliable data on the physical properties of the soil, substantial savings often are realized in the total project cost because the design is matched with the actual soil properties. The cost of a good soils investigation is money well spent.

Materials

The choice of construction materials will affect both the short and long-term costs of a coastal structure. The selection of a particular building material may be controlled by an aesthetic preference on the part of the planner, as in the selection of wood for a dock or walkway. The choice of foundation materials or construction materials for erosion control structures will generally be controlled by local availability, workability, and strength of the alternative materials.

For instance, a revetment might prove equally effective if constructed of concrete (set or precast), rock (cobbles or boulders), sandbags, or timber. Some of these might not be available close to the site and might have to be transported at prohibitive expense. Those which are available would be of differing costs.

The choice of material should be made only after consideration of many factors, such as the durability and expected design life, effectiveness, and aesthetic qualities of each choice. Wood might be cheaper than rock for a given application, but rock is more durable and will outlast the wood structure. With continually rising replacement costs, the long-term costs of stone might be less. The choice between stone cobbles or boulders of similar cost might be made on the basis of the effectiveness of each. In the case of a revetment, the smaller voids between cobbles might prove better at soil retention than boulders and therefore be the preferred choice.

Aesthetic considerations, particularly for coastal construction in the private sector, might dictate the use of a more expensive alternative for construction material. The choice of material consists of a trade-off between many factors, with the planner comparing the costs and benefits of each to select the best for the particular coastal structure.

Construction

The largest cost of a coastal structure will generally be the expense of its construction. This may include excavation, construction of access roads, dredging and spoil disposal, transport and placement of fill material, installation of the foundation, and construction or placement of the actual structure. As with materials, the cost and quality of contractors will vary regionally. Both the planner and engineer must monitor the construction to ensure against poor construction practices which would affect the quality or safety of the structure. Any flaws which are incorporated into the structure may impose an additional cost by shortening the design life or by necessitating later repairs.

Maintenance

Post-construction costs are imposed by monitoring, maintenance, and repair. Monitoring the performance and durability of the structure is an important phase of the planning process, as discussed previously. Monitoring may reveal a design or construction flaw which may compromise the structure or its intended function. The expense of monitoring may be compensated by the early detection of any such flaws, and monitoring should be continued throughout the life of the structure.

The cost of maintenance and repair also must be considered. It will be controlled by many factors including the durability of the construction materials and the difficulty of maintenance access. The cost of maintenance and repair will increase because of inflation over the life of the project. Some construction practices such as dredging will have to be repeated periodically. Similarly, regular beach replenishment is a maintenance cost, extending indefinitely into the future.

Abstract Costs

Many costs are imposed by coastal construction which are not easily assigned a value. The destruction of a wetlands area through filling, impoundment, drainage, dredging, or siltation may have far-reaching costs. These may include the depletion of commercial fish and shellfish populations, the loss of wildlife habitat, and an increase in flood potential for adjacent areas.

The granting of a permit for construction on or adjacent to wetlands may incur extra costs by requiring the builder to replace any wetlands destroyed by such construction. For instance, the construction of the Wandow River Terminal in Charlestown, South Carolina, included the replacement of ". . . any marsh acreage permanently destroyed by the project on a two-to-one ratio" (Kenney, 1980).

Improper or excessive construction in the foredune area behind a beach may prove detrimental to both the dune and beach. It could result in loss of the dune area and subsequent recession of the beach, eventual destruction of the original structures, and increased flood potential for areas behind the beach.

A cost imposed by a jetty, groin, or similar structure may be the increased erosion rates in the down-current direction, resulting in beach recession and property loss. This will not impose cost on the owner of such a structure unless the owner of the eroded area should take legal action.

Other examples of the costs incurred by development of the coastal zone are the loss of the pristine qualities of the natural coastal setting, increased traffic within sensitive environments, and degradation of groundwater quality through overpumping or surface contamination. The planner must attempt to assess all costs of a coastal project, both tangible and intangible.

5.2 Benefits

The benefits of a coastal structure may be numerous and are often project-specific. The typical benefits are discussed below.

Design Goals

An erosion control structure has the obvious benefit of slowing the erosion of a particular stretch of shoreline to an acceptable level. This preserves the beach for recreational use and protects the structures behind the beach from direct wave attack and the impacts of storm surge. The value of this type of benefit is the savings of property, both public and private, which would have been damaged or destroyed if no erosion control had been used.

Structures such as breakwaters which provide protection from large waves offer the benefit of calmer waters on their lee side. The sheltered area may serve many uses, including swimming access and recreational or commercial boat moorings. As such it offers benefits to a wide range of people and activities, and will generate additional revenue for public and private concerns. Similarly, the construction of a shoreline park or other public access area offers benefits to non-shoreline residents, while supplying revenue to some permanent residents of coastal towns who depend on the tourism industry.

Some structures offer benefits in terms of access. These include boat ramps, boathouses, docks, piers, and wharves. They perform a service, generally related to boating or swimming, by offering easier access to the water. Boathouses also offer protection of valuable property from environmental effects.

The primary benefit which many coastal residents derive is simply the pleasure of living on a shoreline. Many residents, and particularly part-year residents, may feel that the benefits derived by living on or near the ocean or a lake are worth virtually any cost.

Benefits of Regulation

Several benefits to the general public are offered by the DEC and COE permit process, although the planner may not immediately perceive them as such. One is the consideration given to the protection and preservation of the coastal environment. The permit process involves a public interest review which limits poor planning or construction practices which might have significant impacts on the coastal environment. Another is the review of the project design provided by the engineers of the Army Corps of Engineers. Their input, based on years of coastal design work, offers the benefits of increasing the safety of the design of the structure.

Abstract Benefits

Many of the costs and nearly all of the benefits described above are not easily assigned a monetary value. They may be of an aesthetic nature, such as the attractiveness of a coastal structure; they may be intangibles, such as the pleasure generated by experiencing a natural beach or wetland; or they may simply not be directly related to money, as in the benefits derived from a free public boat ramp. The planner must be able to compare the costs and benefits, monetary or otherwise, of different alternatives to reach a decision on which is the optimal one. The decision will be a judgment based on the preferences of the planner or planners.

Two planners may decide differently, given similar options. For instance, a choice of breakwater designs fabricated of interlocking precast concrete or large stone, both of equal cost, durability, and effectiveness, may be presented to two planners. One may prefer the aesthetic smooth and uniform lines of a concrete structure, and select it. The other may decide that the rock is preferable because it offers numerous rough surfaces and cavities for plant and animal marine life habitats. In addition, the same planner may select one or the other possibility as the optimal one, at different sites. The overriding considerations at one site may be of little or no issue at another.

5.3 Summary

Each alternative which the planner considers will have many assignable costs and benefits. Some of these will be monetary in nature, others abstract. The assessment of all costs and benefits for each alternative will allow their comparison on an equal basis, so that the most favorable alternative may be selected.

CHAPTER 6

DESIGN AND CONSTRUCTION CONSIDERATIONS

Many site and regional characteristics must be considered in the planning, design, and construction of a small-scale coastal structure. These characteristics will have a large influence on the ease, problems, or methods required for construction and on whether the permit application will be approved. The following describes some of the interacting site characteristics and resulting considerations for the construction of coastal structures.

6.1 Site Considerations

Many site considerations influence the final design of a small-scale coastal structure. These include soil and bedrock characteristics, environmental impacts, site fragility, site access, zoning, and insurance requirements.

Soil Characteristics

The coastal zone includes a large variety of soil types. Soils range from glacial tills, which are composed of a wide range of grain sizes, to more uniform sands, silts, clays, organic soils, and combinations of some or all of them. Differences in soil types will control the type of foundation used for a structure.

Sands or sandy soils, particularly when loose, have a poor resistance to erosion by direct wave attack. This may preclude the use of shallow foundations in areas which will be subjected to continued wave attack. Instead, the placement of a residence, boathouse, or similar structure on sands may require the use of piling.

Clayey soils, by contrast, are more resistant to the scouring effects of waves, so foundation design normally will not be controlled by scour. However, clayey soils have a very low permeability, which may complicate the design of septic systems for residential sites or marinas, and may necessitate the emplacement of a granular fill for this purpose.

All soils, but clays and silts in particular, undergo settlement when a load is applied, as from a structure. The settlement may occur locally from the structure weight or over a larger area because of drawdown of the water table by overpumping. Several laboratory and in-situ tests are available to assess this settlement. These settlements may be accommodated in the structure design or achieved prior to placement of the structure by preloading the soil with fill.

Some clays also exhibit tendencies for swelling and shrinking as groundwater conditions vary from wet to dry, respectively. If problems of this type have been experienced at neighboring sites, special foundation designs may be necessary.

A problem which may occur in silty soils is frost heaving. In cold weather, groundwater in the silt layers can be frozen in a continually expanding ice lens, lifting the soils and structures above. The foundation level must extend below frost depth to prevent heaving in silty soils. A map of the United States showing maximum average frost penetration depths is shown on Figure 6.1.

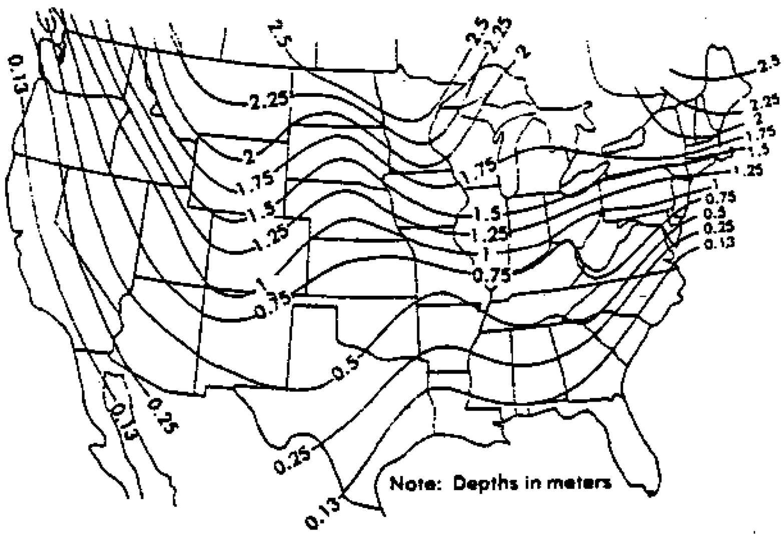


Figure 6.1 Maximum average frost penetration depths in U.S. (Sowers, 1979, p. 141)

For all soil types, and particularly for the softer soil deposits, the possibility of slope failure must be evaluated. If substantial modifications are made to the site topography, the possibility of a landslide or slope failure becomes significant. The removal of soil material from the base of a slope may also initiate a failure. The stability of all existing or created site slopes should be considered prior to modifying the site topography.

Bedrock Characteristics

The bedrock may be an important site consideration. If the bedrock outcrops or is at shallow depth, the planner may encounter problems with the installation of a septic system, the placement of access roads into the site, and the placement of underground utilities.

