REDUCING HURRICANE AND COASTAL HAZARDS THROUGH GROWTH MANAGEMENT:

A Guidebook for North Carolina Coastal Localities

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PREFACE

Whatever success is achieved by this guidebook is due to the efforts of many people. First of all, without the help and encouragement of Larry Zensinger of the Federal Emergency Management Agency, and Will Brothers, Joe Meyers, and Bob Buchanan of the North Carolina Division of Emergency Management, this project would never have become a reality.

Our Advisory Committee--Will Brothers, Bill Collins, John Crew, Dexter Hayes, Allen McDuffie, and Berry Williams--gave patient and constructive assistance, and made innumerable helpful suggestions. In addition, Carol Campbell, Joe Pelissier, John Scheibel, Pat Stahlschmidt, and many others read drafts and offered improvements. We are also extremely grateful to Carolyn Jones, Barbara Rodgers, and Lee Mullis, who spent hours and hours on draft after draft. Last but not least, we want to thank Stacy Guess, who in his real life plays trumpet with the Pressure Boys, for his graphics and marvelous art work. To all of you, and to the many others who helped us in untold ways, our appreciation and gratitude.

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Chapter 1

Introduction

Hurricane and Coastal Storm Hazards on the North Carolina Coast

Hurricanes and severe coastal storms are major threats to people and property in coastal North Carolina. Historically, only Florida exceeds North Carolina in terms of the number of hurricane landfalls among Atlantic coastal states.[1] Between 1899 and 1985 North Carolina has experienced 24 hurricane landfalls, for an average recurrence of one hurricane every 3.6 years. Table 1.1 provides an historical listing of these storms, and Figure 1.1 provides a graphic depiction of previous hurricane tracks. While it has been lucky in recent years and has received only glancing blows from hurricanes (Hurricane Charley and tropical storm Andrew in 1986; Hurricanes Gloria and Juan in 1985; Hurricane Diana in 1984), the North Carolina coast has not been so fortunate in the past. Devastating Hurricanes Donna (1960) and Hazel (1954) are still vivid memories for many older residents of the North Carolina coast.

While hurricane and coastal storm events are a part of the natural coastal system and will continue, the risks associated with them has increased as a result of the dramatic growth occurring in coastal areas, including the North Carolina coast. Nationally, coastal areas are growing at a rate three times that of the nation as a whole. Between 1970 and 1980, population in the 20 coastal North Carolina counties grew by approximately 17%, often with much greater levels of growth occurring on the Outer Banks--the most vulnerable

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[1]Neumann et al., Tropical Cyclones of the North Atlantic Ocean, 1871-1980, Washington, DC: NOAA, 1978; revised 1981.

Table 1.1

COASTAL HURRICANES OF THE 20TH CENTURY

The following list represents those tropical storms which were of full hurricane strength at the time they reached coastal North Carolina. The decayed stages of hurricanes reaching this area are not listed. Storms passing close enough off shore to affect land areas are included even though they did not make landfall.

1901 July 11: Made landfall near Oregon Inlet. No record of damage.

1903 September 15: Passed off shore but affected the northern Outer Banks.

1904 September 14: Made landfall between Charleston, South Carolina, and the North Carolina state line. Damage to crops in eastern and central North Carolina from wind and rain.

1904 November 13: Passed off shore near Cape Hatteras. Three wrecked schooners. Several persons drowned on land and at sea.

1906 September 17: Made landfall near Myrtle Beach, South Carolina. Property damage at Wrightsville Beach.

1908 July 30: Passed up the coast close to Cape Hatteras. Heavy rainfall caused flooding in the eastern counties.

1913 September 3: Made landfall between Hatteras and Beaufort. Storm surge in Pamlico Sound washed away railroad bridges at Washington and New Bern. Wind and rain caused severe damage to crops as far west as Durham.

1920 September 22: Made landfall between Wilmington and Morehead City. One person killed and many injured in Pitt County.

1924 August 25: Passed off shore just east of Hatteras. Two people drowned and Ocracoke partially flooded.

1930 September 12: Passed off shore causing minor wind damage from Atlantic Beach to Hatteras.

1933 August 22-23: Made landfall at Cape Hatteras. High winds and tides caused great damage in northeastern counties estimated at $250,000.

1933 September 15-16: Made landfall west of Hatteras. Storm surge in Pamlico and Albemarle Sounds caused 21 deaths and $3 million in damage; New Bern flooded.

1936 September 18: Passed up the coast slightly east of Hatteras. Estimated damage of $55,000 to the northern coast. Heavy damage to crops.

1938 September 21: Passed off shore on its way north where it did considerable damage and was called "The Great New England Hurricane of 1938." No damage or loss of life reported in North Carolina.

1944 August 1: Made landfall near Southport. Heavy damage to structures at Carolina Beach. Considerable crop damage in the southern coastal counties. Estimated total damage was $2 million.

1944 September 14: Passed a short distance east of Cape Hatteras moving northward. On the central and northern coastal areas 108 buildings were destroyed and more than 600 damaged. Estimated damage to crops at $1 million. Heavy damage in Elizabeth City and Nags Head. One person killed.

1949 August 24: Passed off shore at Cape Hatteras directly over the Diamond Shoals Lightship. An estimated $50,000 in property damage occurred, mostly in the vicinity of Buxton. Two persons died.

1953 August 13: Hurricane Barbara made landfall between Morehead City and Ocracoke. Estimated property damage was $100,000 while the crop loss was $1 million. One person died.

1954 August 30: Hurricane Carol passed just to the east of Cape Hatteras. Widespread light damage came to an estimated $250,000.

1954 September 10: Hurricane Edna passed about 60 miles east of Cape Hatteras. Minor but widespread damage was estimated at $75,000 for property and $40,000 for crops.

1954 October 15: Hurricane Hazel made landfall right on the South Carolina line. From that point northward to Cape Lookout, the ocean front was ravaged by storm surge. At Long Beach 352 of the existing 357 buildings were totally destroyed. Nearby beaches suffered similar damage, and miles of grass-covered dunes disappeared. Flooding occurred in Washington, New Bern, and Elizabeth City. Heavy wind damage was felt all over eastern North Carolina, and record amounts of rainfall were recorded. Nineteen people, most of whom were in beach locations, died. Total property damage amounted to approximately $125 million.

1955 August 12: Hurricane Connie made landfall close to Cape Lookout, causing severe flooding in low-lying coastal areas and around the sounds. Heavy beach erosion also occurred. No deaths were reported. Hurricane Diane followed in five days and made it impossible to assess the damage caused by Connie.

1955 August 17: Hurricane Diane made landfall near Carolina Beach and passed over Wilmington. Winds caused crop damage as far west as Raleigh. Heavy flooding occurred in Belhaven, Washington, and New Bern. Crop damage in the eastern counties caused by this storm and Connie came to more than $20 million, much of it due to salt water flooding and rivers overflowing their banks. No deaths were reported.

1955 September 19: Hurricane Ione made landfall near Salter Path on Bogue Banks. In spite of high winds, damage from this storm was minor. Heavy rains falling on already waterlogged soils were responsible for the flooding of thousands of acres, and in New Bern 40 city blocks were inundated. Hundreds of homes were washed away. Seven people died. Estimated property damage was about $88 million.

1958 September 27: Hurricane Helene passed off the coast from Wilmington to Cape Hatteras. Very high winds were responsible for damage to crops and structures estimated at $11 million.

1960 September 11: Hurricane Donna made landfall between Wilmington and Morehead City and moved up the coast. Heavy damage was experienced by coastal communities from Wilmington to Nags Head. Beach erosion was considerable, and the corn crop in the coastal counties suffered severe wind damage. Eight people died, and damage was estimated at several millions of dollars.

Table 1.1 (continued)

1964 September 1: Hurricane Cleo passed from western North Carolina out to sea in the vicinity of Elizabeth City. Heavy rains caused flooding and damage to crops in the northeast.

1964 October 16: Hurricane Isbell made landfall near Morehead City and moved northward over the eastern counties, causing some flash flooding and damage to the peanut crop.

1968 October 20: Hurricane Gladys moved up the coast and out to sea in the vicinity of Cape Hatteras. Damage was light and the state benefited from two days of moderate rainfall.

1971 September 30: Hurricane Ginger made landfall near Morehead City and began to dissipate as it moved inland. Tides were six feet or more above normal at Washington, Aurora, New Bern, and Cherry Point. Thousands of acres of corn and soybeans in the eastern counties were affected. Damage was estimated at $10 million.

1976 August 9: Hurricane Belle passed east of Cape Hatteras on its way north. Beaches were evacuated but only scattered minor damage occurred.

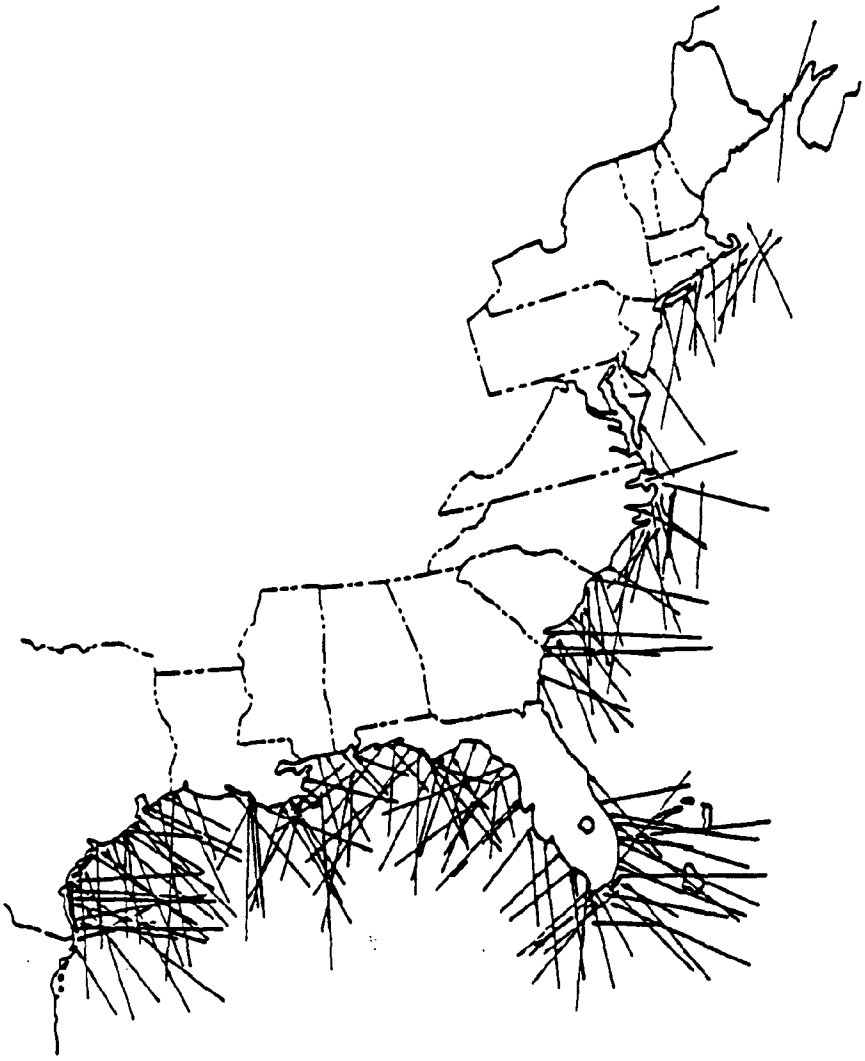
1984 September 11-14: Hurricane Diana crossed the coast near Cape Fear and moved inland before turning back out to sea. The storm spawned a tornado in Nash County and caused three deaths. Total damage was estimated at $65 million, $26 million of which was crop damage.

1985 September 27: Hurricane Gloria, with some of the highest winds ever recorded, passed over Cape Hatteras and moved northward up the east coast. Eight deaths were attributed to Gloria, and total damage estimated at $900 million. Severe beach erosion and coastal flooding occurred along portions of the Outer Banks.

1986 August 17: Hurricane Charley barely reached hurricane strength as it crossed the Outer Banks. Of five total storm-related deaths, one was a motorist attempting to cross a flooded causeway near Manteo. Reported damage in North Carolina was relatively light, resulting primarily from tidal flooding and downed trees.

Figure 1.1

HURRICANE CROSSING THE GULF OF MEXICO AND ATLANTIC COASTS OR PASSING NEAR THE MAINLAND



SOURCE: Baker, 1978

locations. For instance, the Town of Long Beach (Oak Island) has reported that its population has grown by 20 times since 1960. Permanent population figures substantially underestimate the number of visitors and tourists that may be placed at risk during peak summer months. Concurrent with these trends is the general acknowledgement that major advancements in the prediction and forecasting of hurricane tracks is not likely.[2]

North Carolina has addressed the hurricane hazard within the framework of its Coastal Area Management Program. The Coastal Area Management Act (CAMA) was adopted by the State legislature in 1974 and contains both a regulatory and planning program.[3] Policy direction is provided by the Coastal Resources Commission (CRC), a fifteen member group of citizens appointed by the Governor, and advised by the Coastal Resources Advisory Council (CRAC), a forty-seven member body primarily made up of local government representatives. The Division of Coastal Management, within the Department of Natural Resources and Community Development, is the State office in charge of implementing CAMA, and serves as a staff to the CRC. In all, 20 coastal counties are involved in the North Carolina program. North Carolina, as perhaps no other coastal state, has expressed its commitment to the careful management of its coastal areas and to reducing the long-term damages from hurricanes and coastal storms.

The regulatory component of CAMA is contained in the state's permitting control over Areas of Environmental Concern or "AECs." While AECs include sensitive environmental areas, several coastal hazard areas are included. The principal non-regulatory management technique under CAMA is mandatory local

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[2]Committee on Governmental Operations, "Federal Assistance to States and Communities for Hurricane Preparedness Planning," House Report Number 98-557, 1983.

[3]N.C.G.S. §113A-100 et seq.

land use planning. Each coastal locality must prepare a land use plan and update it every five years, consistent with specific state standards and guidelines. These standards address a wide range of resource and environmental management issues from the protection of estuarine areas to the identification and protection of valuable mineral areas. As of 1984, the 20 coastal counties and 55 municipalities had state-approved comprehensive plans in place.[4]

In May of 1983 the CAMA provisions were modified to require the explicit consideration of hurricane and coastal storm hazards in local land use plans. Localities were required not only to consider policies and actions to mitigate storm hazards prior to the event, but also to prepare post-storm reconstruction plans and policies to guide the redevelopment process following such a disaster. The overriding objective of these provisions is to encourage coastal localities to manage development and redevelopment in ways which minimize future storm losses, both in terms of property and human life.

The new CAMA regulations require localities to prepare storm mitigation policies for their land use plans with the following elements:

(i) A composite hazards map and brief narrative description of hazardous areas located within the planning jurisdiction;

(ii) An inventory and analysis of the existing uses of the land in hazard areas;

(iii) A description of the relative severity and type of risk or risks and an indication of the monetary value of the losses that might be sustained in each of the hazard areas;

(iv) Hazard mitigation policies which apply to all hazard areas, including both public and private facilities.[5]

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[4]David J. Brower and Daniel Carol, Coastal Zone Management as Land Planning, Washington, DC: National Planning Association, 1984; David Owens. "Coastal Management in North Carolina: Building a Regional Consensus," Journal of the American Planning Association, Vol. 51, No. 3 (summer): 322-329.

[5]15 N.C. Admin. Code 07B.0203(b)(a).

In developing these policies, localities are instructed to consider at least the following:

(i) Separate policies which deal with the effects of high winds, flooding, wave action, and erosion for those hazard areas where such forces may be expected;

(ii) Means of dealing with structures and uses which do not conform to the hazard mitigation policies;

(iii) Means of encouraging hotels, restaurants, and similar large commercial structures to locate outside of erosion-prone areas;

(iv) Policies which deal with the acquisition of parcels located in hazard areas or rendered unbuildable, for the purpose of public access.

The guidelines also require the preparation of a post-disaster reconstruction plan which implements the above policies and explicitly distinguishes between immediate cleanup and repair and longer term recovery issues. Specifically, reconstruction plans must include, among other things, the establishment of post-storm reconstruction guidelines, including: "the timing and completion of damage assessments; the timing and imposition of temporary development moratoria; and the development standards to which repairs and reconstruction shall conform."[6]

Localities are to establish schedules for reconstruction "according to established priorities assigned to the restoration of essential services, minor repairs, major repairs and new development."[7] Localities are also to prepare policies to guide the repair or reconstruction of public facilities, and to consider their possible relocation outside of hazard zones. The locality is also required to consider the establishment of a "reconstruction task force," to oversee post-storm recovery and to deal with the policy questions which arise during the reconstruction phase.

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[6] 15 N.C. Admin. Code 07B.0202(a)(b)(iv).
[7] 15 N.C. Admin. Code 07B.0202(a)(b)(v).

Evacuation is also a strong concern in the CAMA guidelines. Indeed, some of the strongest language (in the revised 1985 version) concerning the management of local development is found here. The locality, in consultation with the county (where relevant) and the State Division of Emergency Management, must consider the adequacy of the local evacuation plan. "If the required evacuation time exceeds the standard warning time as provided by the National Weather Service, the local government should consider adopting policies which would improve the capacity of evacuation routes, or limit the level of development in areas to be evacuated, or otherwise reduce the amount of time needed to safely evacuate."[8]

While these CAMA regulations are relatively specific in their identification of the required content and coverage of local plans, they provide little concrete or practical guidance as to how to go about developing and implementing these hurricane and post-storm reconstruction components. Consequently, a strong need exists for the development of a detailed guidebook which will assist North Carolina coastal localities in developing and implementing hurricane mitigation and post-storm reconstruction programs. Its preparation will hopefully assist coastal localities in achieving the long-term hazard reduction objectives established by the CAMA guidelines, and will result in a substantial reduction in the long term losses--both to life and property--from hurricanes and coastal storms.

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[8] 15 N.C. Admin. Code 07B.0203(b)(c).

Focus on Growth Management

Localities and states use a number of alternative approaches to mitigating hurricane and coastal storm hazards. Several approaches have become popular: the provision of flood insurance under the federal government's National Flood Insurance Program (NFIP); the provision of post-hurricane disaster assistance, usually by state and federal agencies; efforts to reinforce the coastal environment through the construction of seawalls, revetments, and groins, and the renourishment of beach sands and dunes; and building codes and construction standards which encourage or require that coastal buildings and facilities are better able to withstand hurricane and storm forces. Another approach to these hazards is simply to reinforce the warning and evacuation system in place and generally to find ways to protect people, such as by evacuating and sheltering them, from storm forces. While localities and states typically rely heavily on one or more of these approaches, there are serious limitations to each which must be recognized. While we do not advocate abandonment of other techniques, we do wish to point out the limitations and how these limitations can be overcome through the supplemental use of growth management techniques.

Structural approaches to mitigation--either by strengthening the shoreline through seawalls, groins, jetties, and so on, or by strengthening buildings and facilities themselves--are conventional approaches and are dominant in many coastal regions. These approaches have important limitations. In North Carolina, localities are not permitted to adopt building standards more stringent than those contained in the State Building Code, unless they obtain formal approval from the State Building Code

Council.[9] And, although the Building Code Council has recently modified the code to more adequately address hurricane conditions, building standards can go only so far in protecting property and human lives. Requiring "hurricane-proof" structures is inappropriate and economically infeasible. Engineered, multi-family structures are better able to withstand storm forces, but their location in high hazard areas (e.g., close to an eroding beach) creates the need for structural protection. Moreover, while such structures are certainly stronger, they are not immune to hurricane destruction.[10] Permitting shoreline development pell-mell with the understanding that seawalls and other protective structures will be built to guard against hurricane and storm forces is an extremely expensive approach, and one which is likely to have limited effectiveness. The 17-foot seawall built in Galveston, Texas, for example, despite its immense cost, is only designed to protect against a medium-sized hurricane (a category 3 on the Saffir-Simpson index[11]) and has served to reduce much of the beach seaward of it. In North Carolina, the option of this kind of structural reinforcement has been eliminated. In 1984 a ban on all permanent shore bordering structures along the North Carolina coast was imposed. Those wishing to build structures in hazardous and highly erosive areas will now have to do so under the assumption that future structural protective devices will not be permitted.

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[9]With the exception of ordinances adopted to comply with new NFIP regulations, which are now more restrictive in some areas than the State Building Code.

[10]Orrin Pilkey et al, Coastal Design: A Guide for Builders, Planners and Homeowners, New York: Van Nostrand Reinhold; Jack Salmon "Vertical Evacuation in Hurricanes: An Urgent Policy Problem for Coastal Managers," 12 Coastal Zone Management Journal No. 2/3.

[11]Neumann et al, Tropical Cyclones of the North Atlantic Ocean, 1871-1980, Washington, DC: NOAA, 1978; revised 1981.

Beach nourishment or replenishment is another form of structural reinforcement and another response to hurricane and coastal storm hazards. However, this strategy is very expensive and suffers from very limited effectiveness. New Hanover County, North Carolina, has estimated that the total annual cost to replace all of the sand eroded from county beaches would be over $5.2 million dollars.[12] Great expense and effort can be expended to replenish beach materials only to find that a substantial amount of this material is lost during the next winter storm.

Exclusive reliance on emergency response and evacuation measures will also be inadequate. Such an approach does nothing, of course, to protect public and private property, and the sharp increases in coastal population is serving to dwarf existing evacuation capacities. Moreover, as already noted, there has been little improvement in our scientific and technical ability to predict and forecast hurricanes. One much discussed response to these problems is to evacuate coastal residents vertically--that is, in private engineered structures on the coast. There are, however, a host of legal and practical problems with this idea which have yet to be resolved (e.g., the legal liability of the owners of these structures) and a basic question concerning the safety of residents.[13] Vertical evacuation, or refuge, as it is sometimes called, can create potentially catastrophe situations where a single building failure may lead to a high loss of human life.

Heavy reliance on federal programs, specifically flood insurance and disaster assistance, may also be inappropriate. In both programs the federal government appears to be moving away from private subsidies to a position of

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[12]New Hanover County, N.C., County Involvement in Beach Erosion (1982).
[13]Jack D. Salmon, "Vertical Evacuation in Hurricanes: An Urgent Policy Problem for Coastal Managers," 12 Coastal Zone Management Journal, No. 2/3.

greater financial responsibility for states, localities, and individual property owners. It seems apparent that future federal disaster aid will be strongly contingent on the good faith efforts of states and localities to mitigate hurricane and coastal storm hazards. In short, local and state governments can no longer turn to the federal government for a carte blanche on recovery and reconstruction. Instead, they must act in ways which responsibly prevent or reduce these potential losses in the future or be willing to suffer the losses in an increasingly unilateral manner.

Any effective mitigation program must be founded on a full understanding of the natural dynamics of the coastal environment. As noted, in recent years much of the coastal development has been occurring on extremely hazardous and environmentally-sensitive barrier islands, and much of the focus of this report is on management approaches which can be undertaken in this context. Barrier islands have been shown to migrate and are composed of a complex set of natural dynamics (e.g., washover processes, littoral drift, inlet formation, dune and beach dynamics) which are in turn modified by hurricanes and storms.[14] Coastal erosion, whether a result of normal offshore littoral patterns, the occurrence of hurricanes and storms, or the general rise in the sea level, makes development along the shores of barrier islands particularly tenuous. Effective mitigation approaches, and the approach adopted in this manual, build upon an understanding of, and are sensitive to, those natural dynamics.

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[14]Wallace Kaufman and Orrin Pilkey, The Beaches are Moving: The Drowning of America's Shoreline, Garden City, NJ: Doubleday Book, 1977; Stephen Leatherman, The Barrier Islands Handbook, Baltimore: University of Maryland, 1979; Orrin Pilkey et al, From Currituck to Calabash: Living with North Carolina's Barrier Islands, Durham, NC: Duke University Press, 1980.

This mitigation manual is concerned primarily with the use of growth management as a strategy for reducing coastal storm hazards. Growth management can be defined as a conscious attempt on the part of government to influence, either directly or indirectly, the location, density, type, and timing of quality of urban growth and development occurring in a community.[15] This can be accomplished through a number of specific programs and policies described in this report, including the direct regulation of coastal development (e.g., through zoning and subdivision ordinances), land and property acquisition, capital facilities policies, and taxation and fiscal incentives. These techniques have in common the objectives of reorienting or redirecting urban development away from the most hazardous coastal locations.

While the focus of the manual is on the use of growth management techniques, we do not wish to imply that this is the singular approach that localities should adopt. Just as the previously-described techniques have limitations, so also does growth management. For instance, growth management approaches, as we have described them here, can do little to mitigate the wind hazards generated by hurricanes. These hazards are best addressed through local and state building codes. We present growth management as a tool to be used as a supplement to other mitigation programs--to correct for the limitations of other techniques. Each locality will have to decide on the best overall strategy and combination of mitigation approaches.