Two important characteristics of the bedrock material are the type of rock and the presence of discontinuities. Most types of competent rock are capable of supporting the loads imposed by a small-scale coastal structure. A possible exception is a soluble rock such as soft limestone which may undergo increased erosion through solution.

The overall behavior of a rock mass will be controlled by the presence, frequency, and orientation of discontinuities. The term discontinuity refers to imperfections in the rock mass, including faults, fractures and joints. Discontinuities will decrease the strength and increase the permeability of the rock mass. These factors have to be considered in site selection and design of the facility.

Wind Forces

The high levels of exposure to wind and water attack in the coastal environment must be considered. High winds during a hurricane or other storm create significant horizontal forces which must be included in the design. A frequently used parameter for wind resistant design is the annual extreme fastest wind speed thirty-three feet above ground with a 100-year mean recurrence interval, as shown in Figure 6.2. The design wind speeds for the New York region range from 70 to 90 mph.

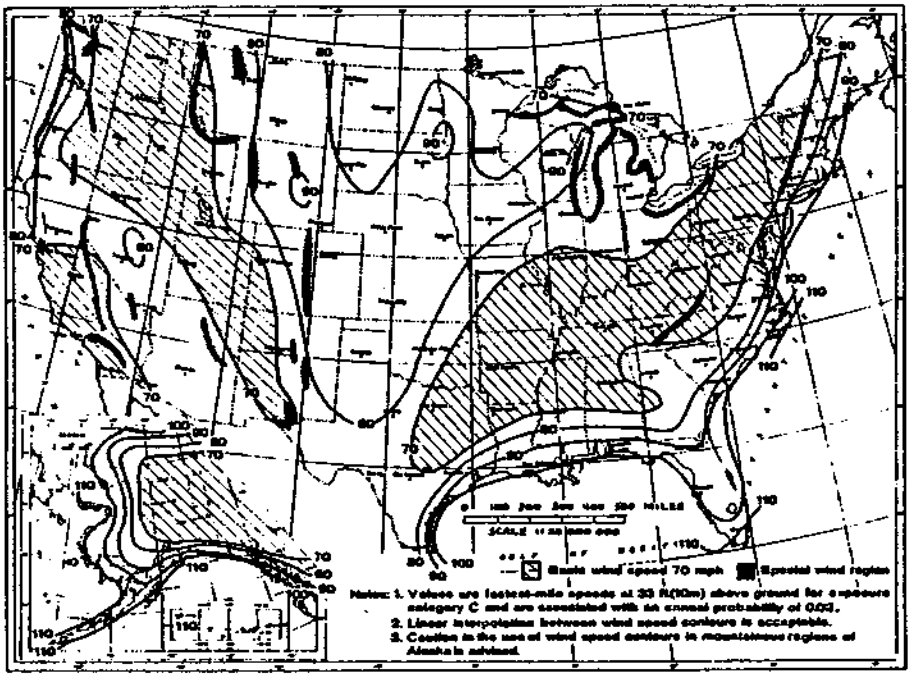


Figure 6.2 Annual extreme fastest wind speed thirty-three feet above ground with a 100-year mean recurrence interval (American National Standards Institute, 1982, p. 36)

Water Levels

Damage from water attack may be from seasonal flooding or be storm-induced and must be considered in structure placement and design. Seasonal water level variations, of greater concern in freshwater than salt, may be determined from many sources. For instance, the free Monthly Bulletin of Lake Levels for the Great Lakes published by the Army Corps of Engineers details current levels for each lake, six month lake level projections, and historic high and low water levels.

For coasts exposed to ocean environments, the National Ocean Survey publishes hydrographic charts detailing water depths and fetch lengths to assess the exposure of the site to wave action. They also publish tide tables containing predictions of high and low levels for one calendar year at primary stations, with a guide to convert the data to many secondary stations, along with the mean, spring, or diurnal ranges for all stations.

Data on storm level predictions are provided by the Federal Insurance Administration, as described in the next chapter. Apart from direct structural damage which seasonal and storm water level rises may impose, they cause short and long-term erosion of the exposed site areas which must be anticipated.

6.2 Construction Considerations

This section focuses on the types of difficulties and decision-making which are necessary in the construction of a small-scale coastal structure. Factors considered are site access, choice of materials, slope stability and groundwater infiltration during construction, use of fill, disposal of excavated materials, and erosion control.

Access

A frequent problem in coastal construction is one of access. The planner must consider how the construction equipment and materials will be brought to the site, and how excavated rock, soil, or dredge spoils will be removed. Access problems may be of a physical or legal nature. Consider a beach erosion project at the base of a high bluff, for which access is denied from either end of the beach by physical barriers. If the bluff is composed of stable rock or soil, an access road might be constructed down the face of the bluff specifically for the project. This would involve obtaining access permission from the owners of land behind the bluff, permits for altering the bluff face, difficulties of constructing the road, and control of the increased bluff erosion. Alternatively, the bluff may be marginally stable. Access in this case would have to be by water, raising problems of turbidity and suspended solids increases, leasing of a suitable barge or other transport, and offloading the material at the beachfront. The constraints imposed by the method of access may control the materials used and thereby the entire project design.

Access also may be controlled by regulatory factors. Permit approval for access and transportation of construction equipment and materials over a sensitive wetlands zone may be prohibitively difficult to obtain. Access through a dune system might be permitted only on agreement to rebuild and replant the dune after construction is completed. When the only means of access is across privately owned land, signed agreements must be obtained from each affected owner.

Removal of material could also pose some access difficulties. As stated previously, dredged material might be removed by trucks. For a small project requiring dredging, the trucks used to haul the spoil away may be the largest vehicles on the site and may be the sole cause of access problems. In this case, the use of water transportation for spoil removal may be preferred.

The planner must also consider long-term access paths. For an erosion control structure, the planner must develop the method by which maintenance operations will be accessed. A breakwater might have been initially constructed from a beach-based operation, but may be best accessed for maintenance from the water. Alternatively, a beach stabilization project may be constructed on an open and easily accessed beach which subsequently is developed with many residential structures built back of the beach. These new owners might resist the usage of their land for maintenance access.

Each site presents different accessing problems, and the planner must try to assess the possible access difficulties, both in the short and long-term.

Construction Materials

The acquisition of the desired construction materials is a problem which should be addressed by the planner. As stated previously, the cost and availability of specific materials may vary considerably from one region to another. If the planner has selected a material which is not available locally and must be brought some distance, the difficulties of transporting the material may control the rate and cost of construction.

Slope Stability

Slope stability problems may be encountered during construction, depending on the slope angles, excavation required, and the site soil conditions. The analysis of slope failure is out of the province of the planner, but should be expected of the designer.

Slope failures can be disastrous, and may destroy equipment, materials, and the structure. Slope failure normally can be avoided by using retaining structures, low excavation slope angles, and by avoiding overloading the slopes with fill or other construction materials.

Infiltration

The leakage of water into excavated areas of the site is a common problem. In sandy or gravelly soils common to coastal zones, the rapid infiltration rate may cause considerable problems during construction. The rate is dependent on the soil permeability, depth to the groundwater table, and boundary conditions which affect the rate of recharge. These factors should be assessed during the site investigation so that groundwater infiltration problems may be planned for. The planner should not be surprised, however, to find that a site excavated into clayey soils for which no infiltration problems had been predicted suddenly yields large amounts of groundwater through previously undetected sand seams. Groundwater infiltration, especially when unexpected, causes delays, pumping difficulties, and increases safety hazards.

Excavation/Fill

Many coastal structure projects will require fill material for increasing the site elevation, adjusting the site contours or drainage patterns, and constructing roadways. The planner must assess the ease or difficulty of obtaining the proper types of fill material needed, including the hauling distances and unit costs.

Several modes of coastal construction will require the disposal of earth materials. If a project requires excavation and blasting of rock material, the excavated boulders will have to be removed to a predetermined disposal site. A more difficult disposal problem is posed by dredging spoils. These are commonly dumped in estuarine or open waters, pumped to lagoons, or diked and levied into coastal fill areas. Each method has some impact on the coastal environment, and is therefore regulated. The planner should consult with the appropriate regulatory agency to assess the most feasible disposal method for the project.

Following the completion of construction activities, the site should be immediately replanted with vegetation to retard erosion. If the site is a beach or dune site, beach grasses similar to the native forms should be planted. Where non-natural vegetation is planted in a saltwater coastal site, care should be taken to ensure that the planted varieties are resistant to saline spray and periodic immersion in saltwater during storm floods.

6.3 Summary

Many site considerations must be acknowledged by the planner. These include the soil types, bedrock depths and characteristics, environmental forces such as maximum wind loads and flood stage water levels, and the fragility of the site environment. Considerations involved in construction of the project include access, materials, slope stability, groundwater problems, and excavation. Full understanding of these considerations will be necessary for structure evaluation and mitigation of environmental impact.

CHAPTER 7

REGULATIONS AND PERMIT PROCESSES

Prior to the construction of a coastal structure, a permit generally will be required. The following sections discuss the rationale behind requiring permits, a description of the various permitting agencies, and the permit application procedure for each.

7.1 Justification of Regulations

Perhaps the best perspective on the need for controls on coastal construction may be gained by looking at a section of coastline which was developed prior to the enactment of such constraints. The shoreline is frequently cluttered with residential structures only a few feet apart, wetlands have been filled, modified, or destroyed for construction sites, dunes have been destroyed through poor construction practices, and the natural character of the coastline has, in general, been altered permanently. Regulations governing construction in the coastal zone are intended to curb the negative environmental impacts of poor construction and development practices. They are enacted to ensure that the planned project conforms to the "general public interest." The regulations must protect the individual and community rights of those affected by the proposed construction.

Regulation of construction in the coastal zone is aimed at protection of the coastal environment, both biological and physical. The environmental impact of a coastal project may be documented through evaluation procedures which allow both the regulatory agency and the planner to consider the probable consequences and side effects of the proposed activity, and which may reveal design modifications to reduce the environmental impact of the structure.

One goal of coastal regulations is the conservation of wetland areas, both fresh and saltwater. A large percentage of the total wetland has been destroyed or irrevocably polluted in the past by improper or excessive construction on or adjacent to wetland areas. Construction may still be performed in these areas, but the planner will need to have a valid justification and may be required to replace all destroyed wetlands with an equal area of new ones.

The second goal is the protection of individual and community rights. In general this means that construction which would benefit a private concern while infringing on the rights of others will, in most cases, not be permitted. The development or alteration of a wetlands area which may result in the loss of its many benefits to the biological and human coastal community will require a permit or will be prohibited. The construction of facilities in a foredune area which would destroy the dune and increase the flood potential behind it may be halted by regulatory agencies. The design and planning of beach growth structures which adversely affect neighboring beaches will be subjected to review and revision. The regulations are enacted to serve the interests of all parties while ensuring that the available coastal resources will be put to the best present uses and yet will be available for the benefit of future generations.

7.2 Regulatory Agencies and Permit Application Processes

The planner of a shoreline structure in New York State will need to obtain permits from three separate agencies prior to construction. They are the local government, the Department of Environmental Conservation (DEC), and the U.S. Army Corps of Engineers (COE). While specific state requirements may vary, the general aspects of the state permit application procedures described below will be applicable to coastal projects in any state. The order of permit application and issuance is usually local, then state and federal. In general, a DEC permit must be issued or at least be in the process of evaluation before the COE will make a decision on the application for the project (Snow, et al., 1981).

7.3 Local Regulations

The assessment of local regulations is left to the planner. Such regulations may entail zoning ordinances which must be observed, construction permit requirements, or aesthetic reviews and design input for the planned structure. Regulations may vary between towns and/or counties. In some cases, the authority for issuing permits will have been transferred to a local government by DEC, but such regulations will be similar to those enforced by DEC. The planner should be aware of all ordinances which might apply to the proposed structure early in the planning process to enable their accommodation in the design.

Zoning regulations are the most commonly used method for towns, cities, or counties to ensure that minimum standards are met in new construction or development. Nearly all coastal areas, fresh or saltwater, are regulated by some set of zoning ordinances, and the planner must review all applicable regulations prior to designing the structure and/or selecting the exact placement of the structure.

Zoning regulations may be enforced by the county and city or town in which the structure will be located. The regulations may reduce the value of an owner's property by restricting the types of uses to which the property may be put or by disallowing the construction of the desired coastal project on a particular site. The property owner is not entitled to compensation for such loss in value, but may appeal for a variance.

Variances

The New York State zoning laws contain provisions for a local zoning board of appeals to "vary or modify" the application of a particular ordinance if there are significant problems with compliance, or if such compliance would create unnecessary hardships for the owner. The validity of such complaints are judged by one of two tests. The "practical difficulty" test is used for situations in which coverage or setback requirements negate the use of the site because of lot size, shape, topography, or other characteristics. The "unnecessary hardship" test is applied when an owner claims he or she can not obtain a reasonable rate of return from the uses of the site which are permitted and that the proposed use will not alter significantly the characteristics of the neighborhood or immediate area. If the appeal is denied in either case, the owner may continue the appeal to the New York Supreme Court (Heikoff, 1980). However, the delays and complications of such appeal processes tend to emphasize the advisability of consideration of local and state zoning regulations early in the planning phases of a coastal project, and formulating a design which will comply with them.

7.4 National Flood Insurance Program Regulations

Another local regulatory program which may affect the design and placement of structures in coastal zones results from flood insurance requirements. A new coastal structure, or a substantial improvement on an existing structure, will be subject to local flood plain management regulations in a community which participates in the National Flood Insurance Program (NFIP). Currently, over 17,000 communities and counties participate in the program, which is administered by the Federal Insurance Agency (FIA) of the Federal Emergency Management Agency (FEMA).

Flood Risk Maps

A community which contains special flood hazard areas is so notified by FEMA through issuance of a Flood Hazard Boundary Map (FHBM) or, after performance of a risk study and establishment of the risk premium rates, a Flood Insurance Rate Map (FIRM) of the community. The detail of the flood risk information contained on the map dictates the extent of regulations which would need to be adopted for participation. Within six months of issuance of a FHBM or FIRM, the community must adopt local flood plain management regulations which meet or exceed the minimum standards set forth in the NFIP regulations, Title 44 of the Code of Federal Regulations, Part 60. A summary of these minimum standards is presented in Appendix A. Once the community meets these and other eligibility requirements, local insurance agents can sell federally supported flood insurance to community residents. The actuarial insurance rates for new construction will be calculated based on the safety of the structure from the estimated flood risk.

While community participation in the program is voluntary, individual compliance with the minimum standards for activities in flood plains is not. Any community in New York State which fails to meet the eligibility requirements or is declared ineligible by FEMA is regulated by the Department of Environmental Conservation (DEC) for the period of ineligibility. The DEC standards, nearly identical to those of FEMA, are summarized in the first section of Appendix B.

The flood level reference for the flood plain management standards is the Base Flood Elevation (BFE). This is the maximum water level attained at each location in the community during the 100-year flood, that with a one percent probability of occurring in any given year. In general, all new construction or substantial improvements to an existing structure must have the lowest habitable floor elevated to or above the BFE.

The goal of this program is to mitigate future flood losses through the practice on the community level of wise flood plain management techniques. As older facilities are replaced by new construction built to good flood resistant standards, the flood loss risk, and therefore the actuarial insurance rates, will reduce.

7.5 State and Federal Agencies

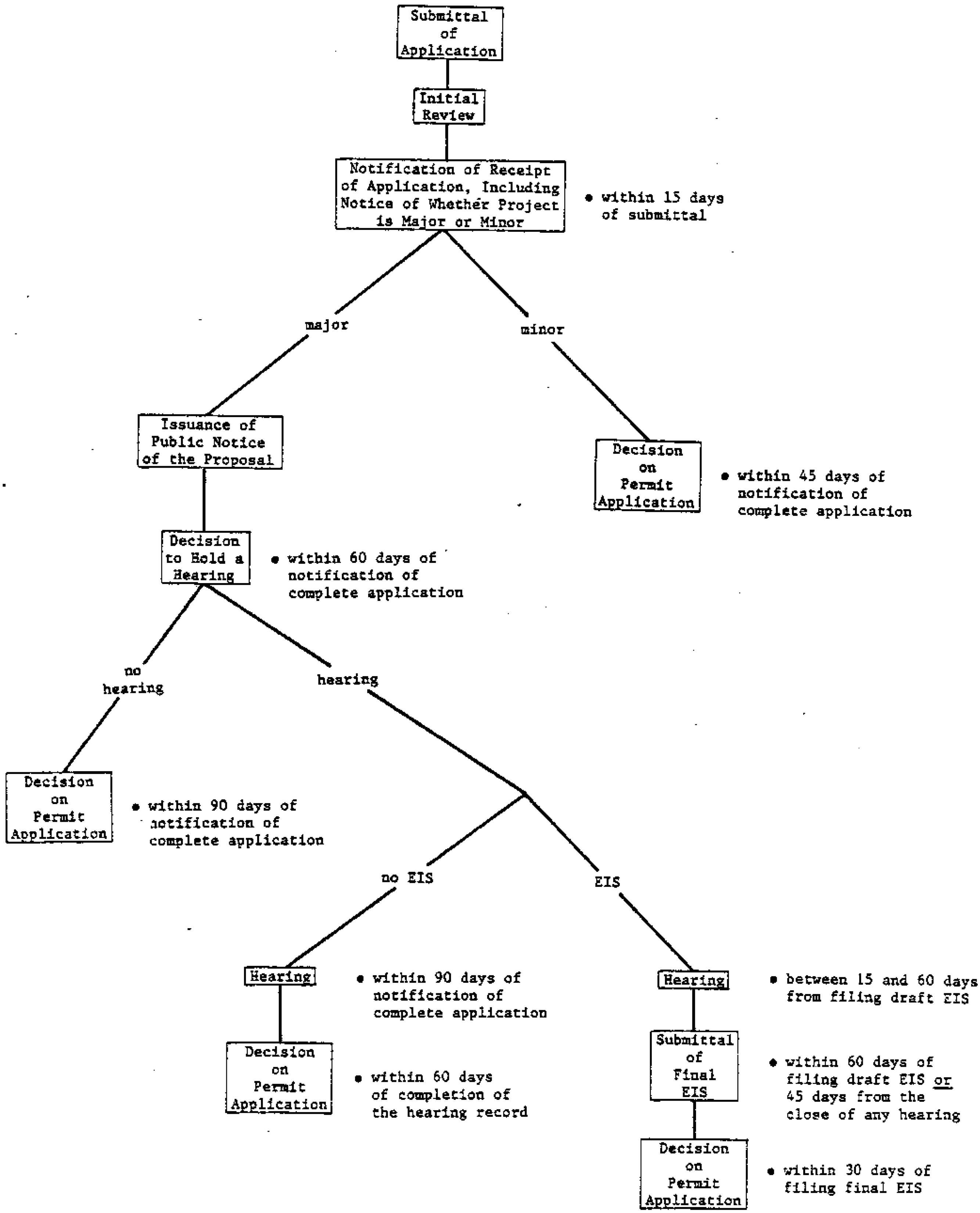
An integral part of both the New York State and Federal permit review procedures is the assessment of the impact that regulated activities will have on the coastal environment. The evaluation of such impacts is comprehensive and generally involves the balancing of social, economic, and environmental considerations to determine compatibility of the project with the public interest. The environmental effects of the proposed project will be documented by the preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS). The type of report format required by DEC or COE will depend on the scope and magnitude of the project, the amount of data available on which to base an informed regulatory decision, the degree of environmental impact, and other factors which may apply to a particular proposal. DEC and COE review procedures, permit requirements, and EIS documentation differ significantly, and as such the aspects of each program are discussed separately below.

7.6 Department of Environmental Conservation

The New York State DEC permit review procedures are standardized by the Uniform Procedures Act, Article 70 of the Environmental Conservation Law (6NYCRR Part 621)[1]. The process is shown by the flowchart in Figure 7.1.

1. This notation is used throughout this section. 6NYCRR Part 621 designates Title 6 of the New York Codes, Rules and Regulations, Part 621.

Figure 7.1
DEC Application Review
Flow Chart



Proposed activities which will impose negligible environmental impact only require that the applicant submit a letter of notification to DEC. The department will review the letter and will, within fifteen days, send the applicant either a written letter of permission or a notification that the activity may directly or indirectly alter or impair the environment and as such will require a permit.

Applications

The permit review process is initiated when the applicant submits a completed DEC application which will include:

- a properly completed DEC application form, where applicable
- the appropriate fee, being the fee for a single permit application or, for multiple permit applications, the larger of eighty percent of the total or the highest single fee
- a list of permits which the applicant knows will be required from another agency or governing body and the application status of each
- plan and profile sketches of the proposed project and map at a scale of 1:24000 or larger showing its location

Initial Review Process

The DEC will perform an initial review of the project to determine whether or not the project will require additional permits. If so, the department will request the applicant to complete the remaining forms so that they may be reviewed simultaneously. The intent is to eliminate duplication and consolidate the review process. If, instead, the applicant feels that the applications should be reviewed one at a time, this may be allowed by the regional permit administrator.

Within fifteen days of receipt of the application, the department will send the applicant notice of whether the application is complete and whether the project is considered major or minor. If the department fails to provide the notification, the application is automatically considered complete fifteen days after it is received by the department. A summary of major and minor activities involving the construction of small-scale coastal structures is presented in Appendix B.

Environmental Impact Assessment

To aid in determining whether or not the proposed activity will impose a significant environmental impact, the DEC uses an Environmental Assessment Form (EAF). The form is completed by the applicant and provides information on the project purpose, location, and potential environmental impact. The EAF may be sufficient for DEC to assess the potential impact of the project, particularly if such impacts will be small or negligible, or it may indicate the need for preparation of the more complex and exacting Environmental Impact Statement (EIS). In the latter case, the application would not be accepted as complete by DEC until the draft EIS had been prepared either by DEC or prepared by the applicant and accepted by DEC.