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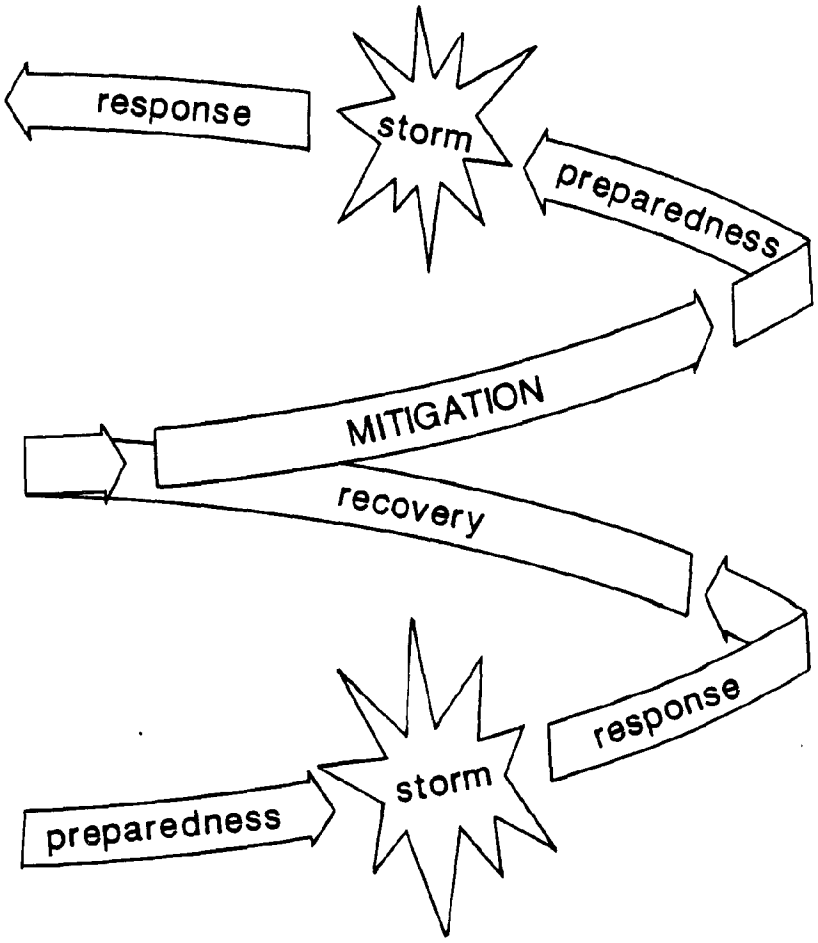
[15]David J. Brower et al, Managing Development in Small Towns, Chicago: APA Planners Press, 1984; David R. Godschalk, David J. Brower et al, Constitutional Issues of Growth Management, Chicago: APA Planners Press, 1979.

Figure 1.2

DISASTER RESPONSE STAGES



As Figure 1.2 indicates, there are several key phases in the disaster process or cycle. Two of these, pre-hurricane mitigation and post-hurricane reconstruction, are of concern to us here. The growth management approach to mitigating coastal storm hazards, and the specific programs and policies described in the chapters to follow, can find effective application in both of these stages of the disaster cycle. In the pre-storm phase, growth management seeks to influence the normal patterns of development--both new development and normal redevelopment of older developed areas. During reconstruction, and depending upon the magnitude of the event and level of destruction, opportunities will exist to mitigate future losses by rebuilding in safer locations and through safer development and building designs.

Plan for the Manual

The following chapters seek to provide local officials in coastal jurisdictions with a clear understanding of the concept of growth management and of the specific programs and policies which can be used to mitigate storm hazards both in advance of and following a hurricane or storm. Chapter 2 introduces more fully the concept of growth management and discusses in detail the various community goals and objectives which can be advanced through such programs. It places hurricane and coastal storm hazard mitigation within a broader, multi-objective framework and discusses ways in which local goals and objectives can be dovetailed. It also introduces the concept of risk and discusses theoretical issues in determining acceptable local levels of hurricane and storm risks. Chapter 3 describes the intergovernmental and institutional context in which hurricane hazard mitigation and local growth management occur. Included are, for instance, a discussion of the nature and extent of local powers and a description of relevant federal and state laws

and administrative procedures which have some bearing on local mitigation efforts.

Chapter 4 provides a methodology for identifying, mapping, and evaluating the different risks associated with hurricanes and coastal storms. It focuses on practical approaches and on identifying readily available sources of data and information. Chapter 5 provides a detailed review of the alternative growth management tools and techniques that can be employed in reducing local hurricane risks. Examples of their use in North Carolina and in other states and localities are provided. In addition, Chapter 6 describes the unique needs and decisionmaking pressures evident in the aftermath of hurricane or major storm. A number of alternative institutional approaches to managing reconstruction and redevelopment during this period are reviewed (e.g., moratoria on redevelopment, reconstruction task forces).

Chapter 7 provides an overview of the legal issues pertaining to this subject. It discusses the legality and constitutionality of the various growth management tools and techniques described earlier. It also discusses other legal issues of relevance to the hazard mitigation area, such as the liability of local governments to prevent development in dangerous coastal locations. Chapter 8 adds a final summary and concluding note on the necessity of local leadership in coastal hazard mitigation. Finally, two appendices contain background information on the nature of hurricanes and coastal storm hazards, as well as model mitigation ordinances. It is our hope that this guidebook can serve as a reference and a resource to help local officials in the adoption and effective implementation of growth management programs.

Chapter 2

Using Growth Management to Reduce Hurricane and Coastal Storm Hazards

Introduction

This chapter introduces the concept of growth management and places it in a risk assessment framework. Growth management is an effective approach to mitigating hurricane and coastal storm risks, yet before this technique should be applied, the locality must make the determination that collective risks, existing or future, are in some sense unacceptable. Accordingly, the first section of this chapter will present a broad theoretical framework in which local officials can consider the relative hurricane risks in their particular locality, and the extent to which mitigation or reduction of these local risks is considered desirable.

Placing Hurricanes and Coastal Storms in a Risk Analysis Framework

As Appendix I discusses in detail, hurricanes and severe coastal storms generate physical forces which put property and human lives at risk. This is an endemic threat in coastal living. The existence of such threatening physical forces does not automatically suggest that we retreat from the coast. On the contrary, coastal environments are increasingly attractive places in which to reside and work. The question is one of balancing the dangers of coastal living against the benefits derived from it, and of deciding what constitutes an acceptable or unacceptable level of risk. Where risks are determined to be unacceptably high, certain actions (e.g., exit, mitigation, risk-sharing, etc.) are then called for.

Figure 2.1 presents a general framework for understanding the process of risk analysis and in which to place hurricane and coastal storm risks. Two

primary components of risk analysis can be identified: risk determination and risk evaluation.[1] In the first determination stage, the primary task is to identify and estimate the range and extent of the risks involved. The second element concerns whether to accept the risk, and, if so, to what extent. Risk determination involves quantifying the risks associated with hurricanes and coastal storms, and risk evaluation involves deciding whether, and in what ways, individuals and collective bodies should respond to these risks. Chapter 4 deals with the identification and quantification of hurricane risks and reviews a number of methodologies and techniques by which to accomplish this. The discussion which follows in this chapter deals with issues involved in risk assessment.

Risk Evaluation: Assessing the Acceptability of Coastal Storm Hazards

When a locality has identified the existence and extent of hurricane and coastal storm hazards, it must determine whether these risks are acceptable. In most cases the question will be one of degree: that is, to what extent are they acceptable and beyond what point are they no longer acceptable? Once these questions are answered, then appropriate actions and policies can be taken which bring levels of risks in line with decisions about acceptability.

From a philosophical point of view, several policy positions might be taken when defining "acceptability."[2]

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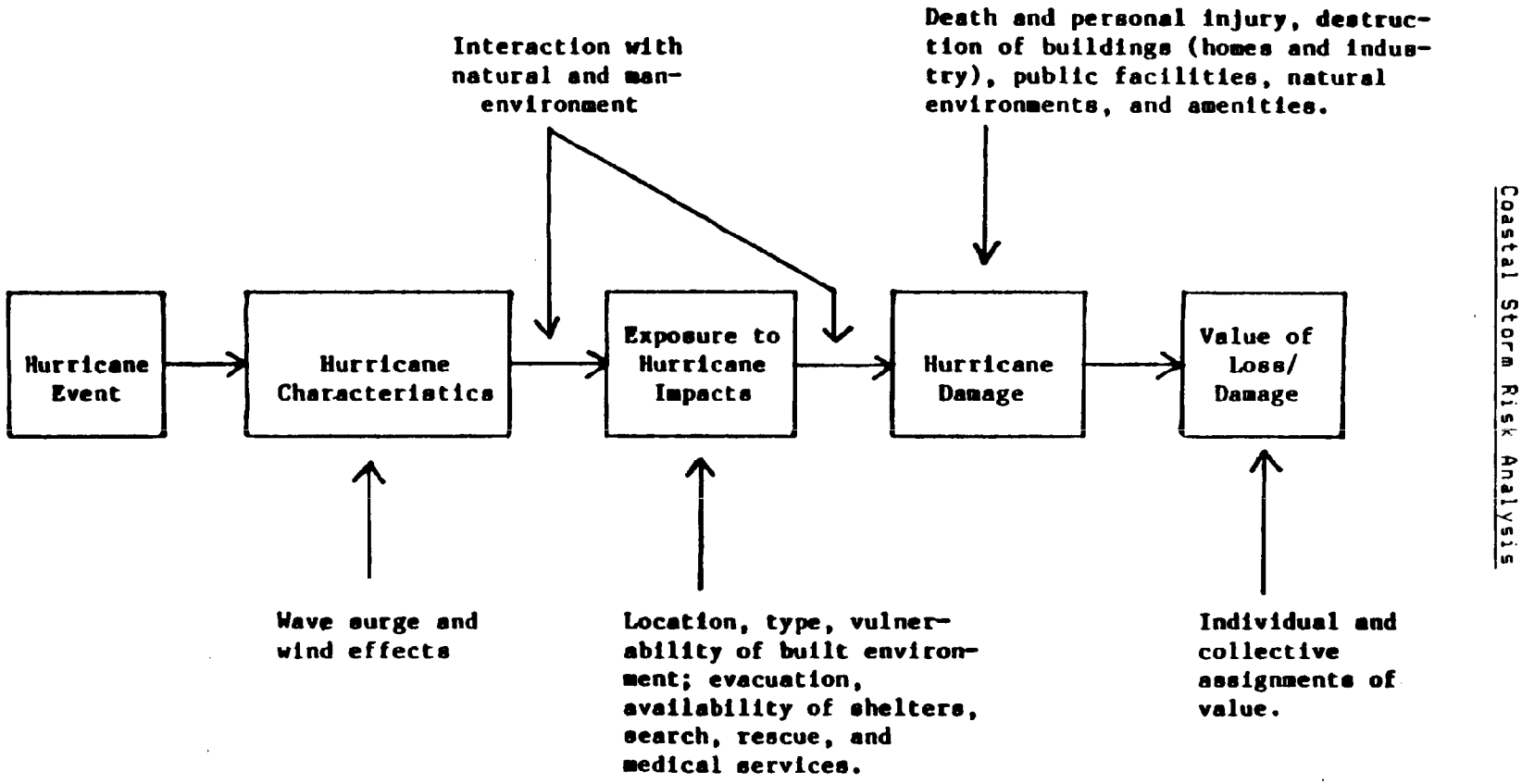
[1]William D. Rowe, "Governmental Regulation of Societal Risks," 45 Geo. Wash. L. Rev. 944-968 (1977).

[2]This discussion is taken largely from Beatley, Influences on the Priority, Adoption, and Effectiveness of Local Coastal Storm Hazard Mitigation, Chapel Hill, NC: UNC Center for Urban and Regional Studies, 1986.

Figure 2.1

Coastal Storm Risk Analysis



Source: Beatley, Brower and Godschalk, 1984

1. Reduce hurricane risks to the greatest possible extent. This position would argue that no degree of coastal storm risk should be accepted and that every possible mitigative action, no matter what its cost, should be undertaken. This appears an untenable position and would seem to call for a complete retreat from the coastline altogether. This position does not acknowledge that taking risks may yield significant social benefits and that complete mitigation may tend to be very costly from a social point of view.

2. Balance hurricane risks against social benefits. A more moderate position would argue that the acceptability of social risks must be balanced against the benefits obtained from taking or permitting these risks. For instance, the social benefits derived from building a high-rise hotel in the 500-year flood zone ("B" zone) might be deemed to far outweigh the storm or flood risks associated with this location. On the other hand, if the building were proposed for a location in a high velocity wave zone ("V" zone), the risks may be judged to exceed the benefits derived and that preventing its location here is then justified.

In assessing these costs and benefits, a number of factors must be considered.[3] An important consideration is whether there is a reasonable alternative to the risk-creating action in question. Even though it may be determined that the benefits of permitting development in a hazardous location exceed the risks, can such development yield the same level of benefits but at a location which involves fewer risks? It can be convincingly argued, for instance, that coastal setbacks do not reduce the overall benefits from coastal development but rather move them back from the ocean, in turn reducing the level of storm risk and increasing the net benefits produced.

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[3]William W. Lowrance, Of Acceptable Risk, Los Altos, CA: William Kaufman, Inc.

3. A maximum acceptable hurricane risk. A standard such as the previous one may lead to a utilitarian maximizing of net social benefits, regardless of the actual impacts on individuals. For instance, it might be argued under the balancing approach that, even though a number of individuals are likely to be killed should a hurricane hit the locality, the social benefits of permitting hazardous development (e.g., levels of development in excess of evacuation capacity) exceed these social costs. This is clearly unacceptable from the point of view of individuals losing their lives in these circumstances. Consequently, a "maximum acceptable risk standard" would not be acceptable. For instance, we may establish that, regardless of the level of net social benefits that might result from such a practice, no additional coastal development will be permitted to occur if it raises required evacuation time beyond 12 hours (or whatever is deemed the maximum risk that any average evacuating individual should have to face).

4. An equitable distribution of hurricane risks. Hurricane and coastal storm risks can be distributed in many different ways, even when satisfying some of the above standards. This evaluatory standard or principle would suggest that an existing risk may be unacceptable because it is distributed unfairly. For instance, a locality may assess developers or homeowners for the full costs of public facilities located in particularly hazardous sites because it feels that it is unfair for the larger public to subsidize such private activities. A locality may take certain risk-reducing actions, for instance the building of new storm shelters, because it determines that hurricane risks are unfairly high for elderly and lower-income residents.

The Issue of Voluntarily-borne Risks

An important value question which policy makers dealing in this area will undoubtedly confront is the extent to which local governments in their attempts to reduce coastal storm risks are usurping the risk-taking authority of the individual. Is it legitimate for the locality to judge as unacceptable a risk which the individual has judged to be acceptable (e.g., building a home on the water)? Response to such arguments hinges in large part upon empirical understandings of the risk. Most individual risk-taking behavior is not strictly "exclusive"; that is, one person's risk-taking behavior affects the welfare of others in the community. With respect to coastal storm hazards, this non-exclusivity occurs in numerous ways. Homes built in high hazard areas can turn into battering rams, destroying homes in other locations. Construction too close to the ocean, and the protective works which usually follow, are highly erosive and may serve to undermine the beach and dune system which protects other homeowners. Structures built in high hazard areas may also comprise a significant portion of the local tax base, so that the cumulative effect of individual risk-taking could endanger the fiscal health of the whole community. In terms of lives, when residents must be rescued from hazardous locations, rescue workers risk their own lives and public agencies expend their resources. One coastal resident's need to evacuate reduces the ability of other coastal residents to do so. The list of such "public effects" is extensive.

However, even if an individual's risk is in fact completely internalized (i.e., does not affect someone else or the public in general), there may remain legitimate reasons for public risk-reducing actions.[4] Individuals

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[4]Timothy Beatley, Development Management to Reduce Coastal Storm Hazards: Policies and Processes, Chapel Hill, NC: UNC Center for Urban and Regional Studies, 1985.

often lack the time, resources, information, or specific cognitive abilities to engage in risk calculations. For instance, the adoption of a jurisdiction-wide building code is clearly justified in that the average coastal homebuyer would not have the necessary information or expertise to adequately evaluate the ability of the structures to withstand hurricanes. Moreover, it can be convincingly argued that the public sector has strong ethical obligation to protect the health, safety, and welfare of individuals, an obligation founded on democratic consent.

Hurricane Hazard Mitigation Goals and Standards

Judgments about the acceptability of coastal hurricane and coastal storm hazards will in turn lead to the consideration and adoption of hazard reduction goals and a specific ordering of these goals. Such goals then serve to guide the development of more specific programs and policies to implement them. These goals might be generated by the following questions which summarize earlier discussion:

A. Are existing risks acceptable?

- o No → 1. Reduction of human injury and loss of life.
  2. Reduction of damages to existing development.
  3. Reduction of damages to existing public facilities and structures.
- o Yes
  ↓
  Do nothing.

B. Are future risks acceptable (given best available knowledge of the future)?

- o No → 1. Reduction of human injury and loss of life.
  2. Reduction of damages to future development.
  3. Reduction of damages to future public facilities and structures.
- o Yes
  ↓
  Do nothing

These goals can then be ranked, depending upon the specific priorities and concerns of the locality. For instance, in a barrier island locality where most development is located in the least hazardous locations and yet where evacuation off the island is difficult, reducing the level of risks to human life may be of greatest importance. In a locality where evacuation is relatively easy, yet where development has and continues to occur in the most hazardous locations, priority may be given to the reduction of damages to property. It should be remembered, however, that which goals receive priority will depend upon judgments about the nature of the local risk. Reducing risks to human life may be the most important goal even in the locality where evacuation is relatively easy, if officials believe that substantial numbers of residents will remain in their homes during a hurricane and that prevailing building practices are not adequate to prevent major catastrophes from occurring.

Once these relatively general goals are established, it is advisable that a locality seek to develop more specific risk-reduction standards. These can then serve as operational standards of what is or is not an acceptable level of risk and will provide specific guidance in selecting appropriate policies and programs to achieve them. Some examples of such standards might include:

- o Total required evacuation time for the locality shall not exceed 24 hours;

- o No more than 25 percent of the total value of taxable private property shall be located in the 100-year floodplain;
- o No future residences or other structures shall be located in Coastal High Hazard Zones (V zones);
- o Development in areas in the community where the storm hazard is greatest will not be permitted until development capacity in safer locations has been reached;
- o Residential development shall not occur seaward of the beach road, unless a protective dune exists to shield it from storm forces;
- o Etc.

Integrating Risk Reduction and Other Local Objectives

The relation of storm hazard reduction goals and the programs designed to advance them to other community objectives should always be considered. Among these non-mitigation goals might be some of the following:

- o The protection and enhancement of the natural environment and ecosystem;
- o The enhancement and improvement of the local economy and the adequate provision of employment and income for residents;
- o The availability of sufficient and affordable housing stock for existing and future residents;
- o The protection of aesthetic and scenic characteristics of the coastal environment;
- o The preservation of the high quality of life and small town atmosphere of the community;
- o The achievement of efficiency in the provision of public services and facilities.

If, for instance, the protection of coastal wildlife areas is an important local goal, this may be accomplished through the public acquisition of such lands, which are likely also to be areas susceptible to hurricane and storm forces. Acquisition of these lands in these cases serves multiple local

goals. Certain mitigation policies, such as setbacks and density restrictions for instance, may also serve to advance local goals of preserving aesthetic resources and ensuring the economic attractiveness of the area. It is important to integrate mitigation goals with other pertinent local goals and objectives. This will almost certainly tend, as well, to enhance the political and financial acceptability of such measures.

Using Growth Management to Reduce Hurricane and Coastal Storm Risks

This section discusses the use of growth management tools and techniques as an effective approach to reducing many of the risks and hazards associated with hurricanes and coastal storms. Growth management has been defined to include programs and policies which serve to influence the location, density, timing, and type of development occurring in a community.[5]

Growth management programs, as we define them, have historically been designed to address a number of social and economic objectives. Primary among these objectives has been the promotion of compact and contiguous urban development, the provision of cost-efficient sewer, water and other public services, and the protection of the natural resource base (e.g., productive farmland and forestland). Growth management programs have in more recent years attempted to address such problems as the availability of affordable housing[6] and the protection of aesthetic and visual resources.[7]

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[5]David J. Brower et al, Managing Development in Small Towns, Chicago: APA Planners Press, 1984; David J. Godschalk et al, Constitutional Issues of Growth Management, Chicago: APA Planners Press, 1979.

[6]W. Dennis Keating, "Linking Downtown Development to Broader Community Goals: An Analysis of Linkage Policy in Three Cities," 52 Journal of the American Planning Association 1986, No. 2 (summer): 133-141.

[7]Christopher J. Duerksen and Mary C. Bean, "Land and the Law 1985: A Run on the Bank," 17 The Urban Lawyer No. 4, 827-870 (1985).

Modifying the Characteristics of Growth

Growth management programs and policies can accomplish goals of hazard mitigation as well as the range of social and economic goals identified above, by seeking to influence or modify one or more characteristics of urban growth and development. These key characteristics or dimensions of growth include the following:

1. Location. A primary strategy for reducing hurricane and coastal storm hazards is to avoid the location of human activities in close proximity to the source of these hazards. This may suggest, for instance, that high hazard coastal storm surge zones be left in an undeveloped state.

2. Density. An important determinant of the extent of risk from hurricane hazards is the density of development which occurs in high hazard locations. Actions may be taken, for example, to ensure that low development densities occur in these high hazard areas, such as low density residential. The overall density of development in a community may be controlled or influenced, for example, to ensure the ability of residents to evacuate in the event of an approaching hurricane.

3. Timing. The phasing or timing of growth may be desirable in order to ensure that local planning capacity and local services and facilities crucial to responding to hurricane and coastal storm disasters are not outstripped. Future development on a barrier island, for example, may be phased according to the capacity of the local street and bridge system to accommodate evacuation in the event of a hurricane.

4. Type. The type of growth or development refers to the actual uses to which land and space is put. Typical uses include commercial and industrial, single family residential, multifamily, open space and recreational uses, and

so on. The presence of storm hazards may suggest that certain uses are more appropriate than others in certain high hazard areas. For instance, recreational and marina areas may be the most appropriate uses for high hazard flood zones, because they involve low levels of property, and do not serve to undermine the preexisting protective features of the natural environment (e.g., dunes, vegetation, etc.).

Conclusion

How should communities go about deciding how to respond to hurricane hazards? Risk analysis is a good first step in developing a growth management policy to reduce coastal storm hazards. This chapter suggests that local governments focus the policy debate on community attitudes towards coastal hazard risks--the extent to which risks should be reduced, the levels of risk that balance out against the benefits of development, the maximum risk acceptable, and which elements of the community bear the risks. Local governments cannot necessarily escape responsibility by relying on voluntarily-borne risks, because the external effects and unintended consequences of individual risk-taking often call for public intervention.

Once a community generates overall hazard reduction goals, it can then rank and operationalize its objectives, specifying such standards as an evacuation time limit or restrictions on the type and level of development to be allowed in high hazard areas. These mitigation planning guidelines can often be integrated with other local policies, such as protecting the coastal environment or preserving a distinctive atmosphere and quality of life.

In many cases local governments can best achieve their hazard mitigation goals through growth management, which reduces risks by reducing the exposure of lives and property to coastal storm hazards. Growth management limits and

guides new development by modifying its location, density, timing, and type, thereby reorienting intensive development away from hazardous locations. Chapter 5 specifies the growth management tools and techniques available to implement local mitigation strategies, following Chapter 4's discussion of the tools which local governments can use to identify hazard location and exposure.

Chapter 3

Institutional Context for Coastal Growth Management

Though growth management, like all land use regulation, is traditionally a local government responsibility, coastal local governments must operate in an interlocking framework involving all three levels of government--federal, state, and local. The interrelated programs and agencies affecting coastal area management present a complex web of legal requirements and political pressures with which local governments should become familiar in designing and implementing their own hazard mitigation policies.

I. The Federal Government

Perhaps the originating impulse for coastal area management in general and storm hazard mitigation in particular comes from the federal government, especially in terms of funding and setting the policy agenda. Because of the Commerce Clause of the U.S. Constitution, which empowers Congress to regulate navigation and interstate commerce, the federal government has always had a strong presence on the coast. The regulation of navigation led to a direct involvement in coastal development, through the activities of the Army Corps of Engineers (COE) in constructing breakwaters, dredging channels, regulating private construction, and otherwise promoting navigation and commerce. More recently, other federal agencies such as EPA have regulated private development activities under the authority of environmental legislation, to protect coastal waters from pollution and coastal environments from degradation. Currently, the federal presence on the coast is confusing and multifaceted: different federal agencies play the roles of developer,

financier of private development, regulator, and facilitator of state government programs. These forms of federal involvement in coastal development regulatory policies are in addition to the background role of the National Weather Service in providing the hurricane monitoring, forecasting, and modeling services which yield the raw data for coastal area management.

Though the federal government's commerce power is so extensive that it could theoretically pre-empt all state and local coastal management, federal coastal policies have been described as a paradigm of the New Federalism, in which the federal government does not directly regulate state government or private activity, but engages in program support and institution-building, usually through categorical grants.[1] The lure of federal dollars, even with complicated procedural and legal strings attached, has been effectively used to create agencies and procedures at the state and local levels rather than to mandate substantive coastal policy. The New Federalism model aptly describes the two federal programs with the greatest effect on coastal hazard mitigation: the National Flood Insurance Program (NFIP) and the Coastal Zone Management Act.