The decision to require the preparation of an EIS is based on the criteria set forth in the State Environmental Quality Review Act (SEQR §8-0113, Environmental Conservation Law). The criteria are indicators of significant effects on the environment which may be caused by the proposed action and include:

- substantial adverse change in existing air quality, water quality, or noise levels
- a substantial increase in potential for erosion, flooding, or drainage problems
- the removal or destruction of large quantities of vegetation or fauna
- impacts on a significant habitat area
- encouragement of attraction of a large number of people to a place or places for more than a few days, compared with the number of people who would otherwise come
- substantial change in the use, or intensity of use, of land or other natural resources or in their capacity to support existing uses
- changes in two or more elements of the environment, no one of which has a significant effect on the environment but which when taken together result in a substantial adverse impact on the environment

(6NYCRR §617.11)

If the DEC decides that an EIS is required, the Commissioner will notify the applicant, who must then begin to prepare an EIS. If the applicant so desires, and if sufficient staff and resources are available, the DEC will prepare the EIA at the applicant's expense. The fee to be charged will not exceed two percent of the total project cost for residential projects or one half of one percent of the total project cost for non-residential construction projects (6NYCRR, §617.17).

An EIS may be of two forms, draft or final. The need for a final EIS is eliminated if, based on the findings of the draft EIS, DEC determines that the proposed project will not have a significant effect on the environment.

The emphasis in preparing an EIS is on clear, concise language that may be easily understood by the public. The body of all draft and EIS's should contain at least the following:

- concise description of the proposed action, its purpose and need
- concise description of the environmental setting of the areas to be affected
- statement of the important environmental effects of the proposed action, including short- and long-term effects and typical associated environmental effects
- identification and brief discussion of any adverse environmental effects which cannot be avoided if the proposed action is implemented
- description and evaluation of reasonable alternatives to the action which would achieve the same or similar objectives, including the no-action alternative
- identification of any irreversible and irretrievable resource commitments the project would entail
- description of mitigation measures to minimize the adverse environmental impacts
- description of any growth inducing aspects of the proposed project
- discussion of effects on energy use and conservation
- list of all studies, reports, or other information used to prepare the statement
- final EIS should include copies or a summary of all substantive comments received along with the response to such comments, and identification of all changes made to draft EIS

(6NYCRR §617.14)

Review Process

If DEC has designated the project to be a major one, the department publishes notice of the application, regardless of whether an EIS is required or not. DEC then allows at least two weeks for public comment. The applicant will probably be required to publish notice of the proposal in a newspaper of general circulation in the area where the proposed activity will take place. Following review of the application and possible discussion of project details with the applicant, the DEC will decide if a hearing is required. Hearings are generally held if relevant and substantial issues have been raised by the public, or if project modifications suggested by DEC to reduce environmental impact have been rejected by the applicant, or if for various reasons the permit is likely to be denied. The decision to hold a hearing is made by the DEC within sixty days of notification of a complete application and the hearing will begin within ninety days of notification. If an EIS is required, the hearing will commence no less than fifteen days and no more than sixty days after the filing of the draft EIS. If denial is likely, the applicant may withdraw the permit application and re-submit a modified version or agree to the hearing, in which case the applicant is responsible for both the costs of preparation of the record of the proceedings and of the hearing room.

The final EIS will be prepared within sixty days of filing the draft EIS or forty-five days after the close of any hearing. The DEC will make a decision on whether or not to approve the proposed project within thirty days of filing the final EIS (6NYCRR, §617.8 and 617.9).

The final decision by DEC on projects which have required a hearing, but no EIS, will be made within sixty days of the date of completion of the record of the hearing. For major projects which do not require a hearing, a decision will be made within ninety days from the date that the application is accepted as complete. Minor projects, which do not require public notice, will receive a decision within forty-five days. If these time limits are not met, the applicant should notify the DEC by certified mail. If no answer is received within five business days, the permit is automatically granted.

7.7 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (COE) has been involved in the regulation of certain activities in waterways since 1890. The main objective of such Corps activities in the past has been the protection of navigation. Current laws have expanded COE's responsibilities to include consideration of the full public interest with regard to construction activities in national waters. This "public interest review" is a dynamic process which varies the weight given to each public interest factor in light of the importance of other such factors in a particular situation (33 CFR §320.1)[1]. The factors considered when evaluating a proposed action include: conservation, economics, aesthetics, general environmental concerns,

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1. This notation is used throughout this section. 33 CFR §320.1 designates Title 33 of the Code of Federal Regulations, Part 320, Section 320.1.

wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, and the needs and welfare of the people (33 CFR §320.4). The permit review process followed by COE is shown in flowchart form in Figure 7.2.

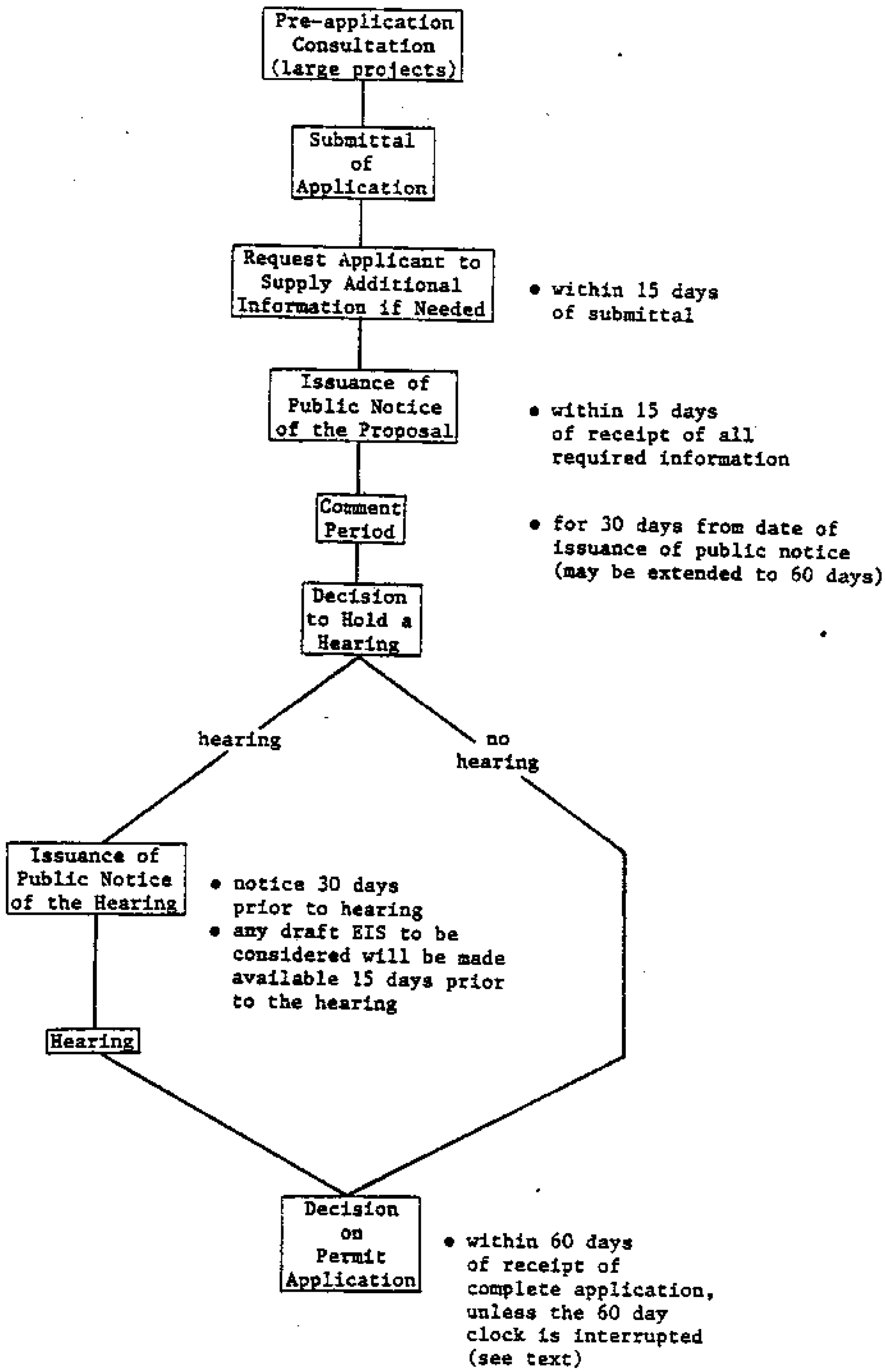
COE Permits

The permits issued by COE take on four different forms: letters of permission, general regional permits, general nationwide permits, and individual permits. The first three types require no public notice and their procedures are designed to reduce COE paperwork and delay. In addition, the applications for these types may require considerably less documentation than an application for an individual permit; applicants should consult with the local district office to see if the proposed activity may be covered by one of these permits.

A letter of permission may be issued if the district engineer reviews the application and judges that the proposed work will be minor, will not have a significant individual or cumulative impact on the environment, and should encounter no appreciable opposition. Letters of permission are not issued for the transport or discharge of dredge or fill material.

General permits, both regional and national, provide a blanket letter of authorization over an extended geographical area for activities which have a minimal impact on environmental quality and

Figure 7.2
COE Application Review
Flow Chart



comply with specific conditions outlined in the permit. If the district engineer, upon reviewing the application, determines that the activity is in compliance with the general permit provisions, the applicant will be advised that no further authorization is required. A summary of the different regional and nationwide general permits and their provisions is provided in Appendix C. If the district or division engineer determines for a particular project that concerns for the aquatic environment are not being met, they may exercise the discretionary authority to override the general permit and require an individual permit application and review. Furthermore, a general permit may be revoked by COE if it is determined that it is no longer in the public interest, following which all activities which the permit would have covered will be handled as applications for individual permits. All general permits are reviewed at least every five years and are modified, reissued, or revoked at that time.

A summary of projects requiring individual permits is also provided in Appendix C. The process of application for individual permits may begin, for large projects, with a pre-application consultation to allow the district staff to advise the applicant of data gathering efforts or specific information which may be required for environmental reviews or other federal action.

Permit Application

An application for an individual permit is made either on engineering form 4345 (Figure 7.3) or on a joint application form (Figure 7.4). The latter is a variation of the application form used to facilitate coordination of state (DEC) and COE application procedures. An application must include a complete description of

Figure 7.3
Engineering Application Form 4345

APPLICATION FOR A DEPARTMENT OF THE ARMY PERMIT
For use of this form, see EP 1145–2–1

The Department of the Army permit program is authorized by Section 10 of the River and Harbor Act of 1899, Section 404 of P. L. 92–500 and Section 103 of P. L. 92–532. These laws require permits authorizing structures and work in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Information provided in ENG Form 4345 will be used in evaluating the application for a permit. Information in the application is made a matter of public record through issuance of a public notice. Disclosure of the information requested is voluntary; however, the data requested are necessary in order to communicate with the applicant and to evaluate the permit application. If necessary information is not provided, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and checklist) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

1. Application number (To be assigned by Corps)

2. Date

Day Mo. Yr.