A. National Flood Insurance Program

A significant factor in coastal development as a whole and a major impetus for local mitigation programs, the NFIP was established by the National Flood Insurance Act of 1968. The program is intended to reduce the magnitude of flood disaster losses and federal disaster aid by providing federal flood insurance to floodplain residents, in return for building codes and land use control measures by the appropriate local government. Since

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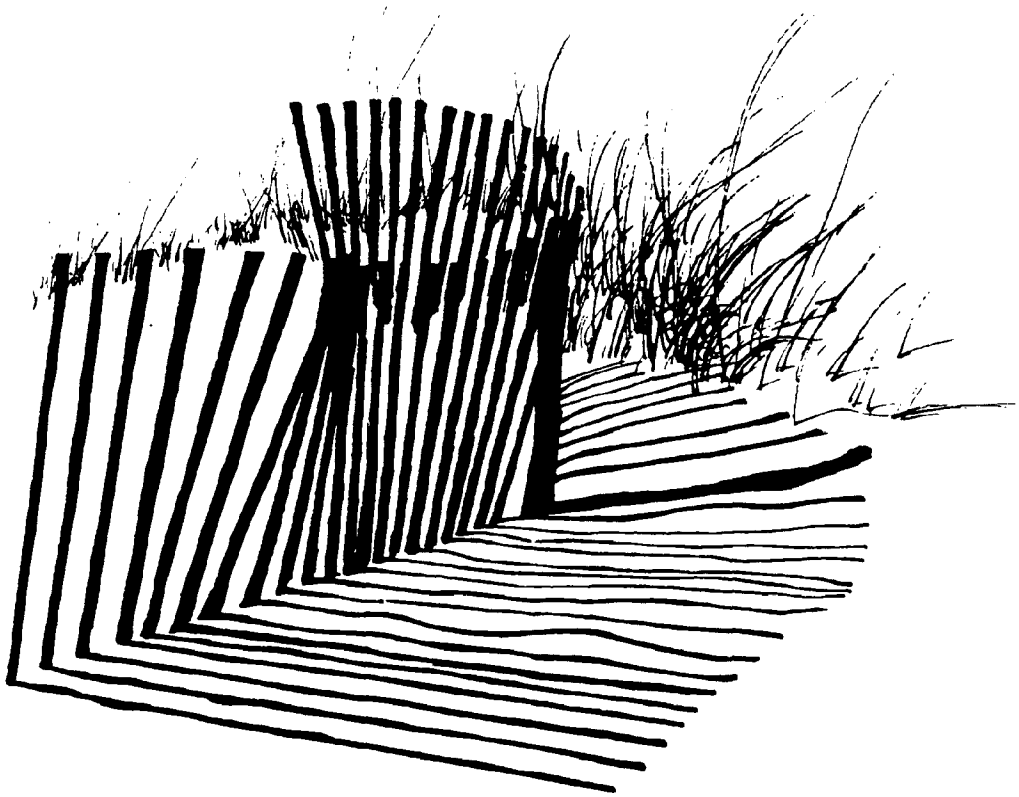
[1] G. Finnell, Intergovernmental Relationships in the Coastal Zone, 25 Nat. Res. J. 31 (1985).



private-sector flood insurance is often unavailable, local governments would be encouraged to qualify for the program in order to make the insurance benefits available to their residents. At the same time, the required development regulations would ensure that new construction would be better protected from flood hazards, thus diminishing the necessity for flood insurance claims payments and federal disaster aid expenditures.[2]

The program is initiated when the Federal Insurance Administration (FIA), a division of the Federal Emergency Management Agency (FEMA), identifies a flood-prone community, generally one which contains a 100-year floodplain. After FIA prepares a Flood Hazard Boundary Map for a community, the local

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[2]The New Federalism approach of the NFIP was upheld in Texas Landowners Rights Ass'n v. Harris, 453 F.Supp. 1025 (1978), aff'd 598 F.2d 311 (1979), cert. den. 444 U.S. 927 (1979). The court found that conditioning flood insurance benefits on enactment of development restrictions was not an unconstitutional interference with state sovereignty.

government can enroll in the emergency phase of the NFIP, instituting preliminary development regulation and making limited insurance coverage available to its residents. Except for communities identified as minimally flood-prone, before a jurisdiction enters the regular phase of the program, FIA undertakes a detailed flood hazard survey which delineates and categorizes the geographical extent of potential hazards and is graphically represented by a Flood Insurance Rate Map (FIRM). As its name suggests, the FIRM provides the basis for setting flood insurance premiums for particular properties, but it also determines the extent and level of required development regulations, usually elevation requirements. For instance, the 100-year floodplain in a community is basically divided into A-zones and V-zones. The latter, being subject to wave action as well as storm surge up to the 100-year flood level, necessitates stricter elevation and construction standards for new development in an enrolled community.[3]

In terms of widespread participation, the NFIP has been a great success in attracting local governments to enroll, but it has been rather less successful in controlling development in vulnerable coastal areas:

> The benefits to communities and their citizens are so great that most coastal communities do participate in the program. However, the program has not been successful in discouraging development in hazardous coastal areas . . . The availability of federally subsidized flood insurance has eliminated much of the economic risk involved in coastal development.[4]

Even though the availability of subsidized insurance has to an extent perpetuated the disaster/federal aid/rebuilding/disaster cycle the NFIP was

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[3]Specific technical provisions of the NFIP are discussed in Chapter 4.

[4]Hildreth, Legal Aspects of Coastal Hazards Management, in Edge (ed.), Coastal Zone '80, Vol. II, Proceedings of Second Symposium on Coastal & Ocean Mgmt., Am. Soc. of Civil Engineers (1980), at 1374. The extent to which the NFIP has contributed to coastal development is controversial. A GAO Report, Flood Insurance: Not a Significant Factor in Encouraging Coastal and Barrier Island Development, August 1982, concluded that subsidized flood insurance was only a marginal added incentive to development.

designed to interrupt, the program has had significant positive effects on coastal hazard mitigation planning. The work done by FIA in delineating flood hazard zones, preparing detailed maps, and promulgating development requirements has provided the technical basis for state programs, such as the designation of flood hazard AECs under CAMA, and for the design of local land use plans. NFIP funds and regulations have brought coastal hazard mitigation to the attention of local governments and have suggested methods to approach the problem. Federal grant requirements have provided a constituency for mitigation and an incentive for cautious reconstruction at a time when many coastal local governments and property owners may think only of rebuilding the status quo ante as soon as possible.

B. Post-Disaster Aid

FEMA has also sought to encourage local government hazard mitigation in the context of its post-disaster aid programs. Federal financial assistance has long been a familiar feature of the aftermath of storms and other natural disasters, and there are a wide variety of aid programs available for both individuals and governments.[5] The institutional structure of federal disaster assistance has been codified under the Disaster Relief Act, which made FEMA the lead agency for all federal disaster relief efforts.[6] Under the Act, most federal aid is contingent on a Presidential declaration of an "emergency or major disaster." The Presidential declaration is promulgated after the governor of the affected state formally requests federal aid and certifies that state and local resources are inadequate. The governor's request must be

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[5]See generally Chapter 6; also Propst, Federal Programs Providing Disaster Assistance to Coastal Local Governments Following a Hurricane: A Handbook for Local Government Officials, Chapel Hill, NC: UNC Center for Urban and Regional Studies, April 1984.

[6]42 U.S.C. §5121 et seq.

sent to the FEMA Regional Director and forwarded through the Director of FEMA to the President for a decision. Once the President issues a declaration, the governor and the FEMA regional director sign a Federal-State Disaster Assistance Agreement which specifies how federal funds are to be used.

Pursuant to §406 of the Act, the federal-state agreement also includes a condition that state and local governments must evaluate applicable natural hazards and develop a hazard mitigation plan "including safe land use and construction practices" for the disaster area in order to receive further federal funds. The §406 plan must be submitted to FEMA within 180 days after the President's proclamation, and is often based on the initial work of a federal/state/local survey team and the Federal Interagency Regional Hazard Mitigation Team.[7]

Another post-disaster program which FEMA employs to reduce potential disaster losses is the damaged property purchase and relocation program of §1362 of the NFIP. In many cases, it would be cheaper for the FIA to purchase properties in particularly hazardous locations and leave the land vacant rather than continue to pay periodic flood insurance claims and allow reconstruction after a regular cycle of floods, especially if local floodplain regulation forbids or restricts reconstruction. Until 1983, FIA used the "constructive total loss" approach where frequently-flooded properties which were damaged, but not destroyed, in the latest storm were deemed total losses and their owners paid off up to the flood insurance policy limits, with the damaged property dedicated to the local government as open space. Section 1362 systematized this process by allowing FIA to purchase insured properties

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[7]D. Brower, D. Godschalk, & T. Beatley, Implementing Coastal Storm Hazard Policy, Center for Urban & Regional Studies, UNC-Chapel Hill, 1986, Ch 4., §2.3.5.

which were either damaged beyond repair, had been flood-damaged for three of the past five years, or were legally prohibited from being reconstructed. FIA uses eight "community selection factors" to allocate its §1362 funds. The §1362 program, though it has worked effectively in several cases and is considered an effective mitigation measure, is vastly underfunded when compared to the estimated number of eligible structures.[8]

C. Coastal Zone Management Act

The exemplar of the New Federalism, the Coastal Zone Management Act of 1972, did not mandate any specific coastal land use politics, but instead sought to institutionalize "management" of coastal resources.[9] The Act sought to encourage state coastal programs, within a specified format, to establish planning and permitting procedures which would balance the conflicting residential, recreational, economic, and environmental uses of the limited resources of the coastal zone, while local governments would retain substantial responsibility for land use regulation.

To be approved under the CZMA, state coastal plans had to conform to certain structural and procedural requirements, such as defining the boundaries of the coastal zone, establishing standards for permissible land and water uses, and designating areas of particular concern, including storm hazard areas. Once approved by the Office of Coastal Zone Management in NOAA, states became eligible for federal grants for both program development and program implementation and administration. This attractive funding incentive was probably the major factor in the widespread acceptance of coastal zone

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[8] Brower, Godschalk, Beatley, Implementing Coastal Storm Hazard Policy, Ch.4, §2.3.4.

[9] M. Wolf, Introduction and Overview, Accommodating Tensions in the Coastal Zone, 25 Nat. Res. J. 7 (1985).

planning by coastal states, but the CZMA also provided another incentive in the form of its federal consistency provisions, which was very important to some states. In states with approved coastal plans, federal public works, development projects, permitting, or other programs must conform to the maximum extent practicable to the state coastal policies and guidelines.[10]

D. Funds Cutoffs

Federal involvement with coastal development policies is not restricted to grants and incentive programs. In addition to the strings attached to federal aid carrots, the federal government is at times willing to use the stick--a cutoff of funds for unrelated programs in order to achieve coastal management objectives. These programs go beyond denying NFIP benefits to communities which don't abide by its restrictions, because the NFIP, like the CZMA, is entirely optional (though financially very attractive). The Coastal Barrier Resources Act, by contrast, forbids any federal expenditures which assist in developing designated barrier islands (infrastructure, mortgage financing).[11] Because certain undeveloped stretches of barrier islands, including portions of the Outer Banks, were found to serve as natural storm barriers and were unsuitable for development, CBRA prohibits federal aid for road and bridge construction, disaster relief, or flood insurance on structures within the designated barrier areas. The effects of CBRA on shoreline development are still being debated, but the Act points out a potential new approach in the use of the federal spending power--withdrawing financial support which local governments and developers may have taken for

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[10] 16 U.S.C. §1456.

[11] 16 U.S.C. §3501 et seq. CBRA was recently upheld against a constitutional due process challenge that the designation of part of Topsail Island as an undeveloped barrier beach was irrational. Bostic v. U.S., 753 F.2d 1292 (1985).

granted--to accomplish federal coastal policy.[12]

Prior to CBRA, President Carter in 1977 issued two executive orders directing federal agencies to avoid supporting development in floodplains (E.O. 11988) and wetlands (E.O.11990). Agencies were required to refrain from financing or permitting development projects in flood hazard areas or wetlands unless "no practicable alternatives" exist. The executive orders and the regulations adopted to implement them are designed to undertake a consistent federal policy to discourage wetland and floodplain development. Executive orders do not have the full force of law in terms of binding the agencies to third parties, but are binding on the agencies within the Executive Branch. In other words, insofar as federal agencies have discretion to allocate or withhold funds under the appropriate statutes, they are required by the Chief Executive to exercise that discretion to avoid wetland and floodplain development. In practice, the E.O. 11988 and 11990 regulations have evolved into a set of procedural requirements for environmental impact statements similar to those of the National Environmental Policy Act (NEPA).[13]

E. Environmental Regulation

As part of its plenary commerce power, the federal government is able to regulate activities which affect the nation's air, water, and environment. Of the major federal environmental statutes and programs of the late 1960's and early 1970's, the measure most significant for coastal zone management is the Federal Water Pollution Control Amendments of 1972. The FWPCA, codified at 33 U.S.C. §1251 et seq., contain numerous complex water pollution initiatives

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[12] R. Kuehn, The Coastal Barrier Resources Act and the Expenditures Limitation Approach to Natural Resource Conservation: Wave of the Future or Island Unto Itself?, 19 Ecol. L.Q. 583 (1984).

[13] See, e.g., County of Bergen v. Dole, 620 F.Supp. 1009 (1985); Sierra Club v. Hassell, 636 F.2d 1095 (1981).

(including the §401 Water Quality Certification and the §402 National Pollution Discharge Elimination System permits), but the most salient provision for coastal management is the §404 permit process. Section 404 of FWPCA directs the COE to regulate and grant permits for the discharge of dredged and fill material into the nation's waters and wetlands. The scope of the §404 program is extensive, comprising not only the navigable waters which COE had been accustomed to regulating in the interests of navigation, but also all waters which affect navigable waters, their tributaries, and adjacent wetlands. Consequently, almost any development activity in the coastal area which involves dredging or filling waters or wetlands will require a §404 permit.

Unlike the NPDES and other environmental permit programs, the authority to administer the §404 program has not been sought by the State of North Carolina, but the COE has agreed with North Carolina agencies to institute a joint permitting process, with a single application form for all activities requiring both state and §404 permits (including major development permits in AECs under CAMA). The §404 process comes under the CZMA's consistency provision, so that the §404 permit applicant must either obtain a Certificate of Consistency from the DCM or a CAMA permit, which itself serves as an indication of consistency with state coastal policies.[14]

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[14]See Gale, Propst, & Sappie, 404 Feasibility Study Final Project Report, Raleigh, NC: Center for Environmental Studies, May 1985.

II. State Government

In the American federal system, states are independent sovereigns, and powers not granted to the federal government under the U.S. Constitution remain with the states.[15] This residual sovereignty includes above all the police power, the authority to regulate private conduct and property in the interests of the public health, safety, and general welfare. State police power is the ultimate legal basis for zoning and other forms of development regulation, while taxing and spending authority is another attribute of independent sovereignty. Subject to the supremacy of federal law, states can regulate development, tax, and spend as they see fit.

State governments are also intimately concerned with coastal issues as owners of much of the shoreline. Under the common law doctrine of the public trust, states hold title to submerged lands and tidelands in perpetual trust for public use in navigation, commerce, fishing, etc. In North Carolina and most other coastal states, the state's ownership extends landwards up to the mean high water line.[16] In this shore area the state can exercise all the normal powers of private ownership as well as governmental authority.

A. The Coastal Area Management Act

Since the state is the ultimate source of police power authority, it, like the federal government under the commerce power, could entirely pre-empt coastal area management if it chose to do so. Instead, through the framework of the Coastal Area Management Act of 1974, North Carolina has established a cooperative planning program which respects the traditions and political

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[15] See 10th Amdmt., U.S. Constitution.

[16] Consequently, the boundaries of the beach area to which the state has title can shift with beach erosion and accretion. See Carolina Fishing Pier, Inc. v. Town of Carolina Beach, 277 N.C. 297 (1970).

potency of local control of land use regulation, while simultaneously advancing broader interests in more comprehensive coastal management:

> This Article establishes a cooperative program of coastal area management between local and State governments. Local government shall have the initiative for planning. State government shall establish areas of environmental concern. With regard to planning, State government shall act primarily in a supportive standard-setting and review capacity, except where local governments do not elect to exercise their initiative. Enforcement shall be a concurrent State-local responsibility.[17]

In some ways the North Carolina CAMA is a CZMA brought down to the state level.[18] CAMA is administered by the Coastal Resources Commission, representing a variety of public and private interests, aided by the Coastal Resources Advisory Council, which includes local government representation, and staffed by the Division of Coastal Management in the State Department of Natural Resources and Community Development. The CRC has promulgated overall state guidelines for public and private land use in the coastal area, to which all local land use plans and state and local permits must conform.

The CAMA framework seeks to achieve these guidelines through two basic approaches. First, each county within the coastal area is required, and municipalities encouraged, to adopt local coastal land use plans for CRC approval. The DNRCD may furnish grants (originally federal funds from CZMA) and technical assistance to help develop local planning capabilities. Regulations issued under CAMA specify the procedures, content, and format of local plans, and now require specific attention to coastal storm hazard mitigation.[19] The Act's second major approach, as contemplated by the CZMA, is the designation and special state regulation of Areas of Environmental

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[17] N.C.G.S. §113A-101.

[18] CAMA was upheld against State constitutional challenges that it was an uncontrolled delegation of power to the CRC and that it was local legislation in Adams v. DNER and Everett v. DNER, 295 N.C. 683 (1978).

[19] 15 N.C. Admin. Code §.07M.0700.

Concern. The various types of AECs include natural hazard areas.[20] Within an Area of Environmental Concern, any development project must secure a CAMA permit, with "major" developments (those of a certain physical size or requiring another state or federal permit, such as a §404 permit) being permitted directly by the CRC, and "minor" development being permitted by approved local governments.

Although the local plans and permits and the state permits are required to conform to overall state guidelines and policies, there is no direct way for CRC to enforce its guidelines or force local governments to adopt any specific substantive coastal policy. By contrast, coastal landowners are given a special, expedited judicial review procedure to determine whether a permit denial or other CRC order constitutes a taking without compensation.[21] Nonetheless, CAMA has been very successful in institution-building at the local level, introducing local governments to coastal issues and providing technical and financial aid to help localities, many of which had little experience with comprehensive land use planning or regulation. In addition, CAMA's state guidelines and planning requirements provide a convenient form of compulsion which helps overcome local opposition to coastal land use planning and regulation.

B. State Building Code

The other major state government program pertaining to coastal hazard mitigation in North Carolina is the State Building Code. Building codes, which set standards for construction design, materials, and practices, are an established subset of the police power used to protect the public health and

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[20] N.C.G.S. §113A-113(b)(6).
[21] N.C.G.S. §113A-123(b).

safety from dangerous building conditions. In some states building codes are predominantly delegated to local governments, but in other states, like North Carolina, there is a uniform statewide code. The North Carolina State Building Code, administered by the Building Code Council, applies throughout the state, and local governments must receive Council approval for any deviation, in order to ensure uniform standards for the state's construction industry.[22] Local variations are frowned on, even though local governments are expected to actually enforce the Code through building inspection and permit programs.[23] The Code does, however, contain provisions for structures to withstand higher wind loads in high-wind areas, the designation of which includes the coastal zone.

III. Local Governments

A. Police Power Regulation

Local governments, with the greatest historical and political attachment to land use regulation, have no inherent legal authority for such regulation. Both counties and cities, or municipal corporations, are legally creatures of the state and can exercise no governmental power--police power, taxing, or spending--without an express delegation from the state, usually by general statute or home-rule charter. But the U.S.'s historical concern with local control over land use, and the profound inability of a central state (much less federal) government to monitor and regulate a multitude of widely varying local conditions, have led to a widespread delegation of policymaking as well as implementation and enforcement authority to local governments.

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[22] N.C.G.S. §143, Art. 9. Because of federal supremacy, local ordinances enacted pursuant to NFIP requirements would supersede the state building code.

[23] N.C.G.S. §160-411 et seq. (cities); N.C.G.S. §153A-350 et seq. (counties).

In North Carolina, the basic statutory authorities for cities and towns are compiled in N.C.G.S. §160A, and for counties in N.C.G.S. §153A. Both cities and counties have been given a general delegation of the full ordinance-making police power to "define, prohibit, regulate, or abate acts, omissions, or conditions, detrimental to the health, safety, or welfare of its citizens and the peace and dignity of the city (county) and may define and abate nuisances."[24] So long as the local ordinance is not inconsistent with or pre-empted by federal or state law, local ordinances may require a higher standard of conduct or condition than state or federal regulation.

In addition to the general ordinance-making power, many specific subjects are authorized for local regulations, but the statutes state that this enumeration is not exclusive and does not limit the general ordinance-making

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[24]N.C.G.S. §§160A-174(a); 153A-121(a).

power.[25] Among the important specific regulatory powers delegated to local governments are: zoning,[26] which is the major tool of hazard mitigation through building lot size, elevation, setback, density, and other requirements; subdivision regulation,[27] which can require hazard disclosure, setbacks, and other mitigation measures for new developments; building inspection;[28] and pollution control.[29]

The grant of regulatory authority to local governments does not mean that localities have a free hand in coastal hazard mitigation or any other form of policy. As independent legal entities known as municipal corporations, local governments have all the rights and responsibilities of a legal person, including the ability to make contracts and to sue and be sued. Consequently, home-rule powers carry with them a corresponding legal responsibility to higher levels of government and to local citizens. Any city or county enactment in general is invalid if inconsistent with state or federal law, and local coastal planning and regulation in particular must be approved by the state under CAMA.[30] If cities or counties breach the conditions attached to federal-local grant programs such as the NFIP and post-disaster aid, they

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[25] N.C.G.S. §§160A-177; 153A-124.
[26] N.C.G.S. §§160A-381 et seq.; 153A-340 et seq.
[27] N.C.G.S. §160A-371 et seq.; 153A-330 et seq.
[28] N.C.G.S. §§160A-411 et seq.; 153A-350 et seq.
[29] N.C.G.S. §160A-185.
[30] According to McQuillin's Law of Municipal Corporations, (Callaghan and Company 3d ed. 1981), §4.107:

> The exercise of local police powers of a municipality with a home rule charter is ordinarily invalid if in conflict with general statutes of the state, home rule charters being subject to the police power of the state, except, perhaps, insofar as police powers have been delegated to municipal corporations by the constitution of the state. The state, even though it has delegated to a municipality the right to exercise such power, does not thereby surrender any part of such powers, and may itself exercise such power not withstanding its delegation, without regard to whether the matter concerns the state at large or the municipality alone. [citations omitted]

would not violate the law per se but might find themselves barred from further federal largess and possibly become liable for damages.[31]

B. Non-Regulatory Authority

Local governments have also been delegated many non-regulatory fiscal, executive, and taxing powers which could be employed in a hazard mitigation program. In general, all local government authority must be exercised for a public purpose, but taxing authority is the most restricted, with very specific statutory delegations of the property which may be taxed and the purposes for which the taxes may be levied. Police power authority is less restricted, and local governments have the most freedom to exercise the spending power.

Supplementing state and federal land acquisition programs, North Carolina local governments can acquire property for public use as recreational open space and/or a coastal storm buffer. In addition to the general authority to acquire interests in land and to use the eminent domain proceedings of N.C.G.S. §40A,[32] and the authority to acquire property for redevelopment,[33] counties and cities may acquire a fee simple or lesser interest in land to be used for open space, which the legislature has declared a proper public purpose for the expenditure of public funds.[34] In addition, property taxes may be specifically earmarked "to provide for shoreline protection, beach erosion control, and flood and hurricane protection."[35] This is ample authority for local funding of hazard mitigation programs; otherwise, new types of taxes must be specifically authorized by the state legislature.[36]

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[31]See the subrogation suits discussed in Chapter 7.
[32]N.C.G.S. §§160A-240.1; 153A-158.
[33]N.C.G.S. §§160A-457, 153A-337.
[34]N.C.G.S. §160A-401 et seq.
[35]N.C.G.S. §§160A-209(c)(7); 153A-149(c)(7).
[36]N.C.G.S. §§160A-206; 153A-146.

North Carolina localities have not undertaken the assessment of development impact fees without authorization by Special Act of the legislature.[37] Given the limited delegation of taxing authority and the derivative nature of all local government powers, many local governments may be reluctant to attempt innovative development management programs (especially those involving taxation) such as TDRs or development moratoria which have not been used before in North Carolina and the legality of which has not been established.

In any case, local governments do not need to chart an independent, untried course in developing coastal hazard mitigation programs. Counties and cities have been delegated extensive powers, especially regulatory powers, which they can exercise within a framework of state and federal programs. Higher authority can offer both binding legal requirements, such as CAMA's mandatory planning, or conditional incentives, such as the strings attached to the federal NFIP and disaster aid programs. Local governments should be fully aware of state and federal programs when designing a hazard mitigation plan to meet their unique local conditions.

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[37]See, e.g., Ch. 536, Sess. Laws 1985 (authorizing the municipalities of Dare County to impose facility fees); Ch. 498, Sess. Laws 1985 (amending Raleigh's charter to allow the city to impose drainage and open space project fees on new developments).

Chapter 4

Identification and Analysis of Hurricane and Coastal Storm Hazards

A. Hazard Magnitude and Location

Coastal planners can use a number of existing techniques and data bases for identifying the location and extent of storm hazards. This section examines those which involve the nature and extent of the storm forces themselves; that is, the wind, wave and surge effects that hurricanes and severe coastal storms can be expected to generate.

1. National Flood Insurance Program (NFIP)[1]

Established by Congress in 1968 through passage of the National Flood Insurance Act, the National Flood Insurance Program is a nationwide program to provide property owners in floodplains with federally subsidized flood insurance in those communities which implement ordinances to reduce future flood losses. In 1973, Congress passed the Flood Disaster Protection Act making the purchase of flood insurance mandatory in the identified Special Flood Hazard Areas (SFHA).

Administered by the Federal Insurance Administration, within the Federal Emergency Management Agency, the program begins by identifying communities which are considered to be flood-prone. The flood insurance studies are based on a flood having a probability of a one percent chance of being equaled or exceeded in any given year. This is often referred to as the 100-year flood event or Base Flood Elevation (BFE) level. FIA has identified well over

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[1]Portions of this section were contributed by Carol S. Campbell, Emergency Management Program Specialist, FEMA Region IV.

20,000 communities which are flood-prone, 17,500 of which are participating in the NFIP.

The program is structured in two phases, the Emergency Phase or initial stage and the Regular Phase of the program. After the initial flood-prone identification, the next step in the process is for a locality, if it chooses, to join the Emergency Program. For Emergency Program participation, a locality normally has been issued a Flood Hazard Boundary Map (FHBM), which provides the general boundaries and outline of the locality's Special Flood Hazard Area (SFHA). Once a Flood Hazard Boundary Map has been formally issued to a locality, it has 12 months in which to adopt a flood damage prevention ordinance to qualify for participation in the Emergency Phase of the program or be placed under the sanctions of nonparticipation.

The effects of nonparticipation, as well as the benefits of the program, generally encourage the majority of communities identified as flood-prone to participate in the NFIP. A community's nonparticipation will have the following effects:

1. Flood insurance will no longer be available. No resident will be able to purchase a flood insurance policy.

2. No Federal grants or loans for buildings may be made in identified flood hazard areas. Includes all Federal agencies such as HUD, EPA, SBA, and HHS.

3. No Federal disaster assistance may be provided in identified flood hazard areas for permanent restorative construction and grants.

4. No Federal mortgage insurance may be provided in identified flood hazard areas. This includes FHA, VA, Farmers Home Administration, and other federally insured lenders.

5. Recent legislative changes to FDPA: Restriction on conventional loans in nonparticipating communities replaced by requirement that lenders:

a. must notify buyer or lessee that property is in flood hazard area; and

b. must notify buyer or lessee that property in flood hazard area is not eligible for Federal disaster relief in a declared disaster.

6. The Flood Insurance Rate Map and appropriate actuarial rates go into effect regardless of whether or not a community participates in the program. Lacking a local ordinance, unsafe construction today may result in prohibitively expensive insurance rates tomorrow.

In order for floodplain property owners in a community to qualify for insurance during the Emergency Phase the local government must agree to regulate new development in floodplains in a way which minimizes future flood losses. More specifically, communities are required to issue permits and review all proposals for development in floodplains and require that such development, using the best available information, be elevated to a point at or above the base flood elevation.[2] Mobile homes must include an adequate tie-down and anchoring system. Proposed subdivisions must be modified in any way which will reduce future storm damages. The amount of federal flood insurance provided during this phase of participation is less than that eventually available under the regular program. Figure 4.1 shows the amounts of coverage available.

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[2]The N.C. Division of Emergency Management Model Flood Damage Prevention Ordinance in Appendix 2 is an example of an ordinance designed to comply with the NFIP.

FIGURE 4.1

THE NATIONAL FLOOD INSURANCE PROGRAM

	EMERGENCY PROGRAM			REGULAR PROGRAM	
	Total Amount Available (First Layer)	Subsidized Rate of $100 of Coverage	Second Layer	Actuarial Rate Per $100 of Coverage	Total Amount Available 1st & 2nd Layer
Single Family Residential	$ 35,000	$ .45	$150,000	Rate varies with risk	$185,000
Other Residential	100,000	.45	150,000	Rate varies with risk	250,000
Contents Residential	10,000	.55	50,000	Rate varies with risk	60,000
Small Business	100,000	.55	150,000	Rate varies with risk	250,000
Contents Small Business	100,000	1.10	200,000	Rate varies with risk	300,000
Other Nonresidential	100,000	.55	100,000	Rate varies with risk	200,000
Contents, Other Nonresidential	100,000	1.10	100,000	Rate varies with risk	200,000

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October 1983

Normally, before a locality can enter the Regular Phase, the FIA must conduct a detailed engineering analysis with a study text and accompanying Flood Insurance Rate Map (FIRM), which delineates the one percent chance flood more precisely and provides detailed base flood elevation information. These maps then become the basis for establishing insurance rates for floodplain property owners. In riverine areas a Flood Boundary Floodway Map is also prepared to delineate the floodway in which no encroachments that would increase base flood level discharges are permitted.

Following a FEMA presentation of the preliminary maps, each community is given a formal 90-day appeal period. At the end of the appeal period or following the resolution of any appeals, whichever occurs later, a Notice of Final Determination of the base flood elevations is published in the Federal Register and issued to the community. The community then has six months from the Notice of Final Determination in which to adopt an ordinance meeting the more restrictive requirements to qualify for participation in the regular phase of the program or be suspended from the NFIP.

As noted, for regulatory and insurance rating purposes, the floodplain is divided into different hazard zones on the FIRM. Table 4.1 provides a summary of these different classifications. Following are brief descriptions of the major zones of interests and the more restrictive relevant building and regulatory requirements.

(a) A1-A30 and AE Zones: The 100-year floodplain. The A-zones represent those areas subject to the 100-year flood, or put differently, areas with at least a one percent chance of being flooded in any given year. As noted, for floodplain property owners to be eligible for flood insurance,

Table 4.1
ACTUARIAL RATE ZONES

The symbols used to designate the Actuarial Rate Zones are are follows:

ZONE SYMBOL	CATEGORY
A	Area of special flood hazards in which no base flood elevations are determined and an estimated BFE is optional.
A1-A30,AE	Area of special flood hazards with base flood elevation determined. Zones are assigned according to flood hazard factors.
AH	Area of special flood hazards that have shallow flood depths (from one to three feet) due to ponding. Base flood depths are shown on the FIRM.
AO	Area of special flood hazards that have shallow flood depths (from one to three feet) due to sheet flow. Base flood depths are shown on the FIRM.
A99	Area of special flood hazards where enough progress has been made on a protection system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes.
V	Coastal high hazard area with wave action velocity waters that is inundated by tidal floods. Base flood elevations have not yet been determined.
V1-V30,VE	Coastal high hazard area with wave action velocity waters that is inundated by tidal floods. Zones are assigned according to flood hazard factors. Base flood elevations are shown on the FIRM.
B,C, and X	These areas have been identified in the community flood insurance study as areas of moderate or minimal hazard from the principal source of flooding in the area. However, buildings in these actuarial rate zones could be flooded by severe, concentrated rainfall. The inadequacies of the local drainage systems are not normally considered in the community's flood insurance studies. The failure of a local drainage system creates areas of high flood risk within these rate zones. These rate zones indicate flood areas where insurance is not required but can be purchased in a participating community.
D	Area of undetermined, but possible, flood hazards.
M	Area of special mudslide hazards.
N	Area of moderate mudslide hazards.
P	Area of undetermined, but possible, mudslide hazards.

their localities must first meet certain basic construction and land use regulatory requirements.

For A1-A30 and AE zones, construction of new residential structures must have the lowest floor, including basement, elevated to a level at or above the BFE (elevation of the 100-year flood). New commercial structures must be either elevated or adequately flood-proofed to the BFE, with floodproofing certification by a registered professional engineer.[3] "As-built" lowest floor certifications must be obtained by the developer or builder and monitored by local enforcement officials. The lowest floor certifications may be completed only by a registered surveyor, architect, or engineer. Flood resistant building materials are to be used, structures are to be adequately anchored to prevent flotation or lateral movement, and construction practices should minimize the flood hazard. Also, sewer and water systems must be designed to prevent infiltration and contamination during flooding. New mobile homes must contain an adequate tie-down and anchoring system.

These requirements also extend to substantial improvements of existing structures. Substantial improvements are defined by FIA as including repairs, reconstruction, or improvements which amount to 50 percent or more of the current fair market value of the structure prior to the repairs, reconstruction, or improvements taking place.

(b) Coastal high hazard areas -- velocity or V, V1-V30 and VE-zones. These are areas where the stillwater storm surge is sufficient to support a minimum three-foot wave and consequently have special higher insurance rates

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[3]Federal Insurance Administration, Elevated Residential Structures, Washington, DC: Housing and Urban Development, 1976; American Institute of Architects, Design Guidelines for Flood Damage Reduction, Washington, DC: AIA, 1981.

attached to them.[4] Initially, the elevation requirements in these zones were based only on still water surge heights. Since about 1979, FIA has been calculating an additional wave height, which is added to the still water elevation in these zones.

Special building standards are required for construction in velocity zones. New residential and nonresidential structures including mobile homes must be elevated on pilings or columns so that the bottom of the lowest supporting horizontal structural member is at or above base flood elevation (BFE). "As-built" elevation certificates are required. The use of fill for structural support is prohibited. Areas below the lowest habitable floor must be free of obstructions or enclosed with breakaway walls. An engineering certification that the structure is designed to be adequately anchored is required. New construction must not alter existing dunes or mangrove stands and must be built landward of mean high tide.

(c) Floodways.

The floodway zone pertains mainly to inland riverine flooding situations, but does have implications for riverine floodplains near the coast which could be affected by hurricanes and coastal storms. The floodways represent the main riverine channel and the land area adjacent to it where the water flow will be extensive. For designated floodway areas, localities must not permit activities and uses, such as the placement of fill or new construction, which will obstruct water flow such that the base flood elevation would be increased by any amount. Prior to any development in the floodway, the builder or

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[4]U.S. Army Corps of Engineers, Guidelines for Identifying Coastal High Hazard Zones, Galveston, TX: Galveston District, June 1975.

developer must present an engineering certification that no increase in flood levels will occur.

NFIP maps, in sum, can provide the basis for identifying the range and magnitude of inland and coastal flooding risks.

2. SLOSH: Modeling Coastal Storm Forces Through Computer Simulation Maximum Surge Penetration Estimates

In recent years more sophisticated computer models have been developed to estimate the predicted wind and surge effects of potential hurricanes. Two models have been developed by the National Weather Service for this purpose: SPLASH (Special Program to List the Amplitudes of Surge from Hurricanes) and SLOSH (Sea, Lake and Overland Surge from Hurricanes). SPLASH can be used for predicting hurricane forces along relatively unbroken coastlines, where no significant bays or sound areas exist. SLOSH is a refinement of SPLASH and is able to take into consideration the effects of bays and sounds and irregularities in coastlines.[5] SLOSH has essentially replaced SPLASH. These computer simulations differ fundamentally from the models used to delineate flood hazard zones under the NFIP in that they are non-probabilistic and do not assume, as the NFIP zones do, a specified return frequency based on historical data (i.e., the 100-year flood zone).

Applying the SLOSH Model to a coastline occurs in several steps. First, the model must be "fitted" to the coastline under study, which means that it must be fine tuned to take into consideration the numerous specific natural and manmade features of the coastline which have some effect on surge penetration. This is undertaken through inputting of data onto geographical grid points. Next the model is "run" for the study area. This usually involves conducting an average of 250 simulations based on different hurricane scenarios (e.g., different hurricane tracks, forward speeds, size, and intensities). The output from these runs is the following:

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[5]Karen Allenstein, Land Use Applications of the SLOSH Model (Sea, Lake, and Overland Surges from Hurricanes, Chapel Hill, NC: University of North Carolina, Department of City and Regional Planning, 1985.

1) surface envelope of the highest surges above mean sea level;

2) time histories of surges at selected grid points;

3) computed windspeeds at selected grid points;

4) computed wind directions at selected grid points.

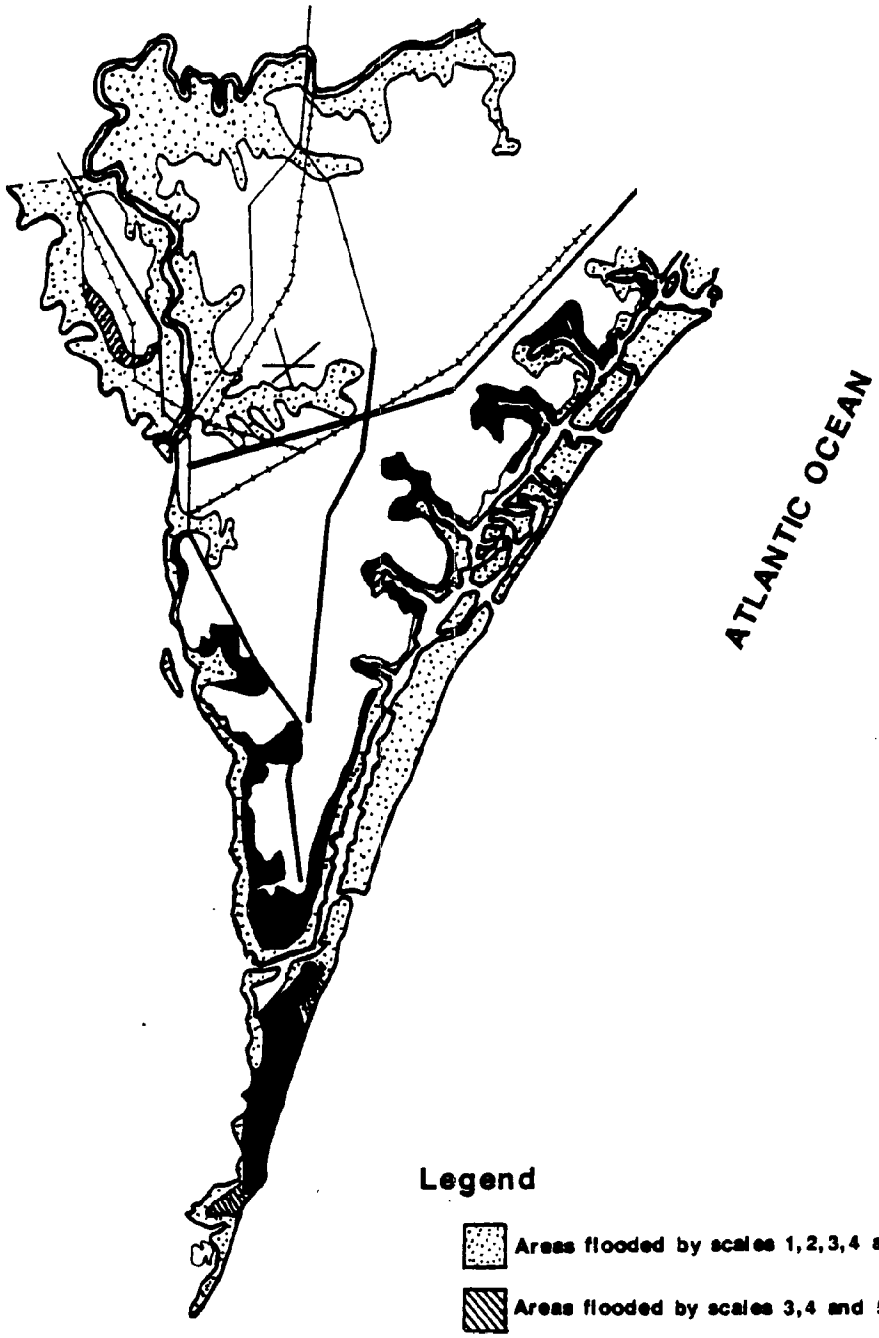
While the SLOSH model has traditionally been used primarily as a preparedness and evacuation tool, its potential utility as a foundation for development management is great.

From the perspective of development management, perhaps the most useful output are the maps indicating areas of maximum surge penetration under different hurricane intensity assumptions. Figure 4.2 presents such a maximum surge map for the New Hanover County area. Notice that according to the SLOSH simulation, most of the barrier island and beach communities would be inundated under the assumption of a relatively small hurricane (category 2). Thus, the SLOSH methodology can generate inundation maps which permit the identification and designation of areas particularly vulnerable to hurricane forces under different assumptions about the expected hurricane event.

In a sense these different hurricane intensity assumptions provide different break-off points for establishing acceptable or unacceptable levels of risk. A coastal jurisdiction might conclude, for instance, that it does not wish to plan for the worst possible event--the category 5 hurricane. This type of decision then dismisses as unnecessary the consideration of zones inundated under this level of intensity but not under smaller, less intense hurricane events. A locality might, as a further example, establish that it will take mitigative actions only in those areas where the cumulative forces appear greatest--e.g., those zones where the surge effects would occur even under the weakest hurricane, and where surge impacts are likely to increase exponentially in the case of stronger hurricanes.

Figure 4.2

POTENTIAL HURRICANE FLOODING in New Hanover County



Legend

- Areas flooded by scales 1,2,3,4 and 5
- Areas flooded by scales 3,4 and 5
- Additional areas flooded by scales 4 and 5

Saffir-Simpson hurricane damage potential scale

Source: New Hanover County

Because SLOSH modeling does not incorporate past flooding or storm histories it provides no information about how frequently each type of hurricane can be expected. Instead, its task is to estimate the likely physical forces that would be generated, if such a hurricane occurs in the future. Rather detailed climatologies are available from the National Weather Service which provide information about the frequency of hurricane and tropical storm occurrences for relatively small segments of the Gulf and Atlantic coasts. Figure 4.3 provides this information in probability terms for the North Carolina coast.[6] It should be remembered that accurate data on hurricane frequencies is only available for approximately one hundred years. This is a relatively short period of time from which to make assumptions about their future occurrence.

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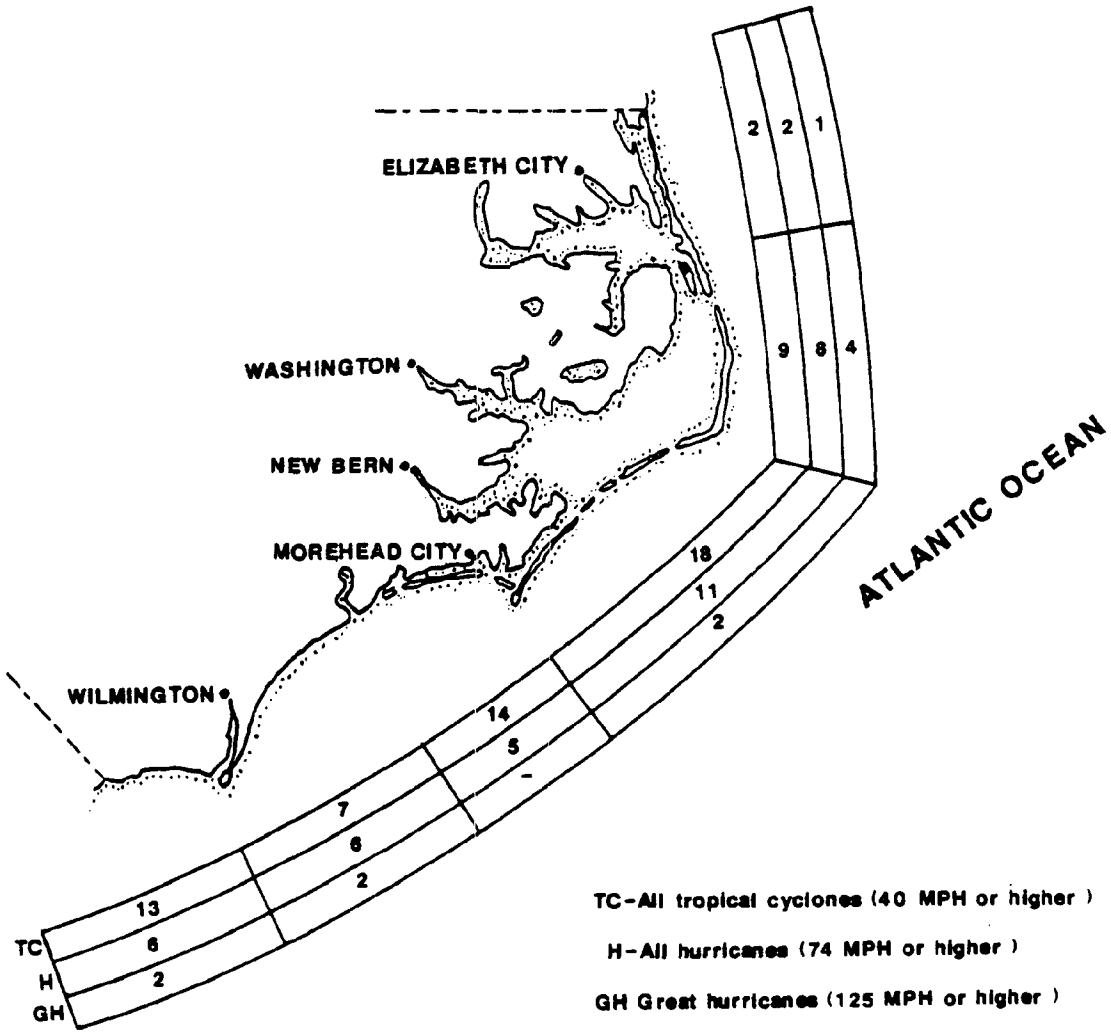
[6]Simon Baker, Storms, People, and Property in Coastal North Carolina, Raleigh, NC: North Carolina State University, UNC Sea Grant, August 1978. For the most recent complete climatology, the reader is referred to R. H. Simpson and Miles B. Lawrence, Atlantic Hurricane Frequencies Along the U.S. Coastline, (June 1971).

Figure 4.3

ANNUAL PROBABILITY OF HURRICANE OCCURRENCE ALONG THE NORTH CAROLINA COAST



Source:Baker 1978

3. Coastal Erosion

In 1971, the Corps of Engineers National Shoreline Study indicated that more than 20,000 miles of our nation's shorelines are experiencing significant erosion.[7] Coastal erosion is caused by a number of factors: changes in patterns of littoral drift, waves and surge effects of hurricanes and coastal storms, the location of man made structures in sensitive coastal areas, and the general rise in sea level.[8] Obviously, erosion represents an important component of the hurricane coastal storm risk--erosion is both caused by storms, and once it occurs (regardless of its course), also heightens the vulnerability of people and property to future storms. Consequently, efforts to document coastal erosion patterns are seen increasingly as a necessary part of coastal natural hazards planning.

Coastal states and localities are increasingly making efforts to scientifically calculate the extent of erosion (or accretion) for specific segments of the coastline. The State of North Carolina has been a leader in this area, and has established, for regulatory purposes, the annual rate of erosion for its entire coastline. This established rate is then used as the basis of an ocean hazard zone setback. For instance, new multifamily structures located in these areas, must be set back from the ocean a distance of 60 times the average annual rate of erosion.[9]

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[7]John H. Sorensen,et al, Coastal Erosion Hazard in the United States: A Research Assessment, Boulder, CO: Institute of Behavioral Sciences, University of Colorado, June 1975; U.S. Army Corps of Engineers, Guidelines for Identifying Coastal High Hazard Zones, Galveston, TX: Galveston District, June 1975.

[8]Michael Barth and Jones G. Titus, Greenhouse Effect and Sea Level Rise: A Challenge for This Generation, New York: Van Nostrand Reinhold, Inc., 1984.

[9]David Brower and Daniel S. Carol, Coastal Zone Management as Land Planning, Washington, DC: National Planning Association, 1984.

4. Inlet hazard areas

Tidal inlets are natural waterways which separate barrier islands and serve to connect the ocean and back barrier lagoons.[10] They are the major route by which sand is transported from beach areas to back barrier areas. Inlets can shift dramatically over time, in turn wreaking destruction on homes and structures built too closely to them. Figure 4.4 shows the changes undergone by the Lockwood Folly Inlet (N.C.) since 1956 (the base photograph was taken in 1974).[11] This type of "active" inlet hazard area can be distinguished from "incipient" inlet hazard areas. The latter represent the location of potential or probable inlets, should a hurricane or severe coastal storm occur. Both types represent significant coastal hazard areas.

The State of North Carolina has perhaps the most extensive program for documenting the movements of existing inlets, delineating inlet hazard areas as part of its coastal area management program, and instituting special development restrictions in these areas. To compute inlet movement, a grid system (300-feet spacing) was established, and historical trend data plotted on it. Linear and quadratic regression techniques were used to calculate the best fit trend of inlet location. The inlet hazard area was delineated by using the landward most point expected to occur over a ten year period (1978-1988).[12]

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[10]Stephen Leatherman, Barrier Island Handbook, College Park, MD: University of Maryland, 1982.