3. For Corps use only.

4. Name and address of applicant.

Telephone no. during business hours
A/C ( ) ____________
A/C ( ) ____________

5. Name, address and title of authorized agent.

Telephone no. during business hours
A/C ( ) ____________
A/C ( ) ____________

6. Describe in detail the proposed activity, its purpose and intended use (private, public, commercial or other) including description of the type of structures, if any to be erected on fills, or pile or float–supported platforms, the type, composition and quantity of materials to be discharged or dumped and means of conveyance, and the source of discharge or fill material. If additional space is needed, use Block 14.

7. Names, addresses and telephone numbers of adjoining property owners, lessees, etc., whose property also adjoins the waterway.

8. Location where proposed activity exists or will occur.

Address:

Street, road or other descriptive location

In or near city or town

County State Zip Code

Tax Assessors Description: (If known)

Map No. Subdiv. No. Lot No.

Sec. Twp. Rge.

9. Name of waterway at location of the activity.

10. Date activity is proposed to commence. ____________

Date activity is expected to be completed ____________

11. Is any portion of the activity for which authorization is sought now complete? ☐ YES ☐ NO
If answer is "Yes" give reasons in the remark section. Month and year the activity was completed ____________. Indicate the existing work on the drawings.

12. List all approvals or certifications required by other federal, interstate, state or local agencies for any structures, construction, discharges, deposits or other activities described in this application.

Issuing Agency	Type Approval	Identification No.	Date of Application	Date of Approval

13. Has any agency denied approval for the activity described herein or for any activity directly related to the activity described herein?

☐ Yes ☐ No (If "Yes" explain in remarks)

14. Remarks (Checklist, Appendix H for additional information required for certain activities).

15. Application is hereby made for a permit or permits to authorize the activities described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

/ / ____________
Signature of Applicant or Authorized Agent

The application must be signed by the applicant; however, it may be signed by a duly authorized agent (named in Item 5) if this form is accompanied by a statement by the applicant designating the agent and agreeing to furnish upon request, supplemental information in support of the application.

18 U. S. C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of The United States knowingly and willfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false fictitious or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than five years, or both. Do not send a permit processing fee with this application. The appropriate fee will be assessed when a permit is issued.

Figure 7.4
Joint Application Form

New York State
Department of Environmental Conservation

Applicable to Regions 6, 7, 8 & 9
Addresses on back of page

Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

JOINT
APPLICATION FOR PERMIT

DEC Application No. ____________

NCBCO-S Corps of Engineers Application No. ____________

☐ Article 15 (STREAM PROTECTION) Environmental Conservation Law.
- ☐ For the construction, reconstruction or repair of a DAM or other impoundment structure.
- ☐ For the construction, reconstruction or repair of any permanent DOCK, pier or wharf; and any dock, pier or wharf, built on open work supports, which has a top surface area of more than 200 square feet.
- ☐ For the disturbance of a STREAM BED or excavation in or fill of navigable waters.

☐ Article 24 (FRESHWATER WETLANDS) Environmental Conservation Law.
☐ Article 25 (TIDAL WETLANDS) Environmental Conservation Law.
☐ Section 10 (RIVER & HARBOR ACT OF 1899) for structures and work in navigable waters of the U.S.
☐ Section 103 (MARINE PROTECTION RESEARCH & SANCTUARIES ACT OF 1972) for ocean disposal.
☐ Section 404 (FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972) for disposal of dredged or fill material in waters of the United States.

READ INSTRUCTIONS ON BACK BEFORE COMPLETING THIS APPLICATION. PLEASE TYPE OR PRINT CLEARLY IN INK.

1. NAME OF APPLICANT | TELEPHONE NO. | 2. NAME OF OWNER (If different from applicant)

STREET ADDRESS | STREET ADDRESS

POST OFFICE | STATE | ZIP CODE | POST OFFICE | STATE | ZIP CODE

3. NAME AND LOCATION OF STREAM OR BODY OF WATER
Stream or Body of Water | Town or City | County

IF UNNAMED, LOCATE BY GIVING DISTANCE AND DIRECTION FROM A COMMONLY ACCEPTED AND IDENTIFIABLE LANDMARK:

4. PROPOSED USE ☐ Private ☐ Public ☐ Commercial | 5. LOCATION OF WORK. ADDRESS ON WATERBODY OR ROAD | 6. WILL PROJECT UTILIZE STATE-OWNED LAND? ☐ Yes ☐ No

7. TYPE AND EXTENT OF WORK (Feet of rip-rap of new channel; cubic yards of material to be removed, draining, dredging, filling and location of disposal sites; type of structures to be installed, etc.)

8. PROPOSED STARTING DATE | 9. APPROXIMATE COMPLETION DATE | 10. IF A DAM OR OBSTRUCTION, INDICATE
Height: ____________ Size of Pond Created: ____________

11. NAME AND ADDRESS OF OFFICIAL NEWSPAPER OF LOCALITY WHERE PROPOSED WORKS ARE LOCATED (only for projects involving Freshwater Wetlands.)

12. NAME, MAILING ADDRESSES AND TELEPHONE NUMBERS OF OWNERS OF PROPERTY ADJOINING THE WORK

13. IS ANY PORTION OF THE ACTIVITY FOR WHICH AUTHORIZATION IS SOUGHT NOW COMPLETE? ☐ Yes ☐ No
If "Yes", give reasons in the remarks. Month and year the activity was completed. Indicate the existing work on the drawings.

14. REMARKS:

15. CERTIFICATION:

I hereby affirm under penalty of perjury that information provided on this form and all attachments submitted herewith is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to Section 210.45 of the State Penal Law. As a condition to the issuance of a permit, the applicant accepts full legal responsibility for all damage, direct or indirect, of whatever nature, and by whomever suffered, arising out of the project described herein and agrees to indemnify and save harmless the State from suits, actions, damages and costs of every name and description resulting from the said project.

In addition, Federal Law, 18 U.S.C. Section 1001 provides for a fine of not more than $10,000 or imprisonment for not more than five years, or both; where an applicant knowingly and willfully falsifies, conceals or covers up a material fact; or knowingly makes or uses a false, fictitious or fraudulent statement.

____________ DATE ____________ SIGNATURE

95-19-3 (2/78)

the proposed work including all necessary drawings, sketches or plans needed for public notice, statement of the location, purpose and intended use of the project, schedule of construction, names and addresses of adjacent structures, and a list of authorizations required by other federal, interstate, state or local agencies, including all approvals received or denials already made (33 CFR §325.1).

Review Process

The COE district engineer will review the application and will, within fifteen days, request from the applicant any additional information required for further processing. Within fifteen days from receipt of all required information, the district engineer will issue public notice of the proposal. A revised, corrected, or supplemental public notice may also be issued later if any significant changes in the application are made. The comment period for public notice is usually thirty days, but may be extended to sixty days. The applicant will be given an opportunity to propose to COE a resolution or rebuttal to the issues raised by public comments.

COE will decide to hold one or more public hearings in connection with the review of an application if such a hearing will aid in making a decision on the application or if modification or denial of the application is likely. In addition, any member of the public may request in writing, during the comment period, that a hearing be held to consider the pertinent issues of the application. Such requests will be granted unless the district engineer determines that the issues raised are insubstantial, which the requesting parties will be informed of in writing. The decision to hold a hearing will be indicated by a public notice issued by COE at least thirty days prior to the hearing. If the content of a draft EIS is to be considered at the hearing, the district engineer will make the draft EIS available to the public at least fifteen days prior to the hearing.

Environmental Impact Assessment

Each application which is submitted is subjected to some degree of environmental evaluation. For most cases, a public interest decision is made based on an Environmental Assessment (EA). On occasion, a project is applied for which may have severe or far-reaching impacts on the quality of the human environment, requiring the preparation of an Environmental Impact Statement (EIS).

Both the EA and EIS are prepared by COE. However, the district or division engineer may require the applicant to provide, or fund the research costs of, obtaining information needed to prepare the necessary document. For large projects, the pre-application consultation provides the applicant with advance notice of the types of information which will be required.

An EA is generally less than fifteen pages in length and includes a brief discussion of the need for the proposed action, its environmental impacts, alternatives to the proposed action, and a list of the agencies, interest groups, and members of the public consulted (33 CFR §230.9). The EA will conclude with a determination that an EIS is required or with the inclusion of a Finding of No Significant Impact form (FONSI). The FONSI will present briefly the reasons why the proposed project will not exert a significant impact on the quality of the human environment, by referencing the EA.

An EIS prepared by COE differs significantly in scope and magnitude from that of the DEC. Where the need for an EIS is indicated and the proposed action is one for which a permit could be issued, the preparation of an EIS is initiated. If, however, the proposal does not appear to be in the public interest and/or the applicant makes no attempt to minimize project related impacts on the environment, no EIS is prepared because ultimately the permit application will be denied.

The type and quantity of information needed to prepare an EIS varies with each project, but generally includes: a complete description of the proposed activity and of all effects resulting from its completion, baseline data on the aquatic and terrestrial environment within the general project area (such studies generally run a minimum of one year to characterize adequately the ecology of the project site), a complete analysis of alternatives to the proposed action, and an analysis of the effects that the proposed work would have on the quality of the human environment.

The EIS may be of a draft or final form. If public or COE internal review comments generated by the draft EIS raise significant issues, or present new reasonable or feasible alternatives or other important issues not addressed in the draft form, the final EIS will answer and incorporate the comments. If, however, the changes affected by such comments are minor and consist of factual corrections, or are concerned with explanations of Corps actions, the final EIS may take an abbreviated form, which includes the draft EIS by reference only.

When an EIS is required, it may cause a delay of up to two years to reach a public interest decision on the proposed action. During this time, no work may be performed in the project area. The issuance of a permit in this case can not occur until thirty days after the final EIS has been noticed by the U.S. Environmental Protection Agency in the Federal Register and the Record of Decision signed.

Decision Schedule

A decision on the application for an individual permit will be made within sixty days of the receipt of the complete application. The sixty day clock may be interrupted for several reasons, including: (1) the case must be referred to a higher authority, (2) the comment period is extended beyond thirty days, (3) a timely resolution of or rebuttal to objections is not received from the applicant, (4) the review process requires a public hearing, or (5) information needed by the district engineer to reach a public interest decision on the application can not be obtained reasonably within a sixty day period, as for the preparation of an EIS. When the delaying factor has been resolved, the sixty day clock is resumed from where it was suspended.

Fee

The application fee in 1983 is ten dollars for non-commercial projects and one hundred dollars for commercial or industrial projects, and is deferred until the permit is granted. If the application is accepted, the district engineer will send the applicant two unsigned copies of the permit. The permit becomes valid when both signed copies and the fee are returned to COE, the district engineer or his designated representative have signed the copies, and one copy is returned to the applicant.

7.8 Summary

The planner of a small-scale coastal structure may have to apply successfully for one or more permits from a variety of agencies before construction. The structure may be constrained by local zoning regulations, or permits may be required from local governments which participate in the NFIP, or from DEC or COE. The planner should assess which agencies will exert control over the desired activity. This must be done in the early stages of the planning process, so that the structure design will comply with all applicable regulations.