[11]Simon Baker, The Citizens Guide to North Carolina's Shifting Inlets, Raleigh, NC: University of North Carolina Sea Grant, March 1977; Jay Langfelder, et al, A Historical Review of Some of North Carolina's Coastal Inlets, Raleigh, NC: Center for Marine and Coastal Studies, North Carolina State University, January 1974.

[12]North Carolina Division of Marine Fisheries, Inlet Hazard Areas, Final Report and Recommendations to the Coastal Resources Commission, September 1978.

Under the N.C. Coastal Area Management Act (CAMA), inlet hazard areas must be delineated on maps and approved by the Coastal Resources Commission. Moreover, state-imposed restrictions limit the potential development density that is permitted to occur in these areas. Permanent structures are not permitted at a density greater than one unit (residential or commercial) per 15,000 square feet, and structures cannot exceed four units in the case of residential structures, or 5,000 square feet total flood area in the case of commercial buildings.

Incipient inlets--that is, areas where future inlets are likely to form in response to storms--are also identifiable and should be incorporated into the risk analysis. A number of factors, such as island width, erosion rate, and elevation will influence the likelihood of an inlet formation and can be used to delineate incipient inlet zones.[13] Perhaps the most important source of data to be used in this process is historical records of present inlets. While an inlet may currently be closed, it should be considered a prime candidate for reopening should a severe storm strike. The recently popular practice of excavating finger canals perpendicular to the ocean on barrier islands can serve to increase substantially the possibility of a future inlet, and these areas should also be identified as hazardous zones. The mapping of incipient inlet areas is necessarily imprecise. Figure 4.5 presents an example of how the Town of Nags Head (1984) has delineated two incipient inlet areas in its hurricane mitigation and reconstruction plan.

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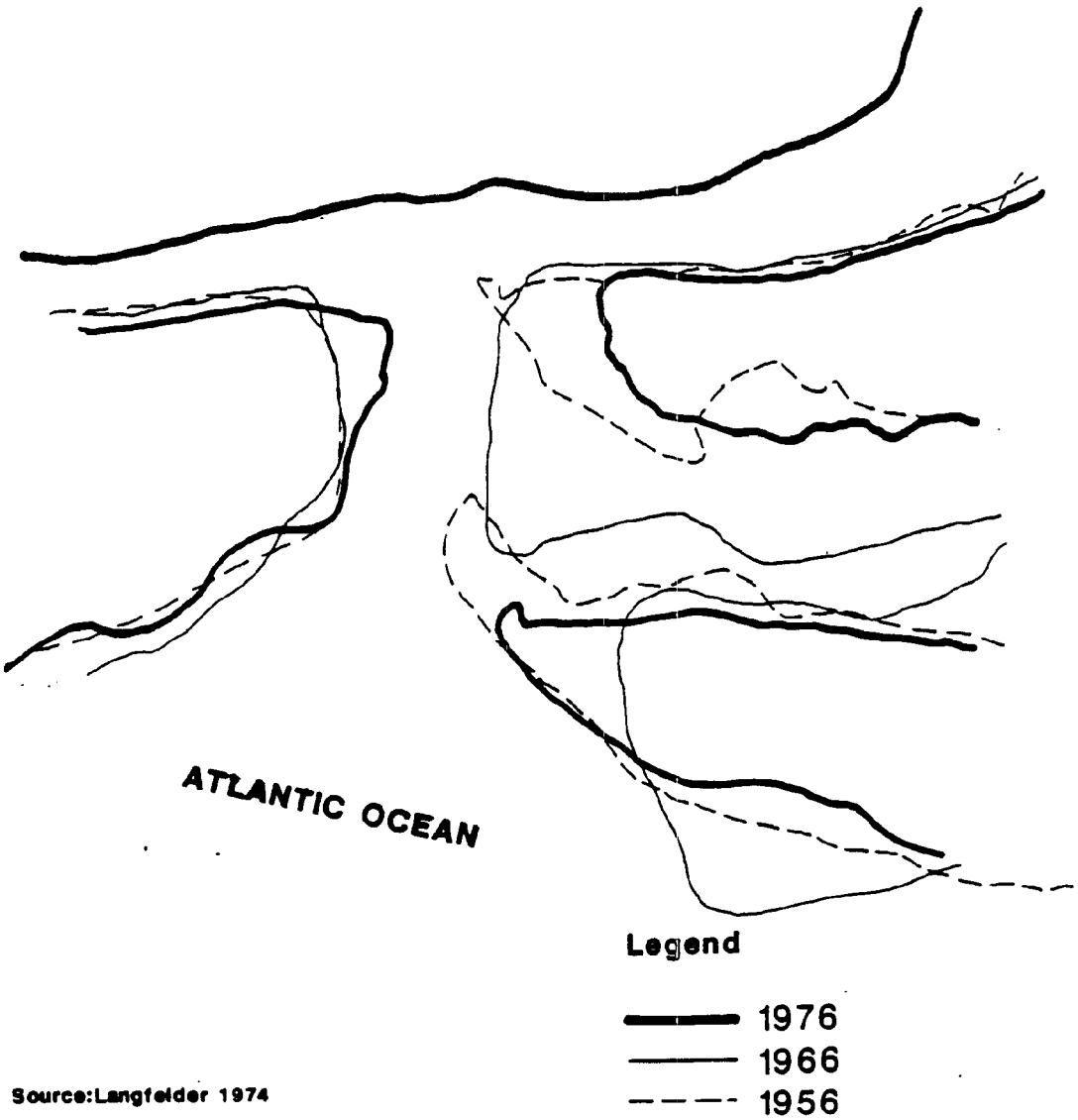
[13]Lisa Lynch, Potential Inlet Zones on the North Carolina Coast, Durham, NC: Duke University, School of Forestry and Environmental Science, December 1983.

Figure 4.4

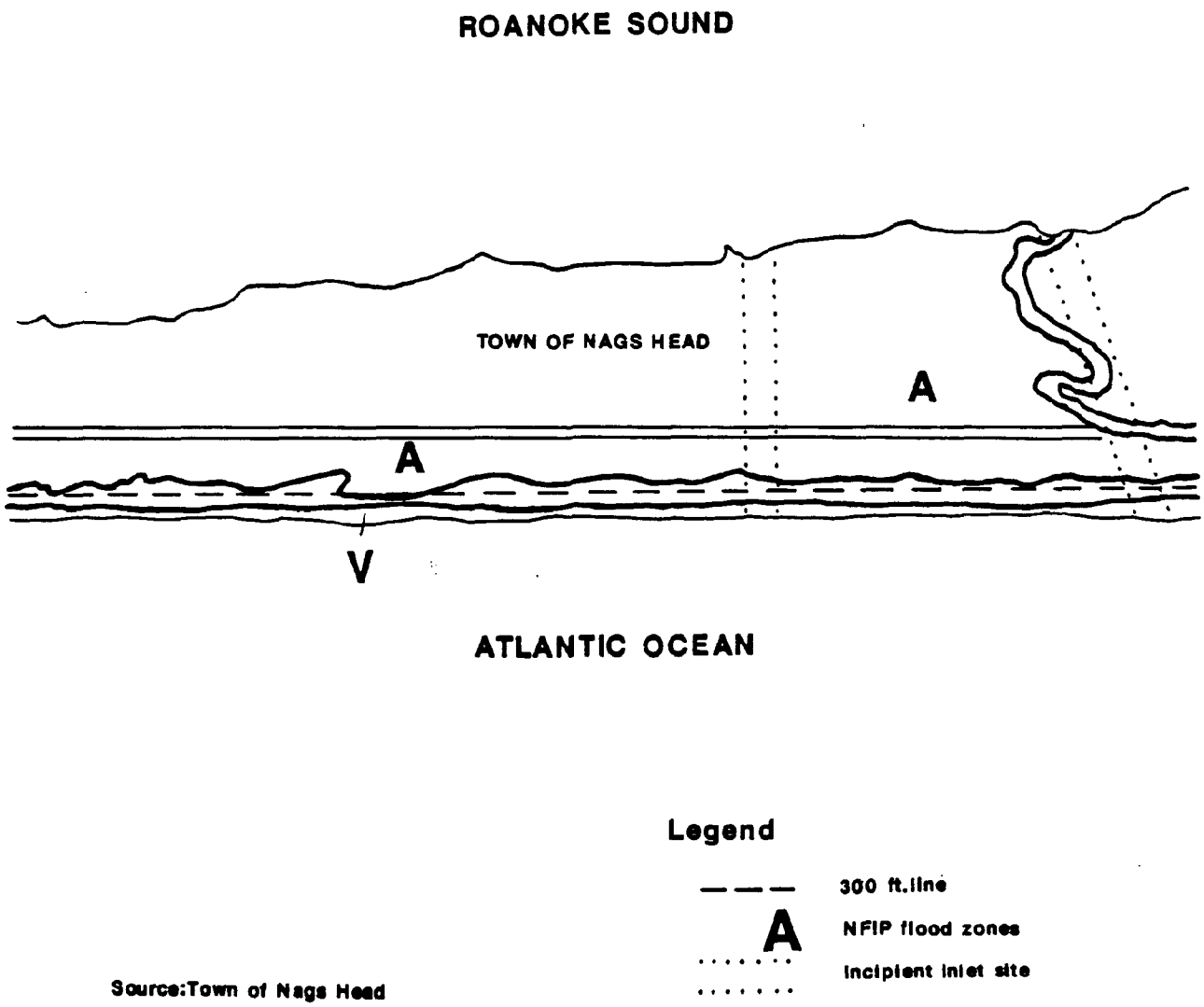
CHANGES IN LOCKWOOD FOLLY INLET



Source: Langfelder 1974

Figure 4.5

HURRICANE VULNERABILITY



Source:Town of Nags Head

5. Producing composite hazard maps

To the extent possible, localities may wish to present these various hazard zones in an overlay fashion. Such a composite map or maps permit policymakers to view the cumulative effects of different elements of the hurricane and coastal storm hazard, and to identify particularly hazardous locations. Figures 4.6 and 4.7 illustrate how one locality--Surf City, North Carolina--has attempted to present coastal storm hazards in a composite format.

B. Assessing Vulnerability and Exposure

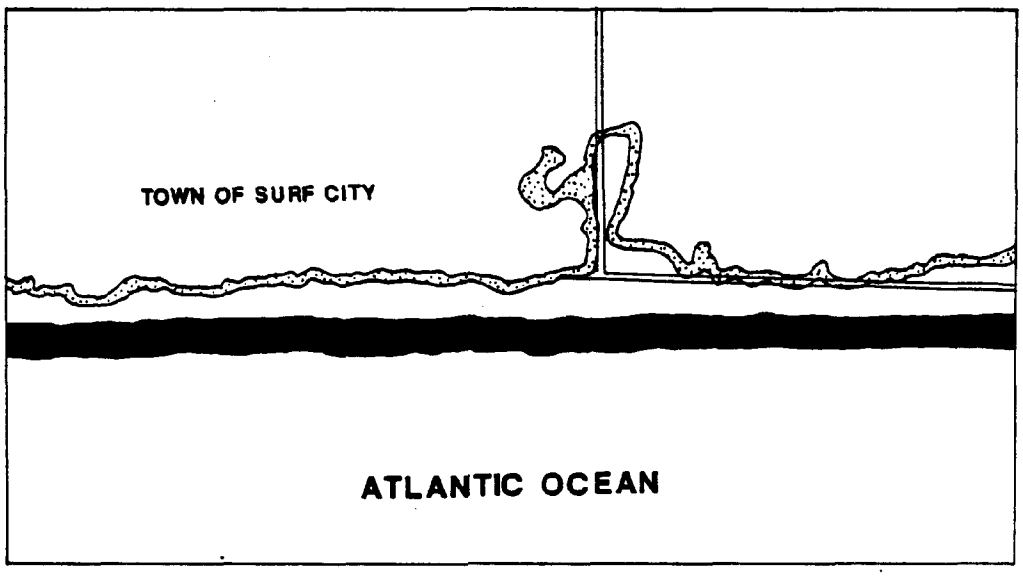
The physical forces of hurricanes and severe coastal storms would not pose a problem or concern if they did not threaten to destroy something of value to coastal inhabitants. Because high hazard coastal zones contain people and property, risks from hurricanes and storms do exist. The extent of this risk will naturally vary with the extent of exposure of people and property. In this section we will briefly address approaches to assessing the extent of a community's exposure.

1. Exposure of public and private property

An assessment of the public and private property at risk can be undertaken for each of the hazard areas delineated in the hazard mapping process. For instance, Table 4.2 below provides summary information on the

Figure 4.6

OCEAN ERODIBLE A.E.C. AND ESTUARINE SHORELINE A.E.C.



Legend

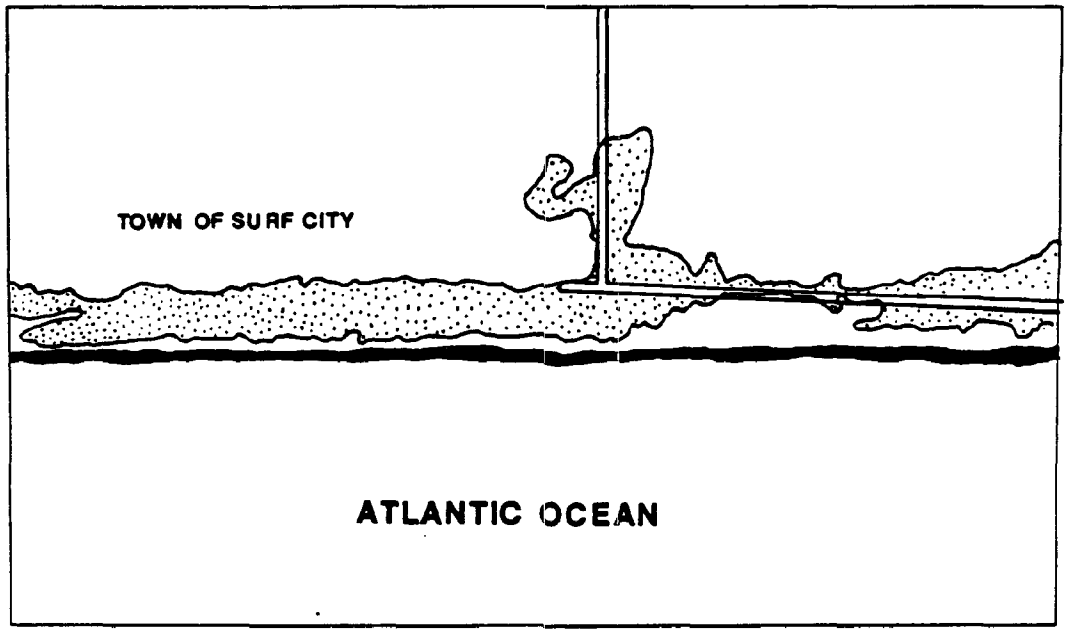
Ocean erodible A.E.C.

Estuarine shoreline A.E.C.

Source:Town of Surf City

Figure 4.7

NFIP FLOOD HAZARD ZONES



Legend

- B Zone: Areas between 100 and 500 year floods
- V Zone: Areas of 100 year flood with high velocity wave action
- A Zone Areas subject to 100 year flood

SOURCE: Town of Surf City

Table 4-2

Summary of Private Property at Risk by Flood Hazard Area, Town of Nags Head, N.C.

	Number of Buildings	Value ($)	Number of Parcels	Value ($)	Total Value
V-zone	544	26,951,000	722	25,321,100	52,272,100
A-zone	1,126	60,835,300	1,968	47,230,100	100,073,400
B-zone	563	33,194,500	674	29,929,800	63,124,300
C-zone	329	18,740,000	640	15,286,000	34,026,000

Source: Brower, Collins, and Beatley, 1984

amount of private property at risk in the Town of Nags Head, North Carolina, according to NFIP zone.[14]

Some 544 structures, valued at over $25 million, are located within the V-zone, for example. This information can generally be obtained from local taxation and revenues departments. The U.S. Army Corps of Engineers may be an additional source of information on extent of property at risk. A 1982 survey of Surf City buildings, for instance, indicated that some $5.5 million in damages to residential structures could be expected under a 100-year storm, as well as some $1.7 million in commercial damages.[15]

Public facilities, such as roads and sewer lines, are also at risk and should be included in a community's vulnerability assessment. Facilities should at least be identified, if not estimated and valued in the same way

[14]David Brower, William Collins, and Timothy Beatley, Hurricane Hazard Mitigation and Post-Storm Reconstruction Plan, Nags Head, North Carolina, Chapel Hill, NC: Coastal Resources Collaborative, Ltd., 1984.

[15]Town of Surf City, North Carolina, Hurricane Evacuation, Hazard Mitigation and Post-Disaster Reconstruction Plan, prepared by George Eichler and Associates, 1984.

that structures at risk are. Tables 4.3 and 4.4 indicate, for instance, the extent of roads and sewer mains at risk in the Town of Nags Head. Included also should be an inventory of publicly-owned structures located in different hazard zones.

Table 4.3

Public Investment Vulnerable to Storm Damage
Water Mains in Flood Zone (in feet)

	Size of Main						
Zone	24"	14"	12"	8"	6"	4"	2"
V	0	0	0	0	6850	1650	6500
A	33070	230	26200	32110	57880		5440
B	0	0	8350	250	0	0	200
300	0	0	0	0	2300	250	1330

Source: Brower, Collins, and Beatley, 1984.

After collecting this type of information, and placing a monetary value on the property, different assumptions about expected losses can be used. A worse case scenario might be assumed, in which all value of property in a flood or hazard zone is lost. A more reasonable, yet somewhat more sophisticated, approach is to apply some form of damage algorithm, which probably changes with the severity of the hazard zone, and the type of property involved.

Table 4.4

Public Streets in Flood Zones, Nags Head, N.C.

Zone	Street Length (feet)
V	10500
A	134300
B	3100

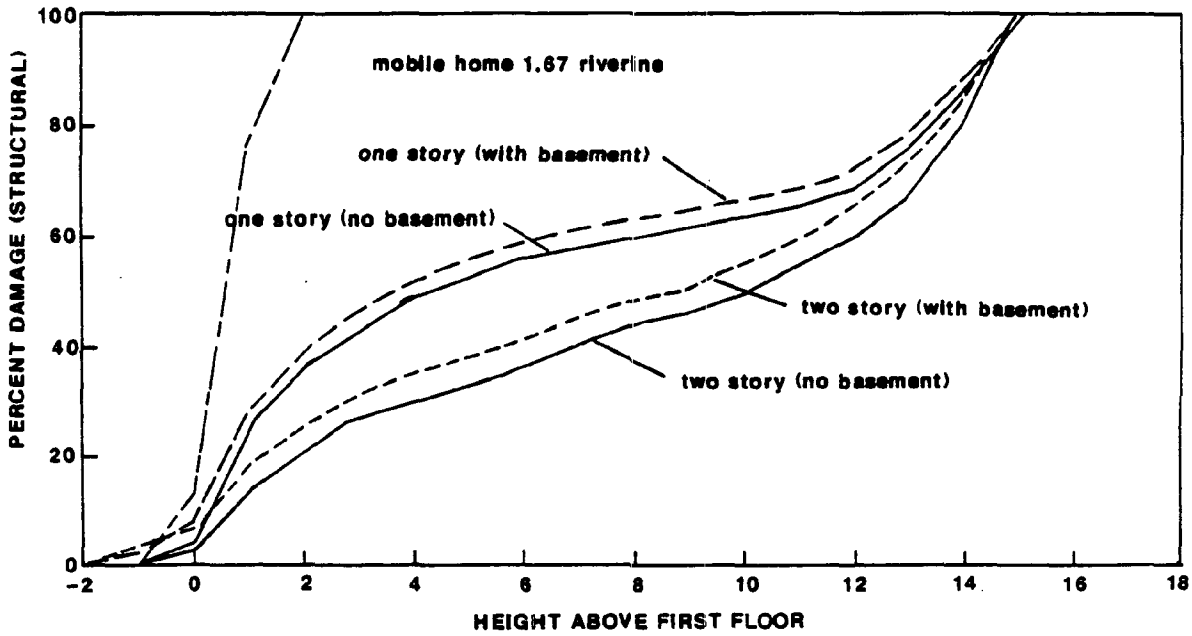
Source: Brower, Collins, and Beatley, 1984.

Figures 4.8 and 4.9 provide useful guides for making such calculations.[16] Figure 4.8 indicates that a two-story structure with a basement can be expected to incur an average around 50% damage when subjected to a 10-foot surge (height above first floor). Figure 4.9, as a further example, indicates that a metal one-to-three story commercial/industrial structure will be about 30% damaged when subjected to wind speeds of 150 mph. From this type of information, more accurate estimates of actual predicted damages can be made. Table 4.5 presents some basic calculations which illustrate how predicted losses can be adjusted under such assumptions. Assume that in this particular sector, only two types of damage components exist: residential structures subject to surge damages and commercial structures outside of the flood zone but subject to storm winds.

[16]From William Petak & Arthur Atkisson, Natural Hazard Risk Assessment and Public Policy, N.Y.: Springer-Verlag, 1982.

Figure 4.8

STORM SURGE DEPTH VERSUS DAMAGE

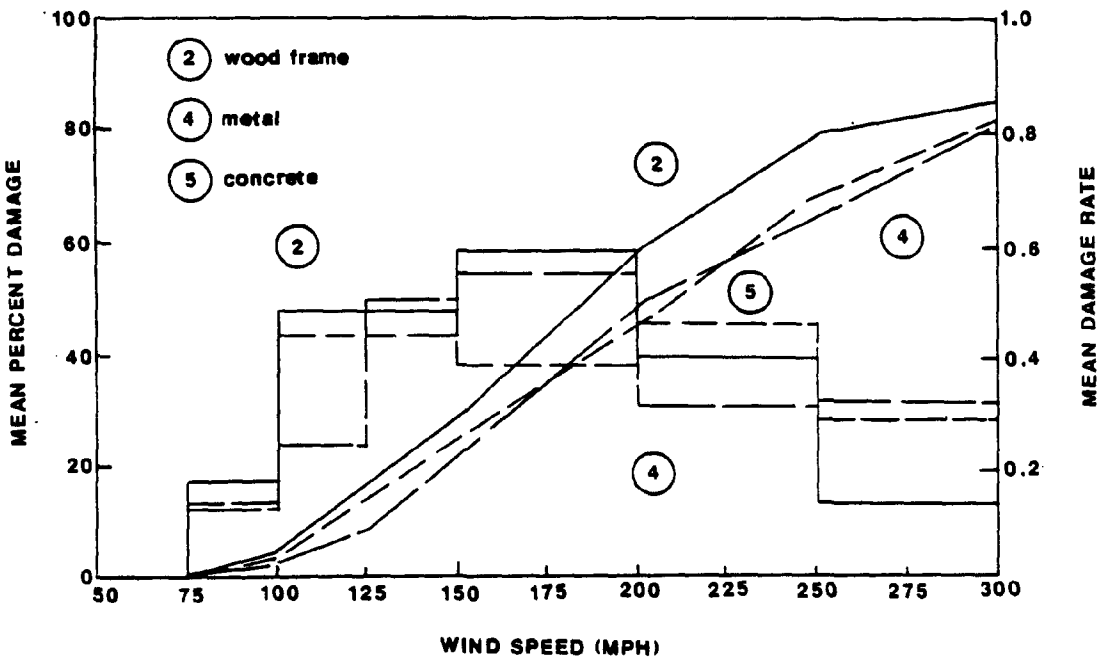


Source: Lee et al. 1978, as found in Petak and Atkisson 1982

Figure 4.9

DAMAGE VERSUS WIND SPEED

(One to three story commercial-industrial)



Source: Hart 1976, as found in Petak and Atkisson 1982

Table 4-5

Illustration of Damage Calculations

	Assessed Valuation	Damage Coefficient	Predicted Loss
Residential Property	$1,000,000	.5*	$ 500,000
Commercial/Industrial Property	$2,000,000	.3**	600,000
Total Predicted Damages			$1,100,000

*assuming two story structures, no basement, and a surge of 10 ft. above first floor.

**assuming 150 mph winds, metal structures

These estimates should also consider any other local or site-specific information that may be available concerning the vulnerability of private and public property. For instance, how old are the structures located in the area under study, and how will this adjust the probable extent of damages? Of what quality of construction are buildings in the area--either new or old--and how should the damage coefficients be adjusted to take these factors into consideration?

The SLOSH simulation can also be used to estimate probable damage losses. Berke and Ruch illustrate the only such SLOSH application to date.[17] The entering of data on people and property in grid cell format is a central feature of this system. The size of the grid cells used is variable depending upon the level of geographical detail needed. Once basic information about

[17]Philip Berke and Carlton Ruch, "Application of a Computer System for Hurricane Emergency Response and Land Use Planning," 21 Journal of Environmental Management 117 (1985).

the location of people and property and the expected location and intensity of storm forces has been entered, high and low damage and casualty estimates can be generated for a particular location or region. A number of methodological components, some of them discussed above, enter into these calculations. Damage algorithms[18] for different types of structures subjected to storm forces are incorporated, with damage estimates adjusted for elevation requirements at particular locations.

Not only can current potential damages and casualties be estimated, but future losses can also be devised by entering information about future patterns of development and economic growth. Berke and Ruch use a land development allocation model which estimates future economic growth or decline for a region and allocates this growth among specific census tracts according to how attractive they are to such activities. A number of factors such as access to transportation facilities and quality of the natural environment serve as inputs to this allocation model. Table 4.6 presents current and future hurricane losses for Nueces County, Texas, and several districts within this county. Note that these are damages and casualties that would be generated for a Category 5 hurricane, with a certain landfall range.

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[18]L.T. Lee and J.D. Collins, "Engineering Risk Management for Structures," Journal of the Structural Division, 1977; William Petak and Arthur Atkisson, Natural Hazard Risk Assessment and Public Policy, New York: Springer-Verlag, 1982.

Table 4-6

For: Storms landfalling 30 miles right of Port Aransas to 20 miles left of Port Aransas with sustained wind of 155 MPH, and over

Composite Surge and Wind Condition Estimates by County and Zone

	RESIDENTIAL												NON-RESIDENTIAL				CASUALTIES	
	Single Family				Mobile Homes				Multiple Family				Commercial-Industrial				Persons Injured	
	Number Damaged		Value ($1000)		Number Damaged		Value ($1000)		Number Damaged		Value ($1000)		Number Damaged		Value ($1000)		Deaths approx. 3.5% of total	
Zone	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
N1																		
(1985)	19,156	14,788	$30,318	$20,903	1,009	728	$1,839	$981	4,890	4,038	$4,364	$3,002	1,357	1,004	$22,050	$6,166	34	16
(1990)	22,729	17,052	$36,327	$24,239	1,329	988	$2,317	$1,230	5,787	4,582	$4,798	$3,224	1,476	1,090	$22,636	$6,495	37	17
N2																		
(1985)	192	177	$1,735	$954	1	1	$10	$5	186	173	$472	$286	29	18	$253	$104	0	0
(1990)	292	269	$2,612	$1,467	2	2	$20	$11	284	262	$732	$437	30	18	$262	$107	1	0
N3																		
(1985)	1,310	1,305	$32,669	$18,798	264	264	$3,102	$2,271	1,184	1,153	$5,543	$2,297	186	183	$11,748	$6,756	11	5
(1990)	1,964	1,963	$48,665	$27,889	396	396	$4,653	$3,397	1,766	1,716	$8,313	$4,417	201	197	$12,539	$7,214	17	8
NA																		
(1985)	1,159	675	$791	$397	125	102	$148	$78	172	111	$20	$13	75	46	$261	$64	2	1
(1990)	1,327	774	$915	$465	154	127	$193	$102	189	120	$22	$14	80	47	$266	$66	2	1
NUECES CO.																		
(1985)	21,817	16,945	$65,503	$41,052	1,399	1,096	$5,702	$3,335	6,431	5,475	$10,389	$6,226	1,648	1,250	$34,321	$13,089	48	22
(1990)	26,311	20,053	$88,519	$54,051	1,881	1,464	$8,083	$4,470	8,026	6,680	$13,865	$8,092	1,787	1,353	$36,704	$13,882	59	26

Source: Berke and Ruch (1985)

2. Exposure of People

(a) SLOSH-based evacuation studies. As noted earlier, SLOSH is basically used as an input to evacuation planning. Consequently, it is only one of the necessary ingredients. A first step in SLOSH-based evacuation planning is to delineate evacuation zones, based upon SLOSH-generated surge penetration data. In the ongoing North Carolina Hurricane Evacuation study, zones in each coastal county were designated for areas where storm surge would penetrate under various hurricane categories.[19] The idea here is that providing such a delineation will permit those areas most vulnerable to storm forces to evacuate first. Figure 4.10 indicates the evacuation zones for Carteret County, with the smaller numbers representing the most vulnerable areas.

For emergency management officials to know how much time they have before they must issue evacuation notices and to pinpoint particular evacuation trouble spots, evacuation times must be calculated for each of these designated evacuation and contingency zones. Such a calculation requires a range of assumptions about how local residents will behave under emergency conditions. The North Carolina study feeds this information into a traffic computer model (traffic assignment algorithm), which selects appropriate evacuation routes and tabulates the number of vehicles using particular parts of the evacuation roadway. Assuming that all people in affected zones must be evacuated, the model calculates a range of "clearance times" based on different sensitivity parameters. Clearance times include the time required

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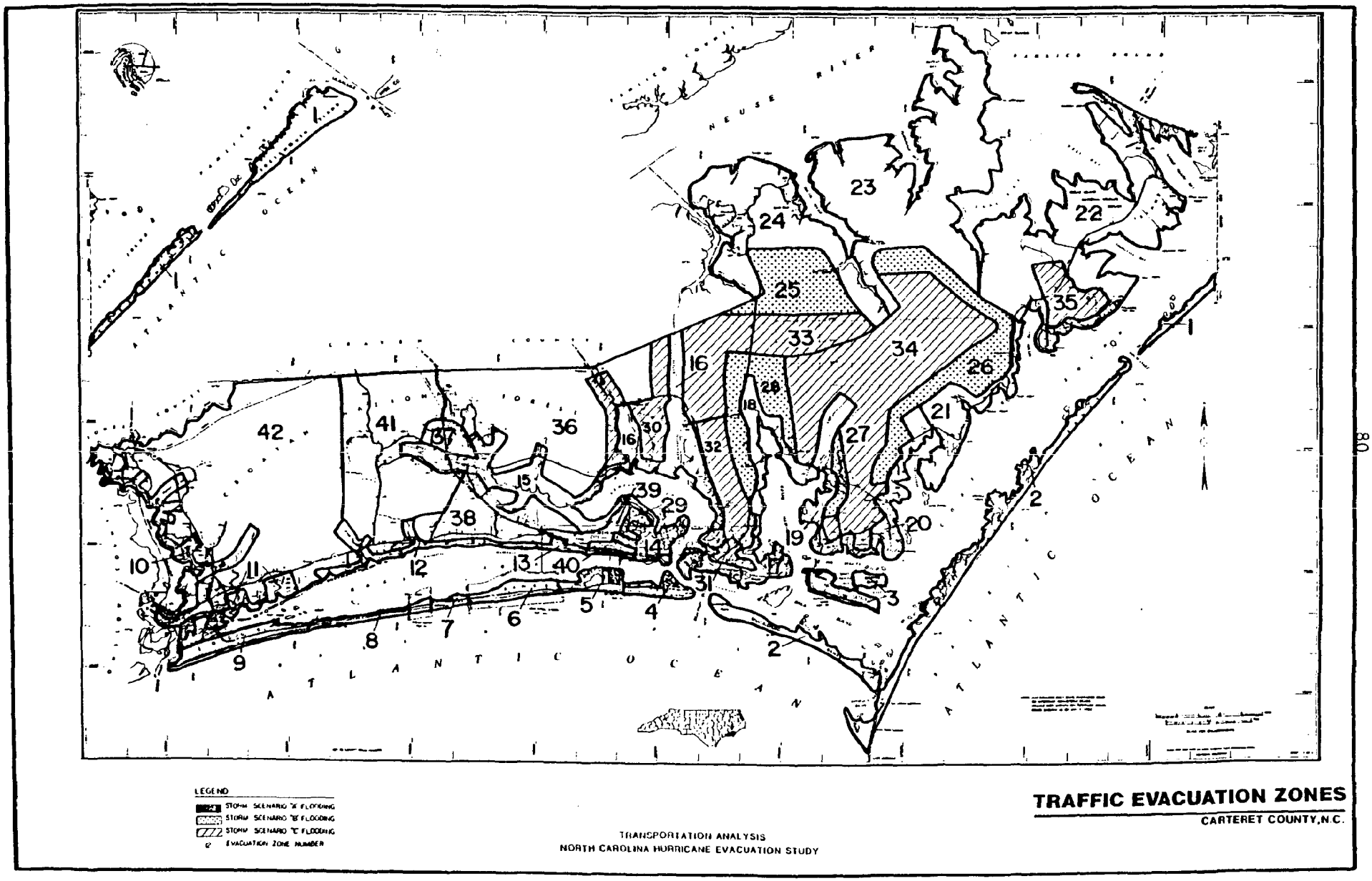
[19]Transportation Analysis Chapter, North Carolina Hurricane Evacuation Study Technical Data Report, prepared for COE by Post, Buckley, Schuh & Jernigan, Inc., December 1986.

FIGURE 4.10


ATLANTIC OCEAN
NEUSE RIVER
LEGEND
STORM SCENARIO "A" FLOODING
STORM SCENARIO "B" FLOODING
STORM SCENARIO "C" FLOODING
EVACUATION ZONE NUMBER
TRANSPORTATION ANALYSIS
NORTH CAROLINA HURRICANE EVACUATION STUDY
TRAFFIC EVACUATION ZONES
CARTERET COUNTY, N.C.

by evacuees to secure their homes and prepare to leave, the time spent traveling, and the time spent waiting along the road network due to traffic congestion. As shown in Table 4.7, clearance times in Carteret County range from 5 1/2 to 12 1/2 hours, depending on hurricane scenario, speed of response, level of seasonal occupancy, and critical roadway segment used. Local officials must take clearance times into account in deciding when to issue evacuation orders, so that coastal residents can be evacuated safely before roadways are inundated and gale force winds rise.

SLOSH-generated evacuation plans could also be used to test the marginal effects of proposed future land uses or patterns of development. For instance, what loss in evacuation capacity (increase in required evacuation time) will result from an increase of 1,000 new dwelling units in a particular location, assuming no improvements in the road system? From SLOSH-modeled assessments, local officials can then establish whether the resulting levels of risk are acceptable or not, and if not, what types of mitigative action are warranted. For instance, if a locality decides that any evacuation time over 12 hours is an unacceptable risk, the SLOSH-based evacuation model can then provide information about at what threshold and pattern of future growth this unacceptable level will be approached.

Because development management measures can be used to ensure that a locality has sufficient evacuation capacity, time histories of surge and wind forces at particular evacuation points also provide hazard analysis information with development management implications. A Houston/Galveston SLOSH study developed a model which yields critical information about potential storm hazards at key evacuation points (for example, Galveston Causeway), as a hurricane moves landward over time under particular

assumptions.[20] This model predicts that a slow moving category 4 hurricane, moving in a 320-degree direction, with a landfall 20 miles west of Galveston, would flood the causeway some seven hours before the storm hits land. Under high tide conditions this inundation would occur 8.5 hours before landfall. Moreover, wind gusts would exceed 65 mph--wind conditions in which vehicle operation is dangerous--13.5 hours before landfall.

This type of information is used by evacuation officials to determine when evacuation notices must be issued. If we assume a situation where it takes 17 hours to evacuate Galveston Island (as determined by the model) and 13.5 hours before winds on the causeway prevent safe vehicle movement (65 mph gusts), a decision to evacuate must be made more than 30 hours prior to hurricane landfall. Further development on the island can substantially increase the evacuation time, which in turn increases the time before landfall that an evacuation notice must be issued, and thus the chance that sufficient time for evacuation will not be available. Usually 16-24 hours of warning time are provided by the National Hurricane Center, but sometimes this is as little as ten hours in the case of storms forming close to land. If a locality established that it was going to make a decision to evacuate no earlier than this 24-hour pre-landfall warning and planned to control development accordingly, these time history data points would play a crucial role. If this locality had a causeway like Galveston's (i.e., 65 mph gusts 13.5 hours before landfall under above circumstances), it would have to restrict the extent of development such that its residents could be evacuated in 10.5 hours or less.

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[20]Carlton Ruch, Hurricane Relocation Planning for Brazoria, Galveston, Harris, Fort Bend, and Chambers Counties, College Station, TX: Texas A&M University, Sea Grant College Program, June 1981.

TABLE 4-7

CLEARANCE TIMES (IN HOURS)

Eastern North Carolina Hurricane Evacuation Study - Transportation Analysis

	Carteret County		
	Low Seasonal Occupancy	Medium Seasonal Occupancy	High Seasonal Occupancy
Category 1-2 Hurricane			
Rapid Response	5 ½/4 ¼/ 7 ¾	8 /4 ½/ 9	9 /4 ¾/ 9 ½
Medium Response	6 ¾/6 ¼/ 8 ½	9 ¼/6 ¼/ 9 ½	10 /6 ¼/10
Slow Response	9 ¼/9 ¼/ 9 ½	11 /9 ¼/10 ½	11 ¾/9 ¼/11
Category 3 Hurricane			
Rapid Response	7 ½/4 ½/ 8 ½	8 ¼/4 ½/ 9¾	9 /4 ¾/10 ¼
Medium Response	8 ½/6 ¼/ 9 ¼	9 ¼/6 ¼/10 ¼	10 /6 ¼/10 ¾
Slow Response	10 ¼/9 ¼/10 ¼	11 /9 ¼/11 ½	11 ¾/9 ¼/12
Category 4-5 Response			
Rapid Response	7 ½/4 ¼/ 9 ½	8 ¼/4 ½/10 ½	9 /4 ¾/11
Medium Response	8 ½/6 ¼/10	9 ¼/6 ¼/11	10 /6 ¼/11 ½
Slow Response	10 ¼/9 ¼/11	11 /9 ¼/12	11 ¾/9 ¼/12 ½

U.S. 70 at Havelock critical roadway segment.
Atlantic Beach Bridge - 2 lanes from beach.
Atlantic Beach Bridge - 1 lane from beach.

(b) Simple (non SLOSH-based) approaches to estimating evacuation capacity. In recent years, simple methodologies have been developed for estimating hurricane evacuation capacity.[21] In areas where SLOSH has not yet been applied, or is not yet operational, these methodological approaches will be more appropriate. This section briefly describes this simpler methodology and applies it to one particular North Carolina barrier island area.

An analysis of evacuation capacity was conducted for Hatteras Island, North Carolina, as part of a larger carrying capacity study.[22] Hatteras is located in Dare County, and currently contains approximately 2,600 dwelling units. The effects of several different build-out scenarios were tested.

In this particular locale, evacuation capacity is essentially a function of Route 12 (main highway) and the Oregon Inlet bridge. A first task was to determine the capacity of this transportation system under ideal conditions. This system was estimated to be capable of handling 2,000 vehicles per hour.[23] This figure was then adjusted to consider lane and shoulder widths, the presence of vacation vehicles on the road, storm conditions, possible obstructions, and the use of emergency vehicles.[24] This yields a maximum hourly capacity of 1,795 vehicles (see Table 4-8). The time available for

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[21] John R. Stone, Hurricane Evacuation Planning: Estimating Evacuation Times for Non-Metropolitan Coastal Communities, Raleigh, NC: University of North Carolina Sea Grant College Program, Working Paper 83-2, April 1983.

[22] Department of City and Regional Planning, A Carrying Capacity Study of Hatteras Island, 1984; and Currituck County Outer Banks Carrying Capacity Study, Chapel Hill, NC: University of North Carolina, June 1983.

[23] Highway Research Board, Highway Capacity Manual, Washington, DC: National Academy of Sciences, National Research Council, 1965.

[24] See Stone, Hurricane Evacuation Planning: Estimating Evacuation Times for Non-Metropolitan Coastal Communities, Raleigh, NC: University of North Carolina Sea Grant College Program, Working Paper 83-2. April 1983; Rogers, Golden, and Halpern, Hurricane Evacuation and Hazard Mitigation Study for Sanibel, Florida, November 1981.

Table 4.8

Calculation of Existing Evacuation Capacity of Hatteras Island, N.C.

a. ((2,000 veh/land/hr) + (2,000 veh/land/hr x 0.9 emergency vehicle factor))

x (0.9 land width/lateral clearance)

x (0.95 RV and boat trailers) x (0.65 storm factor)

x (0.85 obstruction factor) = 1,795 vehicles/hour

b. The evacuation period was calculated:

(12 hours warning) - (4 hours hazard cutoff time) - (3 hours mobilization time) = 5 hours

c. Total evacuation capacity is:

(1,795 vehicles/hour) x (5 hours) + 8,975 vehicles

Source: Department of City and Regional Planning, supra n.23, 1984

Table 4.9

Calculation of Evacuation Demand for Existing Residents, Hatteras Island, North Carolina

2,648 Existing DUs x 1.25 vehicles/DU	=	3,310 vehicles
522 Existing motel units x 1 vehicle/unit	=	522 vehicles
3,170 Total DUs	=	3,832 total vehicles

3,832 total vehicles x 0.8 (since an estimated 20% leave prior to the evacuation order) = 3,066 vehicles to be evacuated

Source: Department of City and Regional Planning, supra n.23, 1984

evacuation is calculated to be five hours, assuming 12 hours of warning and subtracting from that a four hour hazards cutoff time (beyond which evacuation is not possible) and three hours mobilization time (i.e., time required for warning, preparation of residents, and for establishing an evacuation system). Multiplying these five available hours by 1,795 indicates that only 8,975 vehicles can be safely evacuated.

Table 4.9 indicates how evacuation demand is estimated. It is assumed that for each dwelling unit 1.25 vehicles will be evacuating, and 1.0 vehicles for each motel unit. It is also assumed that 20% of the evacuating population will leave before the evacuation order is issued. Under existing development conditions (1984), this indicates that an excess evacuation capacity of 6,179 vehicles, or 3.3 evacuation hours, currently exists.

Tables 4.10 and 4.11 calculate evacuation demand and capacity shortfalls under three different future development scenarios. Under the worst case--Scenario III--total evacuation demand would reach almost 43,000 vehicles, yielding almost a 19 hour shortfall between available evacuation time and the time actually needed to evacuate these vehicles. These estimates provide a quantitative measure of the relative evacuation risks that the locality will face if it permits certain future levels of development to occur.

Table 4.10

Evacuation Demand for Future Development

	Current Situation	Scenario Grand Totals I	II	III
Total DUs	3,170	18,238	20,512	44,380
x 1.21 Vehicles per DU	3,832	22,068	24,820	53,700
x .8 remaining after evacuation order is given =	.8	.8	.8	.8
Demand in Vehicles	3,066	17,654	19,856	42,960

Source: Department of City and Regional Planning, supra n.23, 1984

Table 4.11

Evacuation Capacity Under Future Development

	Current Situation	Scenarios I	II	III
Total Evacuation Capacity (Vehicles)	8,975	8,975	8,975	8,975
Total Evacuation Demand (Vehicles)	3,066	17,654	19,856	42,960
Excess Capacity (+) or Demand (-) (in Vehicles)	+6,179	-8,679	-10,881	-33,985
Evacuation Period Needed (Hours)	1.7	9.8	11.1	23.9
Total Evacuation Time Needed (Hours) (Evacuation Period + 3 hrs. mobilization + 4 hrs. to inundation)	8.7	16.8	18.1	30.9
Excess (+) or Shortfall (-) in Hours	+3.3	-4.8	-6.1	-18.9

Source: Department of City and Regional Planning, supra n.23, 1984

C. Conclusion

The damage a community suffers from hurricanes and other coastal hazards has two necessary components--the natural forces of wind and wave action, and the exposure of people and property. Local governments must understand both elements in order to implement an appropriate mitigation plan, and this chapter has presented a number of readily available methods for calculating hazard magnitude, location, and exposure.

To determine the location of particularly hazardous areas, planners can start with the Flood Insurance Rate Maps of the National Flood Insurance Program. The FIRMs, based on historical data and probabilities, show elevations and delineate zones of wave actions and flooding. A more sophisticated tool is the computerized SLOSH simulations of potential hurricane paths, which can be used to create a map of inundated areas. For the non-hurricane threats of coastal erosion and inlet hazards, communities can turn to the state CAMA program for erosion setback lines and inlet formation maps. Cumulating all three sources, local planners can then compose a composite hazards map.

The second component, exposure, represents the independent variable in the hazard equation. Unlike the natural forces themselves, local governments can influence the location and concentration of people and property through growth management and other policies. To determine the extent of property at risk, planners can use tax maps and other data to locate and value public and private property, and then can apply damage algorithms to calculate the amount of potential damage.

To understand the exposure of people to coastal hazards, planners must use a different approach, focusing on evacuation. Evacuation demand, evacuation routes, route capacity, warning times, and traffic bottlenecks are

among the factors to be considered. SLOSH simulations under the North Carolina Hurricane Evacuation Study are being developed for all coastal counties, and will enable localities to establish "clearance times" for hurricane evacuation. If SLOSH data is unavailable or inapplicable, local governments can apply simple manual methods to calculate evacuation demand and capacities. Once a community has prepared a thorough hazard analysis and mapping, it can specify its mitigation policy in terms of specific areas and development objectives. Next, the locality can begin to implement its objectives through the tools and techniques of Chapter 5.

Chapter 5

Review of Specific Growth Management Tools and Techniques

As discussed in the Introduction, growth management programs are designed to affect the location, density, timing, and/or type of development in a community. The tools and techniques of growth management are well adapted to implement a strategy of coastal storm hazard mitigation, but should not be applied in an arbitrary, cookbook fashion. Individual ordinances or devices will accomplish little unless enacted in the context of an overall policy or plan, such as the hazard mitigation plan required by CAMA regulations. With a plan, local governments can select an appropriate mix of growth management tools to achieve a variety of related objectives. Many of the devices discussed here can be used to complement each other or to achieve non-hazard-related community goals.

Ideally, coastal localities should seek to find that package of growth management programs and policies particularly suited to their political, social, and economic conditions, and which implement the policies embodied in their land use plans. This chapter will discuss specific development management techniques, indicating the range and diversity of different tools and approaches available.[1] Categories of techniques include development regulation, land acquisition, taxation and fiscal incentives, capital facilities policies, and programs for information dissemination. Table 5.1 displays each technique and summarizes the ones which have been employed and which are legally feasible in North Carolina.

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[1]This chapter builds on Beatley, Development Management to Reduce Coastal Storm Hazards: Policies and Processes, Chapel Hill, NC: UNC Center for Urban and Regional Studies, 1985.

Table 5.1

Applicability of Growth Management Tools and Techniques in North Carolina

Tool or Technique	Used in NC	Authorized under NC law
Zoning	Yes	Yes
Open Space/Agricultural	No	Unlikely
Downzoning/Density Reduction	Yes	Yes
Minimum Lot Sizes	Yes	Yes
Floating Zones	Yes	Yes
Nonconforming Uses	Yes	Yes
Coastal Setback	Yes	Yes
Special Use Permits	Yes	Yes
Bonus/Incentive Zoning	No	Uncertain
Performance Zoning	No	Probably
Population Caps	No	Uncertain
Interim/Temporary Moratoria	Yes	Probably
Mobile Home Restrictions	Yes	Yes
Subdivision Regulation	Yes	Yes
Clustering	Yes	Yes
Exactions/Development Conditions	Yes	Yes
PUDs	Yes	Yes
Land/Property Acquisition		
Fee Simple Acquisition	Yes	Yes
Advance Acquisition	No	Probably
Official Mapping	No	Probably
Right of 1st Refusal	No	Unlikely
Funding Aid	Yes	Yes
PDR/Donation of Easements	Yes	Yes
Transferable Development Rights	No	Uncertain
Taxation/Fiscal Incentives		
Differential Taxation	Yes, for farmland preservation	
Special Assessments	No	Yes
Impact Fees	Yes	Needs Special Legislation
Capital Facilities/Infrastructure		
Utility Extension Policy	Yes	Probably
Capital Improvements Plan	Yes	Yes
Post-Storm Relocation	No	Yes
Information Dissemination		
Real Estate Disclosure	No	May Need State Legislation
Community Awareness Programs	No	Yes

I. Development Regulation

The primary development management tools are those which directly regulate and control the location, amount, density, and type of development in a coastal community. Regulations which restrict development can reduce the exposure of people and property to hurricane and storm risks, and can enhance the protective features of the natural environment. Basic types include zoning and subdivision regulations and various specialized applications of these standard tools.

A. Zoning

1) Conventional Zoning: Reducing the quantity of development exposed

Conventional zoning ordinances control the type of land uses allowed in particular parts of a community (e.g., residential, commercial, industrial) as well as their intensity (e.g., bulk, height, floor area ratio, setback provisions). As a result, zoning provisions can control the amount and type of property exposed to hurricane and storm hazards. For instance, open space and recreational uses may be the most appropriate activities to be permitted in high risk areas, such as Ocean Hazard AECs and NFIP V-zones. Restricting such areas to commercial or public recreational activities would substantially reduce the amount of property at risk and in turn the property losses to accrue from future hurricanes and storms.

Zoning, with its emphasis on separation of uses, predictability of land development, and regulation of building height, bulk, and land area is the most common regulatory device for guiding land development in North Carolina. Authority to zone is granted in N.C.G.S. §153A-340 et seq. to counties and in

§160A-381 et seq. to cities. This enabling legislation is based upon the U.S. Department of Commerce Standard State Zoning Enabling Act, which is the basis for zoning enabling legislation in most of the states. Local zoning ordinances must be in accordance with a comprehensive plan.[2] The zoning enabling legislation establishes the permissible purposes for zoning as lessening congestion in the streets; securing safety from fire, panic, and other dangers; promoting health, safety, and the general welfare; providing adequate light and air; preventing overcrowding of land; avoiding undue concentration of population; and facilitating adequate provision of transportation, water, sewerage, schools, parks, and other public requirements. Zoning purposes and variations which are found not to serve these purposes are ultra vires and invalid unless authorized by other legislation.