CHAPTER 8

SUMMARY AND CONCLUSIONS

The coastal zone is a region of intense environmental activity with a delicate interaction of wind, water, and land. A planner of coastal structures will require an understanding of the many coastal environmental processes, coastal construction considerations, and regulatory agencies which control proposed activities. The prospective coastal structure builder will need a planning methodology to achieve the desired goals in a timely and efficient manner.

A general planning process consisting of five phases has been presented here. The formulation of goals results in a comprehensive statement of intent to provide: (1) a baseline for comparison of future changes in desired goals, (2) a mode for comment by the users of the structure or other affected parties, and (3) an understanding of the present and future characteristics of the user population. The selection and evaluation of alternatives results in the examination of many schemes which will meet the desired goals, and the selection of the alternative best-suited to the project goals. Implementation of the design results in construction of the chosen structure. Through regular monitoring and inspection the planner will verify that the structure meets the desired goals and assess maintenance needs.

Beach environments undergo continual sand movements and migration because of storm action and littoral drift. This movement must be acknowledged and planned for in beach structure design. The planner must have an appreciation for natural coastal environmental processes to effectively and responsibly plan a coastal structure.

Dunes act as natural barriers against beach erosion, and as such must be protected from harmful construction. Wetlands serve many important biological and storm-buffering functions, and are protected through legislation against harmful encroachment.

To select effectively the best design alternative, the planner must assess the many costs and benefits of each. Costs include planning, design, land purchase, materials, construction, and maintenance. Benefits are more abstract, generally reflecting the design goals. The selection of any alternative involves a trade-off between costs and benefits.

Actual design and construction of a coastal structure requires an understanding of the environmental and regulatory constraints active in the coastal zone. Site considerations include soil and bedrock characteristics, wind forces, and water levels. Construction considerations include modes of access to the site, chosen construction materials, stability of site slopes, groundwater infiltration, and excavation and fill difficulties.

Any proposed coastal structure generally will require the issuance of some form of permit from one or more regulatory agencies. These include local govenments enforcing zoning laws of the National Flood Insurance Program standards, state agencies, such as the New York Department of Environmental Conservation and a federal agency, the U.S. Army Corps of Engineers. The activities requiring permits differ between various agencies, and the planner of a proposed structure must be familiar with the requirements of each.

The planning of a coastal structure requires use of a broad-based and flexible planning methodology, as outlined in Figure 8.1 (see next page). The planner must consider the probable effects the structure will impose on the coastal environment, and conversely, the impacts of the coastal environment on the structure. Careful consideration of such factors will allow selection of the best combination of trade-offs in coastal structure design. Regulatory agencies play a major role in coastal development, so an understanding of regulations and permit processes is vital to the coastal planner. This study has provided such a basis for understanding coastal construction requirements and should be of use to the planner of coastal structures.

FIGURE 8.1

COASTAL STRUCTURE PLANNING OUTLINE

Formulate goals, reflecting present and future needs of user population, and allowing for input by affected parties.

Generate alternatives to investigate various sites, structure types and design schemes

- sieve map to eliminate unsuitable sites
- threshold analysis to equate acceptable cost levels with available designs
- assess permit requirements of various alternatives

Evaluate alternatives

- cost-benefit analysis to assess trade-offs and select optimal or best alternative

Implementation

- assess regulatory protection afforded chosen site
- assess impact or effects of proposed structure
- perform site survey, soil and bedrock, field and lab investigations
- assess magnitude of littoral drift and/or bluff erosion
- assess expected storm severity/flood levels
- evaluate access methods for cost, environmental impact and difficulty
- assess groundwater infiltration problems for excavations
- apply for permits to applicable regulatory agencies
- implement construction of coastal structure

Monitoring

- follow regular inspection program
- perform repair and maintenance as dictated by inspection

REFERENCES

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New York Codes, Rules and Regulations referenced are:

6NYCRR 505	6NYCRR 608
6NYCRR 621	6NYCRR 661
6NYCRR 663	

Code of Federal Regulations referenced are:

33 CFR 320-330
44 CFR 59-60

APPENDIX A

NATIONAL FLOOD INSURANCE PROGRAM PERMITS

The regulations summarized from 44 CFR §59-60[1] are minimum standards which must be adopted by any township to be eligible for participation in the National Flood Insurance Program. The extent of the minimum standards will be dictated by the detail of the flood data on maps supplied to the community by FEMA. The map may be a Flood Hazard Boundary Map (FHBM) or, subsequent to a risk study and establishment of risk premium rates, an initial or refined Flood Insurance Rate Map (FIRM).

The regulated areas of the community will be delineated three ways on the FHBM as Zones A, M, and E. The applicable standards will vary for each. Zone A, called an "area of special flood hazard," encompass all areas of the community which would be inundated by the 100-year flood or, in other words, all areas within the community with an elevation equal to or below the Base Flood Elevation (BFE). Based on detailed risk studies involving assessment of 100-year flood water depths, Zone A is usually refined on the FIRM into Zones A, AO, AH, A1-99, VO, and V1-99. The last two are called "coastal high hazard areas" and denote areas which may be subjected to high velocity waters including hurricane wave wash and tsunamis. Zone M

1. This notation is used throughout this section. 44 CFR §59-60 designates Title 44 of the Code of Federal Regulations, Parts 59 and 60.

is called an "area of special mudslide hazard" and may be refined in the FIRM depending on varying degrees of risk. Zone E is called an "area of special flood-related erosion hazard" and is land most likely to undergo severe flood-related erosion losses. It may be similarly refined on the FIRM. Areas which may be subject to more than one type of hazard will be identified on the FIRM by using the appropriate symbols in combination.

Within six months of issuance by the Federal Insurance Administrator of a FHBM, or initial or refined FIRM, the community must adopt the corresponding flood plain management regulations. Failure to receive eligibility or loss of eligibility for other reasons will, in New York State, cause DEC to enforce similar regulations, described in Appendix B.

On or after the effective date of approved flood plain management regulations adopted by the community, any regulated activity will require application and issuance of a permit from the community. Proposed activities in A, E, and M zones of the community which will require permits include:

- mining, drilling, excavating or dredging
- grading, filling or paving
- permanent siting of a mobile home
- construction of any walled and roofed building which is principally above ground.

Structures which are non-insurable and therefore non-regulated under this program include:

- fences, retaining walls, seawalls, bulkheads
- wharves, piers, bridges, docks, or open stretches located on or over water
- boathouses or similar structures

<u>Special Flood Hazard Areas</u>

Standards adopted for all special flood hazard areas (A zones) will apply in particular to new construction and substantial improvements to existing structures. A substantial improvement of a structure is any repair, reconstruction, or improvement whose total cost exceeds one-half of the market value of the structure prior to the improvement or damage. The standards will specify at a minimum that:

- residential construction must have the lowest floor including the basement elevated to or above the BFE
- non-residential construction must elevate or floodproof the lowest floor including the basement to or above the BFE
- construction materials and utility equipment must be resistant to flood damage
- the structure is anchored to prevent flotation, collapse or lateral movement, with special provisions of this standard for mobile homes

(44 CFR §60.3c)

Additional standards for activities in areas designated as coastal high hazard areas (V zones) include:

- all new buildings and other structures will be located landward of the mean high tide mark
- new or substantially improved structures will be attached securely to adequately anchored piles or columns, the tops of which are at or above the BFE, as certified by a registered professional engineer or architect
- the space below the lowest floor may not be used for human habitation and shall be constructed with breakaway walls
- no fill may be used for structural support
- no alterations of sand dunes which might increase the potential flood damage is permitted
- mobile homes are restricted to mobile home parks

(44 CFR §60.3e)

Mudslide Prone Areas

Permit approval for activities in areas designated as mudslide prone areas (M zones) includes:

- review of applications to determine if the proposed site and improvements are in a location that may have mudslide hazards and, if so, require site investigation and further review by persons qualified in geology and soils engineering
- regulation of the location of foundation and utility systems for new construction and substantial improvements

- regulation of the location, drainage, and maintenance of all excavations, cuts, fills, and planted slopes

  (44 CFR §60.4)

Flood-Related Erosion-Prone Areas

Permit approval requirements for flood-related erosion-prone areas (E zones) will include:

- review to determine if the proposed site alterations and improvements are reasonably safe from flood-related erosion hazards and that they will not cause or aggravate such hazards
- requirement of a setback from the water for all new development; the buffer strip may be used for agricultural, forestry, wildlife habitat, or similar purposes

  (44/CFR §60.5)

The requirements for permit application will vary somewhat with each community and the applicant must assess the required documentation pertinent to the proposed activity.

APPENDIX B

DEC PERMITS

A wide range of activities in nearly all New York State coastal areas are regulated by the Department of Environmental Conservation (DEC). The purpose of this appendix is to summarize the regulated activities and allow the planner to assess if one or more permits will be required for a particular project. The coastal areas regulated by DEC which are discussed herein include:

- special flood hazard areas identified by FEMA (See Appendix A) (6NYCRR Part 500)[1]
- coastal erosion areas (6NYCRR Part 505)
- navigable waters of the state (6NYCRR Part 608)
- tidal wetlands (6NYCRR Part 661)
- freshwater wetlands (6NYCRR Part 663)

Activities in the last three categories are divided into major and minor projects. As discussed in the text, the review process and time table will differ significantly between the two types. It will be of use to the planner to know whether the project will be regarded as major or minor.

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1. This notation is used throughout this section. 6NYCRR Part 500 designates Title 6 of the New York Codes, Rules and Regulations, Part 500.

Special Flood Hazard Areas

The following permit regulations apply to activities in a flood-prone coastal community which has failed to meet the qualification date for eligibility in, or whose eligibility has been revoked from, the National Flood Insurance Program (NFIP). The regulations will become applicable ten days from the close of the public meetings called by DEC to discuss the community's ineligibility, or on the first day of non-qualification, whichever is later. Any project which was commenced prior to this date may be continued subject to the owner's option, under either the DEC design requirements listed below or the community's floodplain management regulations in effect prior to this date. The DEC regulations will take precedence over any less restrictive local laws or codes, and will remain in effect until the Federal Insurance Administrator approves the community's locally adopted and administered floodplain management regulations. For this period of time, commencement of any of the following activities which will be located in areas of special flood hazards, areas of special flood-related erosion hazards, and/or areas of special mudslide hazards within the community will require a DEC permit:

- mining, drilling, excavation, or dredging
- clearing, grading, filling, depositing, or paving
- permanent siting of a mobile home
- implacement of piling or a foundation

- installation of any sewer, gas, or water main, or electrical transmission line or other service line or facility
- the construction of a new structure
- improvement, alteration, repair, reconstruction, or restoration of an existing structure, including any activity which would affect the loading, structural integrity, or flood resistance of the structure

If a proposed activity in the last category is the restoration of a damaged structure, an additional consideration is applied. The estimated project cost listed on the application is added to the actual costs of all restorations made to the structure during the preceding twelve month period. If the sum is greater than one-half of the pre-damage value of the structure, the project will be classified as a new structure, and both the undamaged and restored sections must be flood-proofed as described below. If the sum is less than one-half the pre-damage value, the applicant may either rebuild the structure with similar materials to its pre-damaged condition and size, or rebuild differently, and flood-proof the rebuilt section as described below.