Zoning has been upheld as constitutional and a legitimate exercise of the police power since the United States Supreme Court decision in City of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926), but the application of specific provisions is still subject to challenge. In North Carolina, the Supreme Court has held that a zoning ordinance is valid unless "it has no foundation in reason and is a merely arbitrary or irrational exercise of power having no substantial relation to the public health, the public morals, the public safety, or the public welfare in its proper sense."[3] The court grants zoning ordinances a presumption of validity.[4]

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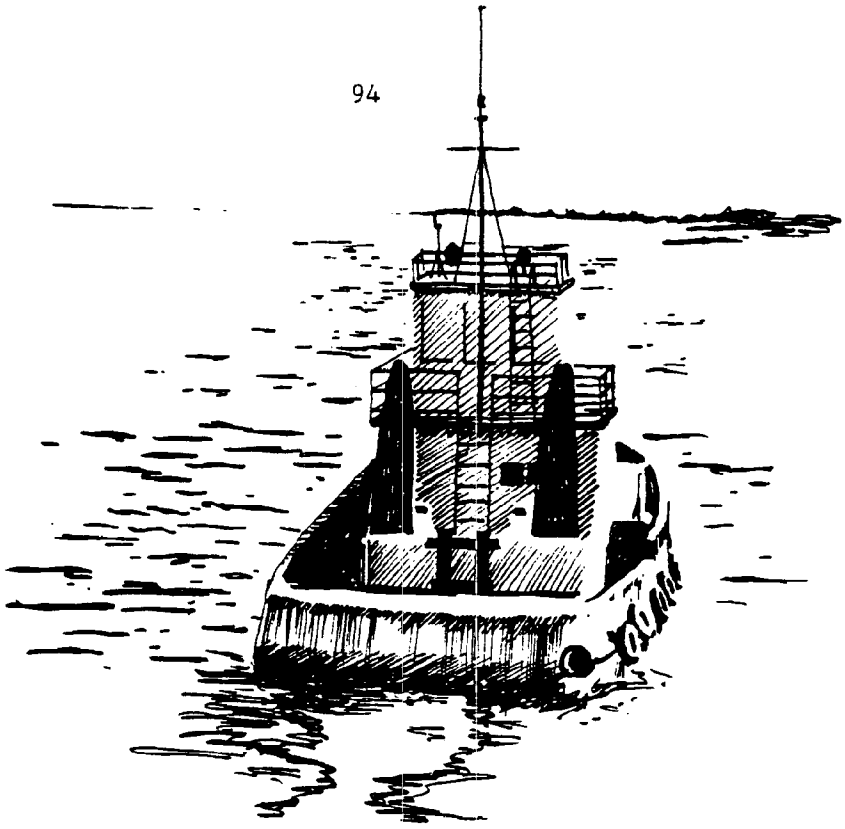
[2]N.C.G.S. §160A-383 (municipalities); §153A-341 (counties).
[3]In re Parker, 214 N.C. 51, 55 (1938).
[4]State v. Joyner, 286 N.C. 366, appeal dismissed 422 U.S. 1002 (1975).



One zoning option for coastal communities is simply to designate hazard areas as an open space or conservation zone in which all future development is prohibited. Even if this were a politically feasible option, in coastal areas where agriculture and other non-developed uses do not yield reasonable economic returns it invites the constitutional challenge of a "taking" of private property without just compensation (see Chapter 7). Depending on the characteristics of the site, a prohibitory approach is not likely to be defensible unless some economic use, such as agricultural, forestry, or commercial recreation, can be supported.

Land which is not suitable for agricultural uses cannot be designated for such use simply to prevent further growth in an area. If undeveloped land, which is in fact not agricultural land but in reality land suited for development, is zoned exclusively agricultural, the courts will probably invalidate the ordinance as a taking without just compensation. The same problem is encountered in any attempt to zone an area exclusively industrial or for other exclusively non-residential uses. However, North Carolina zoning

enabling legislation does provide for the use of exclusive non-residential zoning, and a zoning ordinance which excludes residential use from certain areas can serve a variety of purposes beyond protecting lives from hurricane hazards. Residential exclusion prohibits subdivisions from expanding into an area and serves, in effect, as a holding zone to contain urban development, to protect agricultural areas from increased demands for commercial and residential development, and to prevent scattered residential development which is difficult to serve with public improvements and services.

In most instances, in the absence of land acquisition or some substantial form of landowner compensation, large scale prohibition of new development, including residential, in hazard areas is not likely to be feasible. A more pragmatic approach is one which seeks to reduce the overall quantity of development at risk. While a residential zoning designation in an oceanfront area may still permit considerable development to occur at high risk to hurricane damage, this quantity may still be considerably less than what the unregulated market would support. Moreover, reducing a zoning designation from relatively dense multi-family development to single family uses may reduce substantially the amount of property and the number of lives at risk.

However, the strategy of hazard risk reduction through decreasing development density is contingent to some extent on the quality and type of structures to be built. Multi-family structures, designed by engineers and architects, may be able to withstand the forces of hurricanes and storms much more effectively than builder-designed single-family structures. While limiting development to the latter type may reduce the quantity of property at risk, this property may be more vulnerable to storm damage.

Reducing development densities is a very common approach, and examples of conventional downzoning along high hazard coastal shorelines are not hard

to find. In its recent hurricane hazard mitigation and post-disaster reconstruction plan, the Town of Emerald Isle, North Carolina, notes its efforts to reduce storm hazards by keeping down hazard area densities:

> The Town's growth policy encourages relatively low density residential development; high rise developments along the ocean are not typically found in Emerald Isle. The Town has also downzoned lands that originally allowed up to 13.5 dwelling units per acre to 8 dwelling units per acre. This may reduce the ultimate number of units by 2,200 or about 7,300 seasonal sites (Town of Emerald Isle 1984, p. 10).

The hurricane hazard mitigation and reconstruction plan for Onslow County, North Carolina, recommends that future permissible densities be lowered considerably in West Onslow Beach (Topsail Island) to facilitate evacuation. Moreover, while the plan recommends a reduction in overall density, it also recommends more extensive reductions where the hurricane hazard is greater.[5]

The Onslow County plan illustrates that zoning can be used to reduce the amount of property at risk in coastal hazard areas in proportion to the extent and nature of the storm-related hazards in various locations. The quantity of development permissible could be a function of the aggregate risks at a particular site. For instance, less development may be permitted in an area subject to both wave velocity action from storms and a potentially shifting inlet than in a location subject only to velocity effects without the inlet hazard. Different hazard zones can be designated with varying degrees and combinations of hazards, with the density of development adjusted accordingly. Proximity to ocean and sound waters may serve as a good proxy for storm risks, with the most extensive new development permitted on locations farther inland. An important factor to remember is that in a typical coastal community there will be gradations of hazard risk, with the primary (mitigation) objective of

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[5]Onslow County, N.C., Hurricane Storm Mitigation and Post-Disaster Reconstruction Plans, prepared by Henry Von Oesen and Associates, Inc., April 1984.

zoning often being to orient future development away from high hazard areas to lesser hazard areas.

As with many of the other development management techniques discussed herein, it is important to utilize zoning provisions to preserve, to the extent possible, the protective features of the natural environment. It may be desirable, for instance, to permit only very low densities of development (where permitted at all) around wetlands. Development in close proximity may threaten the health and vitality of these areas and in turn reduce their utility in absorbing storm forces.[6]

Density of development can be reduced in several ways. One approach is to raise the minimum lot size required for structures. For instance, in a high hazard zone, the zoning ordinance may be modified so that new residential structures here must be situated on a minimum lot size of 50,000 square feet rather than the previous 25,000 square foot minimum.[7] A complementary approach is simply to reduce the number of dwelling units permitted per acre in high hazard areas. An existing permitted density of 10 dwelling units per acre may be reduced to that of 5 dwelling units per acre. Either approach serves to reduce the overall quantity of permissible development in a particularly hazardous location.

On the other hand, this type of zoning may produce an inefficient form of development, which increases the cost of providing services within the area. Minimum lot sizes also tend to drive up land and housing costs. Extensive minimum lot size requirements are likely to face legal difficulties where it

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[6]Conservation Foundation, Flood Hazard Management and Natural Resource Protection, prepared for FEMA, October 1980; Arthur R. Benton, Carolyn A. Clark and Wallace W. Snell, Galveston Island-A Changing Environment, Texas A&M University, January 1980.

[7]See Kill Devil Hills Ocean Impact Residential Zone, Appendix II.

appears that the primary purpose of the ordinance is exclusionary (to prevent certain groups of people from residing in a community) rather than related to a valid governmental purpose such as protection from septic tank pollution or protection of environmentally fragile or scenically important areas.[8]

Where an existing zoning ordinance already exists, a reduction in density may be most expediently accomplished by rezoning hazard areas to existing zoning designations which exclude higher density uses. For instance, the hurricane mitigation and post-storm reconstruction plan for the Town of Nags Head, North Carolina, recommends that the town consider rezoning certain portions of its beachfront from CR to R1 or R2, in order to prevent the location of high density hotel and motel uses.[9]

Reductions in the densities of development permitted by zoning in high hazard areas can occur in either the pre-storm stage or during recovery and reconstruction. It may be difficult to overcome the political obstacles to downzoning in the pre-storm stage, while storm devastation may present unique mitigation opportunities.[10] Of course, to fully realize post-storm mitigation opportunities, localities should develop a reconstruction plan in advance, based on the elements required in the CAMA regulations. Without a detailed, thoughtful plan, post-storm rebuilding may proceed haphazardly to replicate or worsen the pre-storm condition.

As one element of the post-storm plan, the community might decide in advance that certain pre-determined density reductions will be activated

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[8] See Salamar Builders v. Tuttle, 29 N.Y.2d 221, 325 N.Y.S.2d 933 (1971) (upholding large lot zoning to protect against septic tank pollution) and National Land and Investment Co. v. Kohn, 419 Pa. 504, 215 A.2d 597 (1965) (striking down large lot zoning intended to prevent the overburdening of existing municipal services).

[9] Town of Nags Head, N.C., Hurricane Hazard Mitigation and Post-Storm Reconstruction Plan, prepared by Coastal Resources Collaborative, Inc., 1984.

[10] See Chapter 6.

according to the extent of overall property damage occurring in particular areas of the locality. For instance, in areas where multi-family structures have been damaged by 50% or more of their market value on average, the community may automatically imposed a density reduction of, say, 25%. This would permit some structures to be rebuilt but would simultaneously reduce substantially the amount of future property at risk. The pre-specified restrictions would likely be tied to the damage zones delineated during the early stages of recovery and reconstruction and would resemble a sort of floating zone which would become binding only upon the occurrence of certain damage conditions.[11]

Floating zones are shown in the text of the zoning ordinance but not on the zoning map. This technique is used when a local government recognizes that a particular activity is desired for a general area, but the specific site has not been located in advance. The floating zone may be applied to a site if the conditions in the ordinance are met. A floating zone therefore "floats" in the text of the zoning ordinance and waits to be affixed to an appropriate parcel of land. Typically employed for such uses as shopping centers, light industry and mobile home parks, floating zones are not explicitly authorized by enabling legislation in North Carolina. A floating zone ordinance may have legal difficulties as a form of spot zoning. The North Carolina Supreme Court has defined spot zoning as arising "where a small area, usually a single lot or a few lots, surrounded by other property of similar nature, is placed arbitrarily in a different use zone from that to which surrounding property is made subject." [12] Conversely, legal problems

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[11]See the triage discussion in Chapter 6, and the Model Moratorium Ordinance, Appendix II.

[12]Zophi v. City of Wilmington, 273 N.C. 430 (1968).

with the floating zone concept may be avoided if it is viewed as a form of a special exception, with more detailed requirements and conditions to be met before the use is permitted.[13]

Another traditional zoning concept that can be readily applied to density reduction is the doctrine of nonconforming uses. A nonconforming use is created when a land use or activity formerly permitted by right is prospectively invalidated by a new zoning ordinance. The ordinance's restrictions do not apply retroactively, so the former use is "grandfathered in." That is, the use is permitted to continue, yet is generally not allowed to expand beyond a certain extent, and, if destroyed or discontinued, is not permitted to re-establish itself. For instance, a commercial establishment may become a nonconforming use in a new exclusive residential zone. While the business may continue operating in the short term, it may not expand its size, and, if destroyed by a fire or other catastrophe, will not usually be permitted to rebuild in this zoning district.[14]

Nonconforming uses can be used to reduce storm hazard in several ways. Certain high density uses in high hazard areas can be zoned out and declared nonconforming uses through changes in zoning districts, and in time a slow process of land use change might be expected. A shorter-term approach uses the nonconforming use concept as a way of preparing for and managing reconstruction after a hurricane or storm occurs. For instance, while a major hotel or condominium complex may be tolerated in a high hazard zone because it already exists, storm destruction provides an opportunity to change allowable land uses and start over with a clean slate. Local officials should try to

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[13] Rogers v. Village of Tarrytown, 302 N.Y. 115, 96 N.E.2d 731 (1951).

[14] See Myrtle Beach Coastal Protection Overlay Zone §2, Model Amendments §2, Kill Devil Hills Ocean Impact Residential Zone §20-10.10, Appendix II.

rezone hazard areas before the storm so as to give notice of nonconforming use status and to prevent the reconstruction of nonconforming structures before the locality has a chance to change the zoning after the storm. Older structures which are nonconforming may also be required to be brought "up to code" in the event they are faced with substantial repairs.

Several issues are raised when rezoning for hazard reduction creates nonconforming uses. The first concerns the financial and economic impacts of declaring an existing use to be nonconforming. To what extent, for example, does the zoning change lower the fair market value of a property and the ability of its owners to secure continued financial backing? Furthermore, will a loss in market value result in lower tax assessments and reduced property tax revenues for the locality? Another issue is the extent or degree of damage required before a storm-damaged nonconforming use is considered destroyed and is barred from being reconstructed. The National Flood Insurance Program has used a 50% fair market value loss criterion to distinguish between damaged structures which do or do not have to be repaired to NFIP standards (i.e., elevation to the 100-year BFE).

Localities which are not content to wait for storms to remove their nonconforming uses might employ the concept of "amortization." Amortization, typically employed to restrict signs and billboards, permits a nonconforming use to continue for only a specified period of time. The amortization period is often tied to the economic depreciation of particular types of property and must be reasonable in order to be upheld as a legitimate exercise of the police power. The North Carolina Court of Appeals has upheld amortization provisions in sign control ordinances.[15] The use of amortization might be

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[15] Goodman Toyota v. City of Raleigh, 63 N.C. App. 660 (1983); Givens v. Town of Nags Head, 58 N.C. App. 697 (1982).

expanded to situations where it is considered equitable to provide owners of relatively short-lived property in high hazard areas with a definite amortization or compliance period. For instance, a locality might require a single-family homeowner in a high erosion area to relocate his home to a safer parcel by some reasonable period of time.

2) Coastal Setbacks

The concept of a development setback has long been part of zoning and land use control. Setbacks are used in urban settings to ensure that sufficient land is available for future roads and other public improvements, and to ensure adequate light, access, and separation of structures. Setbacks in coastal hazard areas are an extension of this zoning technique and have become relatively popular as a means for both minimizing the impact of development on beach and dune systems and reducing exposure to storm hazards.[16] Setbacks can be required from the ocean itself (i.e., from the mean high tide line), the first line of vegetation, or the dune ridge. Such setbacks may be state-mandated or local option. North Carolina, under CAMA regulations, requires small coastal developments to be located landward from the first line of vegetation (or crest of dune), or a distance 30 times the annual rate of erosion for that particular segment of coast, whichever is greater. This setback is 60 times the annual rate of erosion in the case of multi-family structures of four units or more and structures of more than 5,000 square feet in size.[17]

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[16]Kusler, Innovative Local Floodplain Management: A Summary of Local Experience, Boulder, CO: Institute of Behavioral Science, 1982; UNC Center for Urban and Regional Studies, Review of State Programs and Policies to Reduce Coastal Storm Hazards, Chapel Hill, N.C., 1984.

[17]15 N.C. Admin. Code 07H.0306. The Myrtle Beach Coastal Protection Overlay zone, Appendix II, establishes a "Building Control Line."

3) Special Use Permits

Many localities across the country have felt constrained at times by the rigid classifications of conventional zoning. In order to gain flexibility or acquire desirable developments, some communities have resorted to directly bargaining with developers to exchange zoning rules for some form of benefit. Such an exchange is referred to as contract or conditional zoning.[18] However, contract and conditional zoning have been ruled invalid in North Carolina, as in the nature of spot zoning.[19] Amendments to the zoning ordinance designed to give preferential treatment to select landowners are referred to as "spot zoning" and are almost always struck down by the courts if they are challenged.[20]

Even though pure contract zoning is illegal, localities have many other options to enhance the flexibility of land use controls. One of the most

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[18]Under the concept of contract zoning, the jurisdiction agrees to allow a land use activity not normally permissible in a particular area, such as a rezoning from low-density residential to commercial or higher-density residential, in exchange for a certain desirable feature provided by the developer, such as a deed restriction or public improvements. Conditional zoning is similar to contract zoning, but without the community selling or bargaining away its regulatory authority. Here, zoning changes are permitted only if they satisfy the stipulations laid down by the community at the time of project review. For example, a locality may agree to rezone low density residential to commercial uses in a high hazard zone, only if the developer agrees to ensure that his structures can be used for sheltering the public in the event of a hurricane threat.

[19]Allred v. City of Raleigh, 277 N.C. 530 (1971).

[20]The invalidity of spot zoning consists of isolating a select parcel for preferential treatment and relieving the parcel of restrictions to which surrounding property is subject. Blades v. City of Raleigh, 280 N.C. 531 (1972); Godfrey v. Union County Board of Commissioners, 61 N.C. App. 100 (1983). The North Carolina Court of Appeals has explained that rezoning must be effected by the exercise of legislative power rather than by special arrangements with the owners of a particular parcel of land. Rose v. Guilford County, 60 N.C. App 170 (1982). See also Brough, "Flexibility without Arbitrariness in the Zoning System: Observations on North Carolina Special Exception and Zoning Amendment Cases," 53 North Carolina Law Review 925 (1975).

common devices in North Carolina is the conditional or special use permit, also called the special exception. This technique is employed in areas where certain activities are permissible but require special scrutiny to screen out or minimize the particular problems individual developments may present. Generally, the special use is permitted as a matter of right within a given zone if the proposed development meets certain conditions and criteria. These criteria, which must be objectively stated in the ordinance, most often relate to the provision of municipal services or to the reduction of adverse environmental impacts.[21]

Special use permits are distinguished from contract or conditional zoning in two ways. First, criteria that must be met before a special use permit is issued are expressly stated in the ordinance and apply equally to all property owners within a given zone. Second, special use permits require no concessions or commitments from the community. The applicant for the permit needs only to demonstrate that the proposed development meets the required conditions for the permit to be granted. Also, the special use permit is entirely different from a variance, which is a departure from the terms of the zoning ordinance and is granted where enforcement of the terms of the ordinance would result in undue hardship. The special exception is a permitted use under the terms of the ordinance in contrast to a departure from the ordinance in the case of a variance.[22]

Authority for the use of special exceptions or conditional use permits is granted to municipalities in N.C.G.S. §160A-381 et seq. and to counties in

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[21] In re Ellis, 277 N.C. 419 (1970); Coastal Ready-Mix Concrete Company v. Board of Commissioners of the Town of Nags Head, 299 N.C. 620 (1980).

[22] Jackson v. Guilford County Board of Adjustment, 2 N.C. App. 408 (1968), aff'd 275 N.C. 155 (1969).

§153A-340 et seq. The North Carolina Supreme Court has upheld the use of special exception ordinances against an improper delegation of legislative authority challenge so long as specified conditions are met. The special exception ordinance is valid when the standards set forth in the ordinance provide adequate standards for the delegation of legislative authority, form the basis for the decision of the board of adjustment, and follow the applicable procedural safeguards.[23]

4) Bonus or Incentive Zoning

Bonus or incentive zoning allows developers to exceed limitations, usually height or density limitations, imposed by conventional zoning in exchange for developer-supplied amenities or concessions. For example, a builder may be permitted to exceed a height restriction if the developer provides open space adjacent to the proposed building. Incentive zoning has been used for some time in large urban developments. In New York, for example, a developer can obtain a 20% increase in permissible floor area for projects which incorporate a legitimate theatre. Density bonuses have been given to encourage the incorporation of low and moderate income housing into development projects.[24] In the case of coastal hazard areas, developers may be granted additional development units if projects incorporate hazard-reduction features. These features may include the purchasing and deeding to the public of high hazard lands, or the provision of design features which may increase the ability of structures to withstand storm forces. It may

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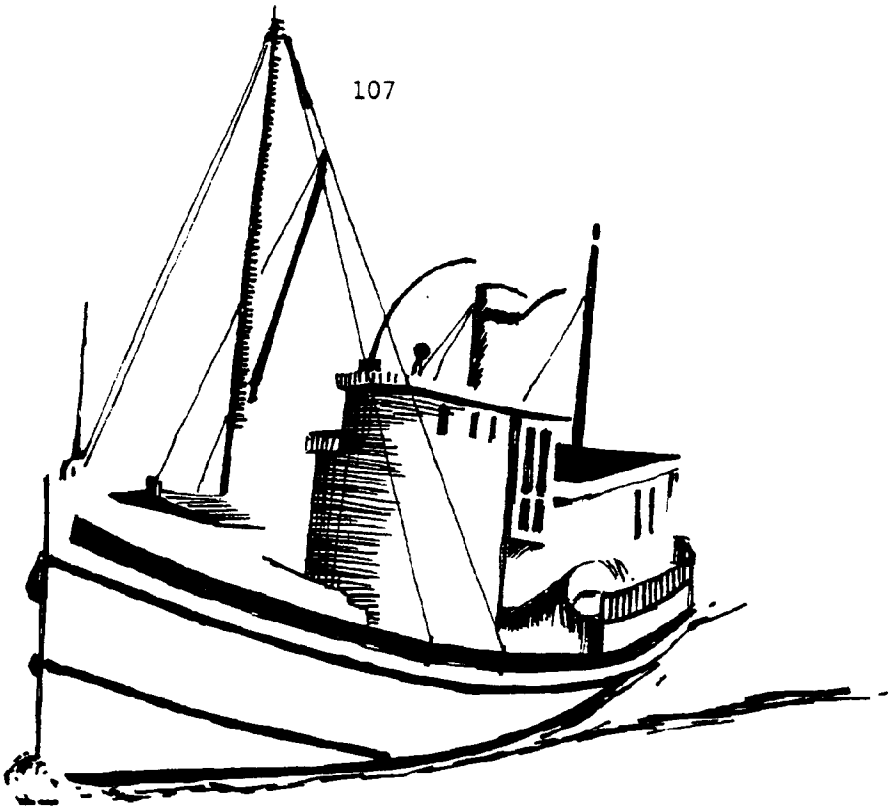
[23] Humble Oil and Refining Company v. Board of Aldermen of Chapel Hill, 286 N.C. 170 (1974).

[24] G.M. Fox and B.R. Davis, "Density Bonus Zoning to Provide Low and Moderate Cost Housing," 3 Hastings Con. L.Q. 1015 (1978).

counteract other hazard mitigation strategies, however, to encourage or permit additional densities in coastal hazard areas, even if public amenities and hazard-reduction features are provided as compensation.

Moreover, bonus or incentive zoning is not explicitly permitted by North Carolina zoning enabling legislation. The legality of this zoning variation in North Carolina is uncertain because of its resemblance to contract and conditional zoning. Legal problems might arise for two reasons. First, when used without traditional zoning, incentive zoning deals primarily with density, and not use, in classifying land uses. There may be questions as whether this is within existing enabling legislation. (Apparently no municipalities have used this tool without also using conventional zoning.) Secondly, if used in combination with traditional zoning, the technique might be attacked as unlawful contract zoning. On the other hand, incentive or bonus zoning is similar to dedication, and the use of dedication has been upheld when used as part of a subdivision regulation and in other contexts.

The relationship between the amenity provided by the developer and the bonus allowed in return may be important for judicial approval of incentive zoning. For example, an incentive ordinance may allow a smaller lot size in subdivisions in return for more open space than is ordinarily required. There is an obvious relationship between allowing smaller lots and providing more open space. A more difficult situation arises when an ordinance allows smaller lots in return for the provision of an amenity such as bikeways. It may be that incentive ordinances for non-controversial purposes are not likely to be challenged, and perhaps even a tenuous relationship between the amenity and the bonus will justify the ordinance.



5) Performance Zoning

Performance zoning sets standards for each zone based on permissible effects of a development rather than specifically enumerating the types of uses, dimensions, or densities permitted. If the prescribed standards are met, any use is allowed in the zone. This technique has been extensively used in industrial zoning to set standards on noise, dust, emissions, and glare. More recently, the technique has been used in broader applications, with standards keyed to demands on public services such as water supply, waste water treatment, and roads. Application may involve protection of the environment by specifying maximum levels of permissible stress on natural systems. For example, a community may specify the amount of permissible disturbance of vegetation in a given zone, and any use would have to meet that standard before development could take place. Performance controls for sensitive lands may work as a system to protect natural processes in environmentally sensitive areas, such as wetlands, floodplains, and dune

systems. Performance controls are most often used in conjunction with traditional zoning ordinances, or as an overlay to the conventional zones.