The type and quantity of information required for permit application differs significantly from that in other DEC regulated coastal areas, and therefore is worthy of specific mention. All information listed below must be submitted in triplicate with the application to the regional permit administrator. Applications for construction of a new structure, or improvements, repairs, or expansions of existing structures must include plans which contain:

- elevation views of all external faces of the proposed structure

- specifications of the proposed finishing materials and their resistance to flood damage

- elevation of the lowest floor including the basement and/or the elevation to which the structure is to be flood-proofed, expressed as feet above mean sea level (MSL)

- site grading plans, site drainage paths, location of water courses, and significant changes to existing site topography

- cross-sections indicating major structural elements, foundations, and anchorage systems, the latter of special pertinance to mobile home emplacement

- plan views and/or cross-sections showing location and elevation above MSL of all permanent mechanical and electrical equipment, and flood resistant design of all service and utility connections

(6NYCRR §500.7)

A permit application for mining, dredging, excavating, or filling must include a survey showing existing and proposed site topography as well as the locations of temporary and permanent structures associated with the project.

A professional engineer, architect, or land surveyor licensed by the State of New York must certify that the plans meet the applicable flood-proofing standards outlined below. The extent of the standards enforced will correspond to the detail of the flood risk data supplied by the Federal Insurance Administrator on the FHBM or FIRM.

The standards for new construction or substantial improvements to an existing structure include:

- residential construction must have the lowest floor including the basement elevated to or above the BFE

- non-residential construction must elevate or floodproof the lowest floor including the basement to or above the BFE

- construction materials and utility equipment must be resistant to flood damage

- the structure must be anchored to prevent flotation, collapse, or lateral movement, with special provisions of this standard for mobile homes

(6NYCRR §500.10)

Additional standards for activities in areas designated as coastal high hazard areas, subject to high velocity waters such as hurricane wave wash and tsunamis, include:

- all new buildings and other structures will be located landward of the mean high tide mark

- new or substantially improved structures will be securely attached to adequately anchored piles or columns, the tops of which are at or above the BFE, as certified by a registered professional engineer or architect

- the space below the lowest floor may not be used for human habitation and shall be constructed with breakaway walls

- no fill may be used for structural support

- no alterations of sand dunes which might increase the potential flood damage is permitted

- mobile homes are restricted to mobile home parks

(6NYCRR §500.10)

Fees

The 1983 costs of application for DEC permits in affected areas are as follows:

- construction of and additions to a one to four family residential structure:
  - up to 1,000 square feet of floor area .... $ 30
  - between 1000 and 2000 square feet .... $ 50
  - over 2000 square feet of floor area $100
- construction and additions to a multiple residential structure:
  - up to 30,000 cubic feet of volume $100
  - from 30,000 to 50,000 cubic feet .... $3 per additional 1,000 cu ft
  - over 50,000 cubic feet .... $2 per additional 1,000 cu ft
- construction of and additions to a nonresidential structure:
  - up to 10,000 cubic feet of volume $50
  - from 10,000 to 50,000 cubic feet .... $2 per additional 1,000 cu ft
  - over 50,000 cubic feet of volume .... $1 per additional 1,000 cu ft
- for minor or substantial improvements to any structure:
  - up to $100 worth of work .... no charge
  - from $100 to $500 .... $5
  - from $500 to $1000 .... $10
  - over $1000 worth of work .... $3 per additional $1,000 worth of work
- excavation, filling, grading, mining, and dredging
  - up to 1,000 cubic yards $10
  - over 1,000 cubic yards .... $2 per additional 1,000 cu yds
- paving
  - up to 1,000 square feet $10
  - over 1,000 square feet .... $2 per additional 1,000 sq ft
- all other projects $10

(6NYCRR §500.16)

Coastal Erosion Areas

The construction, modification, or restoration of most types of coastal erosion area structures will require a permit as dictated by 6NYCRR Part 505. DEC will not exercise jurisdiction over the issuance of erosion area permits until after all appropriate local levels of government have had an opportunity to do so. DEC will, however, process erosion area permit applications for New York City or counties outside New York City if such authorities do not submit suitable erosion hazard area local laws to DEC and enforce them.

The following activities, grouped by shoreline features they will be located on, are among the restricted activities in each area which will require a permit:

Bluffs

- new construction, modification, or restoration of erosion protection structures, walkways, or stairways
- excavation of a bluff cut (which must be in a direction normal to the shoreline) for the purpose of providing shoreline access

Shoals, Sandbars, and Nearshore Areas

- dredging activities for constructing or maintaining navigation channels, bypassing sand around natural and manmade obstructions, or for artificial beach nourishment
- deposition of suitable materials onto shoals, sandbars, or nearshore area
- new construction, modification, or restoration of
  - docks, piers, or wharves, except those of top surface area of less than 200 square feet which are supported on floats, columns, open timber, piles, or similar open work structures, or such structures built on floats which are removed each fall

- bulkheads, seawalls
- breakwaters, jetties, and groins

- artificial beach nourishment

Primary Dunes

- deposition of clean sand obtained from excavation, dredging, or beach grading onto a primary dune or on an area formerly a primary dune to increase its size or restore it

- construction or placement of elevated walkways, stairways, or other approved pedestrian and vehicular beach access structures (These are the only types of structures permitted on primary dunes)

Secondary Dunes

- deposition of clean sand obtained from excavation, dredging, or beach grading onto a secondary dune or an area formerly a secondary dune to increase its size or restore it

- construction or placement of a new building, shed, garage, mobile home, or other structure, or major addition to an existing structure, provided that: 1) the lowest floor of the new structure or major addition is built on adequately anchored piling at least four feet above the surface of the secondary dune and 2) the space below the lowest floor is left open and free of obstructions

General Considerations

Restrictions on erosion area activities prevent the removal, excavation, or mining of any of the coastal features listed above which would diminish the erosion protection they provide, except such excavation as is required to perform the permitted activities listed above. Active bird nesting and breeding areas must not be disturbed. Vehicular traffic is prohibited on bluffs, permitted on primary dunes only on areas designated for dune crossing, and only allowed on beaches seaward of the debris line or the toe of the primary dune, not including vegetated areas.

While the construction, modification, or restoration of erosion protection structures will require a permit, normal maintenance or repair will not. All erosion protection structures must be designed and constructed in accordance with proven methods, and must have a reasonable probability of controlling erosion at the immediate site for at least thirty years. The permit application must include a long-term maintenance program to ensure the continued performance of the structure. Materials used must be of a sufficiently durable nature to withstand wave impacts and weathering. Construction practices must be used which will prevent measurable increases in erosion at the development site or other locations and minimize adverse environmental effects.

Setback requirements are enforced which control the proximity of nonmovable structures with respect to erosion protection structures as dictated by the effectiveness, continued integrity, and maintenance of the protecting structures. Setback requirements also regulate the proximity of movable structures with respect to the receding edge of a bluff or the landward limit of the primary dune or beach.

Fees

The 1983 cost of processing permit applications for coastal erosion areas is as follows:

- construction or modification of docks, piers, or wharves

  - on piles $35
  - on fill $50
  - other $25

- construction or modification of erosion control structures

  - structures less than 100 linear ft ... $ 50
  - structures greater than 100 linear ft ..$100

- construction or placement of other structures $40

- excavation, grading, mining, filling, or dredging

  - less than 100 cubic yards $25
  - more than 100 cubic yards $50

- all other projects or activities $25

Navigable Waters of the State

The following activities in navigable waters of the State of New York require a permit from DEC. Navigable waters of the state, as defined in 6NYCRR Part 608, include all lakes, rivers, streams, and other bodies of water in the state on which vessels with a capacity of one or more persons can be operated, and exclude all waters completely surrounded by lands held in single private ownership. Major projects in navigable waters of the state include:

o erection, reconstruction, or repair of any permanent dock, pier, wharf, or other landing place with top surface of 200 square feet or more

o dredging, filling, or spoil disposal except as specified below

Minor projects in navigable waters of the state include:

- o repair or replacement in kind of existing docks with no increase in size
- o installation of open timbered or pile supported docks if the supports are less than twelve inches in diameter
- o dredge or fill of less than 100 cubic yards in navigable waters
- o navigation channel maintenance dredging not to exceed 500 cubic yards
- o construction in navigable waters of new bulkheading or riprap of less than 100 linear feet per parcel of land
- o construction of a dock support by rock-filled timber cribs with a top surface area of less than 400 square feet, less than one-half which is underlain by cribwork
- o construction of docks built with less than 100 cubic yards of fill
- o backfill associated with replacement in kind of existing bulkheads

(DEC, 1978)

Fees

The 1983 cost of processing permit applications for navigable waters of the state is as follows:

- major dock projects .... $ 25
- minor dock projects .... $ 10
- major dredge or fill projects .... $ 50
- minor dredge or fill projects .... $ 10

(6NYCRR §621.4)

Tidal Wetlands

The various activities listed below which will be located in or adjacent to tidal wetlands will require application for a permit from DEC. Tidal wetlands are divided into six areas as delineated on each final tidal wetlands inventory map established by DEC and filed in the office of the county clerk. These divisions include:

- coastal fresh marsh, the upper tidal limits of river systems where significant freshwater dominates the tidal zone, designated FM on an inventory map and in the presentation below
- intertidal marsh, the vegetated tidal wetland zone between high and low tidal elevations, designated IM
- coastal shoals, bars, and flats, the tidal wetland zone which is covered by water at high tide and is exposed or covered to one foot depth at low tide, designated by SM
- littoral zone, all tidal wetlands under tidal waters to a low tide depth of six feet, which are not covered by other categories, designated LZ
- high marsh or salt meadow, the normal upper most tidal wetland zone, designated HM
- areas adjacent to tidal wetlands, designated AA

Adjacent areas, as defined in 6NYCRR §661.4, include all lands landward of the wetland perimeter shown on the inventory map, for a distance of 300 feet or to the nearest established man-made boundary such as a road, bulkhead, or seawall, whichever is closest. For lands which slope upward from the wetlands periphery, adjacent areas extend to the elevation contour of ten feet above mean sea level, or to the crest of the bluff or hill for steep sloping areas.

Major Projects in Tidal Wetlands

The following projects in tidal wetlands will be generally designated by DEC as major ones. They will require public notice, usually will require submission of an environmental assessment form, and may require preparation of an environmental impact statement. Each activity is listed below followed by the designated tidal wetland area(s) of application, whose definitions and abbreviations were provided above:

- construction of single and multiple family dwellings and of a sewage disposal septic tank, cesspool, leach field, seepage pit, dry well, retention basin, filter, open swale, pond, or any accessory structure or facility not specifically mentioned (FM, IM, HM, SM, LZ)
- construction of commercial or industrial use facilities, public and semi-public building, or commercial and industrial use activities, any of which require water access, and/or all accessory structures of such facilities (FM, IM, HM, SM, LZ)
- any construction activity described in the previous category which does not require water access (FM, IM, HM, SM, LZ, AA)
- permanent or seasonal mooring of any vessel or structure to be used as a single or multiple family dwelling, commercial, industrial, public, or semi-public use building (FM, IM, HM)
- dredging (FM, IM, HM, SM, LZ, AA)
- disposal of dredged material (SM, LZ, not allowed in FM, IM, HM)
- filling and construction of berms or construction or substantial modification of drainage ditches for other than agricultural or mosquito control purposes (FM, IM, HM, SM, LZ)
- construction of bulkheads, groins, and shoreline stabilization structures (FM, IM, HM)

- construction of open pile catwalks and/or docks wider than four feet, multiple catwalks and/or docks up to four feet wide, installation of floating docks of greater than 200 square feet area, relocation and/or rearrangement of floating or open pile docks within an established marina or boat basin (FM, IM, HM)

- construction of solid fill docks (FM, IM, HM, SM, LZ)

- operation of motor vehicles other than for educational or scientific purposes (FM, IM, HM)

(6NYCRR §661.5)

Minor Projects in Tidal Wetlands

An activity which is defined as a minor project by DEC will not require public notice and generally will result in timely issuance of a permit or written approval of the letter of notification, whichever is required. DEC may, however, exercise discretionary authority to assign a project as major even though it falls into the categories described below. A multiple permit application containing one or more major project applications will be treated as a major project. Minor projects in tidal wetlands include:

- all of the major activities listed above which occur in divisions of tidal wetlands or adjacent areas not listed with each respective activity. (For instance, the construction of solid fill docks is a minor activity in area AA)

- constructing one open pile catwalk and/or dock not greater than four feet in width (FM, IM, HM, SM, LZ, AA)

- installation of floating docks totaling less than 200 square feet in area (FM, IM, HM; no permit or letter needed for other areas)

- maintenance dredging (FM, IM, HM, SM, LZ, AA)

- connection to an existing facility or installation with restoration of original grading, or electric, gas, sewer, water, telephone, or other utilities (FM, IM, HM, SM, LZ, AA)

(6 NYCRR, §661.5)

Specification of projects in tidal wetlands which require no permit or only a letter of approval, as well as other projects requiring DEC permits, is provided in 6NYCRR §661.5.

Fees

The 1983 cost of processing permit applications for tidal wetlands is as follows:

- major activities .... $ 50
- minor activities .... $ 10

(6 NYCRR §621.4)

Freshwater Wetlands

The activities in freshwater wetlands and adjacent areas listed below will require a permit. The application will be made to DEC except in areas of the state where DEC has promulgated a final freshwater wetlands map and a local government has assumed the freshwater wetlands regulating authority, or within the confines of the Adirondack Park, in which case the Adirondack Park Agency is the regulating authority. Freshwater wetlands are defined extensively in Section 24-0107 of the Environmental Conservation Law. This definition includes lands and submerged lands commonly called marshes, swamps, sloughs, bogs, and flats which support wetland trees and shrubs or rooted floating vegetation, free-floating, wet meadow, bog mat vegetation or underwater vegetation, each of which are individually defined. All freshwater wetlands of 12.4 acres or more in area, or smaller ones having unusual local importance, as well as areas adjacent to freshwater wetlands, are offered protection by the applicable governing body. Adjacent areas are areas of land or water extending 100 feet around the outside of the boundary of the wetland, although the adjacent area for a particular wetland may be broader than 100 feet if DEC deems it necessary.

Major Projects in Freshwater Wetlands

The following activities will require a public notice, usually will require submission of an EA, and possibly will require preparation of an EIS. Each activity is considered major for both freshwater wetlands and adjacent areas except where otherwise noted.

- constructing, expanding, or substantially modifying drainage ditches, draining, and altering water levels, except as part of an agricultural activity
- filling and dredge spoil disposal
- installing or creating a dry well, retention basin, filter, open swale, or pond
- clear cutting timber
- clear cutting vegetation other than timber, except as part of an agricultural activity (letter of notification only required for AA)
- grading and dredging of more than 500 cubic yards
- mining
- constructing roads
- drilling a well, except for an individual residence
- installing any dock, pier, wharf of greater than 200 square feet in area, not including ordinary maintenance and repair
- constructing groins, bulkheads, or other shoreline stabilization structures
- constructing or removing berms, levees, dikes, dams, or other control structures

- installing utilities which require major modifications or construction activities in the wetlands
- constructing a residence or related structure or facility
- constructing commercial or industrial use facilities, public buildings, or related structures or facilities.

(6NYCRR Part 663)

Minor Projects in Freshwater Wetlands

The following activities requiring a permit in freshwater wetlands and adjacent areas are regarded as minor. DEC or the local regulating authority may exercise discretionary authority to treat such activities as major. Minor projects in freshwater wetlands include:

- installation of public utilities in existing corridors not involving new clearing or grading
- reconstruction in kind of existing docks where a permit is required
- installation of seasonal floating docks
- discharge of uncontaminated storm water
- pond excavation requiring less than one-quarter acre of wetlands

Minor projects in adjacent areas include:

- private recreational pond construction
- private driveway construction
- installation of underground utilities

(6NYCRR Part 621)

Fees

The 1983 cost of processing permit applications for freshwater wetland areas is as follows:

- major activities disturbing more than 1/4 acre .... $ 50
- major activities disturbing less than 1/4 acre .... $ 25
- major activities of any size in adjacent areas .... $ 25
- minor activities in wetlands or adjacent areas .... $ 10

(6NYCRR Part 621)

APPENDIX C

COE PERMITS

Individual Permits

The term "navigable waters of the United States" is defined by the U.S. Army Corps of Engineers as those waters of the United States that are subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past, or may be used in the future for the transport of interstate or foreign commerce (33/CFR §322.2).[1] Regulated activities in or affecting such waters will require a permit from the COE district office. The COE will perform an individual permit review if the proposed activity does not qualify for national or regional permits, discussed in the following sections. Regulated activities include:

- construction of piers, wharves, dolphins, wiers, and booms
- construction of breakwaters, jetties, bulkheads, revetments, or riprap
- construction of a permanent mooring structure or placement of a permanently moored vessel
- use of piling or any other obstacle or obstruction
- dredging, excavation, or other modification or such waters

1. This notation is used throughout this section. 33/CFR §322.2 designates Title 33 of the Code of Federal Regulations, Part 322, Section 322.2.

The disposal of dredged material or use of fill material to create new land or alter the bottom topography of a water body requires a COE permit for any such project in "the waters of the United States." The COE definition of "waters" is more encompassing than "navigable waters" and includes:

- all waters in current, past, or possible future use for transport of interstate or foreign commerce, including all waters subject to tidal ebb and flow
- all interstate waters including interstate wetlands
- all other waters such as interstate lakes, rivers, streams, etc.
- tributaries of such waters
- territorial seas
- wetlands adjacent to all above mentioned waters

(33/CFR §322.2a)

All of the aforementioned activities will require an individual permit, except for those activities covered by general nationwide and regional permits, or for certain farming operations which require no permit. An individual permit also will be required for the transport and dumping of dredged material in ocean waters, which are all open waters seaward of the territorial sea baseline.

General COE Permits

General permits authorize a category of activities over a broad geographical area, either nationwide or regional. The application and documentation needed are the same as for an individual application, but the processing time will be considerably less. They are applicable only if the conditions of the particular permit are met; if not, the activity will require an individual permit. COE may use discretionary authority to require any application which may meet the criteria for nationwide or regional permits to undergo individual permit review.

The number of activities for which nationwide permits are in effect is equalled or exceeded by the number of conditions which must be followed for issuance of such permits. Permits and conditions applicable to small scale coastal structures are both listed below. Nationwide permits include:

- discharge of dredge or fill material into certain waters of the United States, including non-tidal rivers, streams, and their lakes and impoundments, adjacent wetlands, and other non-tidal waters not part of a surface tributary system to interstate waters or navigable waters of the United States, excluding the state of Wisconsin

- discharges of dredge or fill material into waters of the United States that do not exceed ten cubic yards as part of a single and complete project provided no material is placed in wetlands or the state of Wisconsin

- dredging of no more than ten cubic yards from navigable waters of the United States as part of a single and complete project

- discharge of return water from a contained dredged material disposal area provided the state has issued a certification under Section 401 of the Clean Water Act

- repair, rehabilitation, or replacement of fill or of any currently serviceable structure listed in the individual permit summary, provided: (1) the structure or fill must either have been previously authorized or constructed prior to the requirement for authorization, (2) the repair, rehabilitation, or replacement does not entail significant deviation from the plans of the original structure or fill, (3) the uses specified in the permit authorizing the original construction of the structure or fill do not change, and (4) the permit is not used for maintenance dredging

- any structures listed in the individual permit summary placed within anchorage or fleeting areas to facilitate moorage of vessels where such areas have been established by the U.S. Coast Guard

- non-commercial, single-boat mooring buoys

- bank stabilization activities necessary for erosion prevention of less than 500 feet in length which which comprises a single and complete project; placement of clean material must average less than one cubic yard per running foot along the bank within waters of the United States and no more than the minimum needed for erosion protection; no material may be placed in, or blocking surface water flow into or out of, a wetland area.

(33/CFR §330.5a)

The issuance of such permits is dependent on adherence by the applicant to the following conditions:

- the discharge of dredged or fill material will not occur in the proximity of a public water supply intake or areas of concentrated shellfish production, the discharged material consisting of suitable material free from toxic pollutants

- such discharges or other activities will not jeopardize a threatened or endangered species or destroy or adversely modify the habitat of such a species

- the activity not disrupt the movement of indigenous-aquatic species

- the structure or fill authorized will be properly maintained to prevent erosion

- the discharge or activity will not occur in a component of the National Wild and Scenic River System

- the activity will not cause an unacceptable interference with navigation

(33/CFR §330.5b)

In addition, the following management practices should be followed, otherwise COE may take discretionary authority to regulate the activity on an individual or regional basis.

- discharges of dredged or fill material will be avoided, particularly in wetlands areas, and other practical alternatives should be used instead
- discharges into spawning areas during spawning seasons, breeding areas for migratory waterfowl, and discharges which restrict movement of indigenous aquatic species or impede the movement of normal or expected high water flows will be avoided
- heavy equipment working in wetlands will be placed on mats
- all temporary fills will be entirely removed

(33/CFR §336a)

Regional COE Permits

Proposed activities which are not covered by or do not meet the requirements of nationwide permits may be suitable for a regional permit issued by the district COE office. Activities which do not meet the requirements for a nationwide or regional permit must be filed as an application for an individual permit. The conditions for regional permits, issued with each permit, will be similar to those issued with the nationwide permits. Regional permits vary between COE districts, but some examples of regional permits issued by the Buffalo, New York, district are (Gaume, 1977):

- construction of timber crib docks along the New York shorelines of Lake Ontario and St. Lawrence River
- riprap shore protection on New York shoreline of Lake Ontario
- open-pile docks, portable docks, boat hoists, buoys, and any floating structures in entire Buffalo district region of New York State

The applicant should consult with the specific COE district office which regulates activities in the project area to find out which, if any, regional permits are in effect which will be applicable to the project.