The power to zone by the use of performance standards is not explicitly granted in North Carolina enabling legislation, and no court decisions expressly address the validity of the technique. The North Carolina Supreme Court has, however, upheld the use of performance standards in a municipal floodplain ordinance against taking and equal protection challenges.[25] It seems that performance standards, if rationally devised and consistently applied, could qualify as a comprehensive plan, and zoning in conformance with those standards could be upheld under the broad grant of zoning authority.

6) Population Caps and Annual Development Limits

One approach to addressing the hurricane threat is simply to restrict the number of people permitted to reside in the community. Population caps may be particularly appropriate in barrier island communities where only limited numbers of people can evacuate safely should a hurricane or severe storm threaten. It may also be true that a strategy to reduce future property damage is actually aimed at restricting the amount of development permitted in the community. Usually, however, such restrictions are employed for other purposes, such as to protect the aesthetic quality of a community or to ensure that a natural resource is not overtaxed.

Two basic approaches have been identified. One approach is to establish an absolute "cap" on the amount of future growth permitted in the community.[26] The cap may be assessed in terms of overall population or development or

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[25] Responsible Citizens in Opposition to the Flood Plain Ordinance v. City of Asheville, 308 N.C. 255 (1983).

[26] For a general review and comparison of these, see Bureau of Government Research and Service, Local Government Policies for Urban Development: A Review of the State of the Art, University of Oregon, 1974.

dwelling units. The City of Boca Raton, Florida, has become a classic example of an attempt to use this approach. Citizens here voted in 1972 to enact a charter amendment restricting the absolute number of dwelling units in the jurisdiction to 40,000, with a series of downzonings to implement this provision.[27] The Boca Raton ordinance was found to be constitutionally deficient as a violation of state and federal due process and as having no rational relationship to a permissible municipal objective.[28] It is highly unlikely that such an ordinance would survive judicial scrutiny in North Carolina unless some dire circumstances were exhaustively documented or undisputed.

A second and more legally acceptable approach is to limit growth on an annual basis. The City of Petaluma, California, is a prime example of the use of this approach. Here provisions were enacted which restricted the issuance of building permits to roughly 500 residential units per year. Development applications are evaluated according to the Petaluma General Plan and environmental design plans.[29]

A program of restricting the amount of annual growth, or enacting a temporary building moratorium, may have several advantages for a storm-vulnerable coastal locality. It will reduce the speed of new development and growth and consequently the reduce the extent of lives and property at risk in

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[27]David Godschalk, David J. Brower, et al, Constitutional Issues of Growth Management, Chicago: APA Planners Press, 1979; and Toni I. Meador, "Managing Growth on Florida's Gold Coast: Boca Raton and the Growth Cap," Fla. Environmental and Urban Issues, February 1979.

[28]City of Boca Raton v. Boca Villas Corp., 371 So.2d 154 (Fla. App. 1979), cert. denied, 381 So.2d 765 (1980).

[29]Godschalk, Brower et al., Constitutional Issues of Growth Management, supra. The Petaluma ordinance was upheld in Construction Industry Association of Sonoma County v. City of Petaluma, 522 F.2d 897 (9th cir. 1975), cert. den. 424 U.S. 934 (1976).

the short run. In the long run, however, the absolute level of development may remain unchanged. Timing growth in this way may afford a community more time to plan for the storm hazard, and may place the community in a better position to make intelligent land use and other decisions which can eventually reduce the extent of local storm hazards. As a further example, a community may need additional time to finance and put in place certain public facilities critical to the safety of people and property, such as a new bridge to the mainland or a detailed hazard map.

No communities in North Carolina have enacted annual permit limitations like Petaluma's. A similar, although not so rigid approach, is to dictate stringent conditions which must be met before a permit will be issued. North Carolina's building laws set various standards for structures in pursuance of the public health, safety, and general welfare. Absolute limitations on the number of permits, however, are not mentioned in the building code enabling legislation. The issuance of a building permit is conditional upon compliance not only with the state building code, but with all applicable local laws such as the local zoning regulations.[30] Local regulations may not modify the state building code, which governs construction standards. The enabling statutes do not state how stringent the conditions set by local government for permit issuance may be, with respect to the provision of public services and the protection of the environment and neighboring property owners.

The population cap and permit limitation techniques suggest the possibility of closely tying permitted new growth to the capacity of a coastal locality and its residents to respond to a storm hazard. Such an approach has been employed in the growth management system adopted by Sanibel Island,

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[30] N.C.G.S. §160A-417.

Florida. Shortly after the island was incorporated, a moratorium on new development was initiated and a comprehensive plan based explicitly on the capacity of the island's natural and built environments to sustain new growth was developed. Evacuation is calculated to take five hours, assuming 12 hours of warning and subtracting from that a four hour hazards cutoff time (beyond which evacuation is not possible), and three hours mobilization time (i.e., time required for warning, preparation of residents, and for establishing an evacuation system).[31]

The Sanibel case illustrates the use of the concept of "carrying capacity." Carrying capacity means the natural and manmade limits to development beyond which significant harms will occur.[32] Carrying capacity can be used to assess the effects of development on such natural factors as ground water supply and wetlands productivity, and manmade factors such as sewage treatment and roadway capacity. This concept has been applied in practice to a number of coastal localities.[33] Several implications for storm hazard reduction arise from the application of carrying capacity analysis. The first is that, as in Sanibel, carrying capacity is particularly relevant

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[31]See Godschalk, Brower et al., Constitutional Issues of Growth Management, supra; J. Clark, The Sanibel Report: Formulation of a Comprehensive Plan Based on Natural Systems, The Conservation Foundation 1976; City of Sanibel, Florida, Comprehensive Land Use Plan 1980.

[32] David Godschalk and Francis H. Parker, "Carrying Capacity: A Key to Environmental Planning?" 30 (4) J. of Soil and Water Conservation 160-165, 1975; Devon M.Schneider, David Godschalk and Norman Axler, The Carrying Capacity Concept as a Planning Tool, PAS Report 338, 1978; David Godschalk, et al., Carrying Capacity--A Basis for Coastal Planning? Department of City and Regional Planning, University of North Carolina at Chapel Hill, June 1974.

[33]See, e.g., Department of City and Regional Planning, Currituck County Outer Banks Carrying Capacity Study, University of North Carolina at Chapel Hill, 1983; Town of Nags Head, N.C., Hurricane Hazard Mitigation and Post-Storm Reconstruction Plan, prepared by Coastal Resources Collaborative, Inc., 1984.

to assessing evacuation capacity.[34] Second, natural and manmade limitations on coastal development may provide a rational means to regulate the location and quantity of new growth, which in turn may serve to reduce storm hazards. Carrying capacity objectives, in other words, may be used to reinforce and complement efforts to reduce storm hazards generally.

7) Interim or Temporary Development Regulations

Interim or temporary regulations are designed to substantially retard development for a limited period. These regulations often take the form of a complete temporary moratorium on certain types of development or all development in certain locations. Temporary development moratorium can be of at least two types. First, a planning moratorium may be used to slow or to freeze development in a certain area until a plan can be drafted and a permanent scheme of growth management controls implemented. Temporary development control serves three functions: it permits planning and ordinance writing to proceed relatively free of development pressures; it prevents uses that will be incompatible with the eventual regulatory and planning scheme from being initiated before the scheme is operational; and it allows time for public debate on issues relevant to development of the permanent control system.

Second, an environmental moratorium restricts development during a period in which community facilities are over-pressured. Environmental moratoria are most commonly called for during rapid community growth and, to be effective, must be generally tied to programming of facilities related to the environmental problem. The most common example of such a moratorium involves

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[34]See particularly Currituck County Outer Banks Carrying Capacity Study, supra.

inadequate capacity of a sewage treatment facility. For example, in the early 1970's, Currituck County instituted a 15-month moratorium on approval of new subdivisions in order to provide time for land use planning and replatting of unrealistic subdivisions.

The power to impose an interim moratorium on development is not granted explicitly to local governments in North Carolina zoning or planning enabling legislation. Reasonable interim controls, if related to pressing community problems, however, are likely to be upheld. Judicial decisions in several other states have upheld interim moratoria as constitutional and as within the scope of standard zoning enabling legislation.[35]

8) Regulation of Mobile Homes

Because of their relatively fragile construction and lack of adequate foundations, mobile homes present particular dangers in the event of a hurricane. Both the occupants and the neighbors of mobile homes would be endangered by wave and wind action destroying or uprooting the home and battering it into nearby structures. Coastal communities may employ several specific methods to regulate mobile homes, including licensing, inspection, taxation, and zoning. The most obvious technique would be to prohibit mobile homes from locating in high hazard areas or to confine them to mobile home parks in sheltered locations.[36] Uniform standards regarding the construction and sale of mobile homes are contained in N.C.G.S. §143-144 *et seq*. and rules promulgated by the Building Code Council thereunder. Local building inspectors are charged with enforcement of these rules.

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[35] *See Westwood Forest Estates v. Village of South Nyack*, 23 N.Y.2d 424, 244 N.E.2d 700 (1969).

[36] See N.C. Division of Emergency Management, Model Flood Damage Prevention Ordinance Article 5, §B(4)(c), Appendix II.

The authority to regulate mobile homes stems from the North Carolina general zoning and public power enabling legislation and from legislation granting counties and cities the power to enact ordinances which protect the general health and safety. Mobile homes are considered sufficiently different from other types of housing that there is a rational basis for placing different requirements upon them.[37]

B. Subdivision Regulation

1) Subdivision and Site Plan Review

Subdivision regulations govern the conversion of raw land into building sites or developed uses and the type and extent of improvement made in this conversion. Subdivision regulations can control the density, configuration, and layout of development. They operate in ways similar to zoning to control the amount and density of development on a particular site. They can also establish effective requirements and standards for public improvements, including streets, drainage pipes, sewer outlets, and so forth. The requirement of minimum lot size can reduce the amount of new development exposed to storm hazards. Site plan review and other requirements of subdivision approval can provide the opportunity to orient the location of development sites in ways which minimize storm risks. For instance, subdivision regulations may require that new single-family dwellings on lots

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[37] Currituck County v. Willey, 46 N.C. App. 835, review denied 301 N.C. 234 (1980). Mobile homes may not be absolutely prohibited from a city, Town of Conover v. Jolly, 277 N.C. 439 (1979), but they may be restricted to mobile home parks. City of Asheboro v. Auman, 26 N.C. App. 87, cert. denied 288 N.C. 239, 217 (1975); Duggins v. Town of Walnut Cove, 63 N.C. App. 684 (1983).

in hazard areas be sited so as to maximize distance from high hazard oceanfront areas.

The authority to regulate subdivisions is granted to both municipalities and counties. Both are authorized, among other forms of regulation, to require dedication or reservation of recreation areas adequate to serve the residents of the immediate neighborhood within the subdivision.[38] Dedications of a specified amount of land (usually for parks or schools) or money in lieu of land force the developer of the subdivision to provide for needs generated by the subdivision. When the developer is allowed to pay in cash instead of in land, the community is given additional flexibility in meeting the needs of the subdivision. If, for example, a good park site is not available on the land owned by a developer, the cash contribution can allow the local government to purchase a nearby park site for the neighborhood.

Standards have recently been broadened in scope, and a subdivision plan may be refused approval where there is a fair or substantial showing that the subdivision will cause undesirable off-site problems such as creating hazards, environmental degradation, or increasing the burden on already overloaded public facilities, such as roads and sewers. In this newer form, subdivision regulations can facilitate orderly municipal growth in accordance with a comprehensive plan by controlling the sequence and time of development.

Subdivision approval might also be made contingent on mitigation actions, such as the protection of dunes, wetlands, or natural vegetation.[39] For instance, subdivision and site plan provisions may require that structures be located a sufficient distance from protective dunes. This may, in fact,

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[38] N.C.G.S. §160A-371 et seq. (cities); N.C.G.S. §153A-330 et seq. (counties).

[39] See Model Amendments §4(b).

amount to a setback over and above the CAMA requirements, but not necessarily. Subdivision approvals may also be made contingent upon the planting of certain vegetation and the restoration and repair, to the extent feasible, of existing dunes. Another promising alternative is to preserve the option of moving a structure back from the ocean by requiring lots which are sufficiently deep for this purpose. The additional depth could be considered analogous to the "repair" areas often required for septic tank use. If necessary, a structure could then be moved to the landward portion of the lot, in a safer location.

2) Clustering

Perhaps some of the most promising subdivision regulation techniques from a storm mitigation perspective are clustering provisions.[40] Clustering may either be required generally or be presented to developers as an option. Applied either way, these provisions would not affect the overall density permitted on a particular site, but would seek to concentrate or cluster a higher density of structures on portions of the site which are less hazardous (e.g., outside of the flood zone, at a distance from velocity zones and active inlets). By directing density to a particular portion of a site, clustering can both permit and encourage development to locate on the less-hazardous portions of a site, while preserving hazard-prone areas in an undeveloped state.

A prime opportunity for accomplishing such a reorientation of development could occur during reconstruction following a damaging storm. For instance, post-storm development regulations could encourage clustering new development on the landward side of the ocean highway, with parking and recreational open

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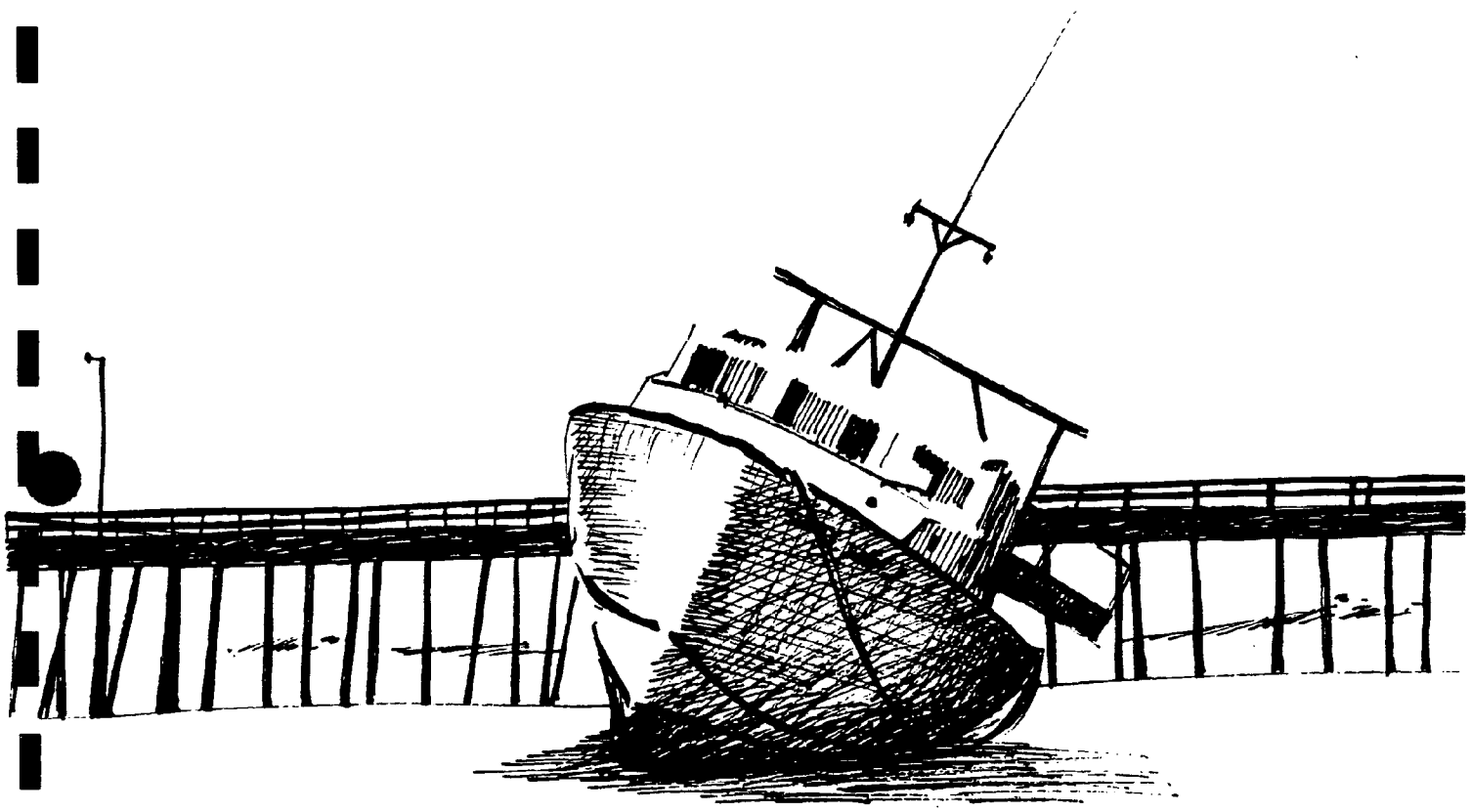
[40]See William Whyte, The Last Landscape, Garden City, NY: Doubleday, 1968.

space areas on the seaward side. Undeveloped beachfront areas may typically include features such as wetlands or vegetation which in themselves serve to protect against storm forces. Clustering may also encourage the construction of buildings which are more structurally resistant to storm forces, and may provide a more economical provision of certain storm protection improvements



(e.g., bulkheads). Clustering can, as well, economize on the public facilities, such as sewer, water, and roads, which must accompany development, in turn reducing the amount of property at risk.[41] Clustering may offer further advantages in the provision of community storm shelters and evacuation services.

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[41]Real Estate Research Corporation, The Costs of Sprawl, Council on Environmental Quality, 1974.

3) Exactions and Development Conditions

Traditionally, subdivision approval is contingent upon the provision by the developer of certain land or facilities, or monetary contributions in lieu of such dedications. Referred to as "exactions," these conditions have often taken the form of requirements to construct and dedicate, or to pay for the construction of, such immediate facilities as sewer and water lines, curbs and gutters, and roads. Typically included as well are requirements that the developers contribute a certain amount of land for open space, parks and recreation, and future school sites. These are generally needs directly related to the new development.

The exactions process offers potential for storm hazard mitigation in several ways. It may require, for instance, that when private developers build and dedicate public facilities, these facilities be constructed in ways which are hurricane-resistant (floodproofing sewer and water lines, elevated roads, etc.). Moreover, in the dedication of lands, or fees in lieu of such dedications, the community can require that lands which are particularly hazardous be dedicated--in turn ensuring that such areas are used for non-developed or non-intensive uses. An in-lieu land acquisition fund may allow the community to combine resources and to acquire in a more aggressive way large tracts of high-hazard land. Consideration of public reconstruction requirements may also be appropriate. For example, the community may wish to make subdivision approval contingent upon the contribution of the developer to a "reconstruction fund," which would be used to finance both immediate recovery and longer-term reconstruction costs.

Some communities have attempted to tie subdivision approval to the adequate provision of off-site community facilities and services, such as police, fire, and schools. Subdivision regulations which take into account

off-site facilities recognize that new development requires more services than those which are on-site. These regulations protect the revenues of the municipality and force the development to carry its own financial burden. They also promote development in areas where there can be orderly and efficient extensions of municipal services and where major expenditures for new roads, schools, and other public facilities are not required.

The state enabling legislation for subdivision regulation by municipal and county governments recognizes as legitimate objects of regulation the provision of community service facilities, the dedication of parks and recreational areas, and the reservation of school sites. Similar reasoning applies to hurricane hazard reduction. Subdivision approval might be contingent, for instance, on adequate community-wide evacuation capacity, or the provision of community storm shelters. It seems apparent that a city or county has the authority to condition its subdivision permits on the provision of off-site facilities.

4) Planned Unit Development (PUD)

Planned unit developments combine elements of zoning and subdivision regulation in permitting flexible design of large- and small-scale developments which are planned and built as a unit. Specific plans for the development are required in advance and must be approved by the administrative body. This concept eliminates the lot-by-lot approach common to zoning and subdivision regulation and can be used as an incentive for better development by enabling complete development proposals to be planned and approved.

In its simplest form, planned unit development takes the shape of cluster development. An example might involve a developer with 100 acres of land which he could divide into 400 quarter-acre lots according to existing local ordinances. Cluster zoning would give the developer the alternative of

clustering units closer together in one part of the site, provided that the overall number of units does not exceed 400. The open space saved by clustering is left for the common use of the residents. From this simple "density transfer," planned unit development builds into complex forms. In its most advanced stage, planned unit development allows a variety of housing types as well as commercial, agricultural, and industrial uses. Typically, developers are permitted to develop under PUD provisions when the proposed development exceeds a minimum specified number of acres or housing units. Planned unit developments are usually subject to zoning ordinances, although they are not actually mapped, and must therefore comply with the use restrictions within the zones where they occur. Increasingly, however, some mixing of uses and increases in density are permitted.

The PUD technique provides flexibility because the final design is a matter of negotiation between the developers and the planning authorities. PUDs are generally attractive to developers of large tracts of land. Planned unit development projects can be provided with urban services and facilities more economically than conventional development. They also allow environmental protection of sensitive areas while allowing residential and commercial development. PUD project design can enhance storm hazard reduction by, for instance, permitting deviation from normal zoning and subdivision requirements when the developer's plans incorporate storm hazard reduction features, such as protective land and vegetation buffers and the provision of on-site storm shelters.[42]

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[42] Robert Burchell (ed.), Planned Unit Development, Rutgers University: Center for Urban Policy Research, 1972; Robert Burchell (ed.), New Frontiers of Planned Unit Development: A Synthesis of Expert Opinion, Rutgers University, 1973.

Planned unit development ordinances are not specifically authorized by enabling legislation in North Carolina, nor has their validity been tested in the courts. The use of this technique would probably be upheld as an extension of the special exception procedure, which is permissible under the existing enabling legislation. Most recent decisions in other jurisdictions have upheld the validity of such ordinances. Many North Carolina municipalities have such ordinances, and specific enabling legislation would remove doubt as to their validity.[43]

II. Land and Property Acquisition

The acquisition of land and property, or interests therein, may in many cases be the most effective approach to reducing the extent of exposure to storm hazards. Several acquisition approaches are discussed here: 1) fee simple acquisition of undeveloped land; 2) acquisition of less-than-fee-simple interests in undeveloped land; and 3) fee simple acquisition or relocation of existing development.

A. Fee Simple Acquisition of Undeveloped Land

Fee simple acquisition entails the public's obtaining the full "bundle of rights" associated with a parcel of real property. With respect to the storm hazard, acquisition may have several immediate functions. The first is to secure in public hands high hazard areas, thus in turn preventing the future exposure of lives and property to storm hazards. On a larger scale public acquisition of land can serve to influence the direction and timing of growth

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[43] See Patterson, "Planned Unit Development and North Carolina Enabling Legislation," 51 North Carolina Law Review 1455 (1973).

and development in a locality. Urban land banking programs, particularly popular in Europe, have attempted to regulate growth by preventing development in undesirable locations while strategically releasing other land more suitable for development.[44] On a smaller scale, single parcels of land may be purchased to prevent the location of certain growth-attracting activities such as a shopping center, boat marina, or manufacturing complex. Land acquisition can also be used to secure, in advance, and typically at lower prices, land that will be needed at some point in the future for public facilities and services. The primary focus of the following discussion will be on the acquisition of undeveloped high hazard parcels as an attempt to reduce the level of risk to lives and property.

As a basic legal requirement, land acquisition by a local government must meet the "public purpose" test. Early North Carolina decisions required that land purchased by a governmental unit meet a narrow "use by the public" formulation of the public purpose test.[45] More recently a broader "public benefit" application of the public purpose test has been applied in judicial review.[46] The general statutory authority to acquire property or interests in property is granted to North Carolina counties and municipalities in N.C.G.S. §§153A-158 and 160A-11, respectively. Specifically, counties and cities may

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[44]See Ann L. Strong, Landbanking: European Reality, American Prospect, Baltimore: Johns Hopkins Press, 1979; Sylvan Kamm, Landbanking: Public Policy Alternatives and Dilemmas, Washington, DC: Urban Institute, 1970; Kermit C. Parsons, Public Land Acquisition for New Communities and the Control of Urban Growth: Alternative Strategies, Cornell University, Center for Urban Development Research, March 1973.

[45]Cozad v. Kanawha Hardwood Co., 139 N.C. 283 (1905).

[46]State Highway Commission v. Asheville School, Inc., 276 N.C. 556 (1970). See also Note, "Eminent Domain--The Public Use Requirement," 46 North Carolina Law Review 663 (1968).

acquire fee simple or other interests in land in order to acquire open space, which has been declared a proper public purpose.[47] Municipalities in Dare County have been authorized to buy land for "open space and water access projects" by special community service facility fee legislation.[48]

The use of fee simple acquisition as a hazard mitigation technique poses a number of practical if not legal questions. Perhaps the most significant problem for coastal localities is the cost and means of financing acquisitions. Outright purchase of land in coastal areas experiencing moderate or high levels of market demand will tend to be very expensive--prohibitively so for most localities. The purchase of already-improved land will be even more expensive, although damaged properties purchased in the aftermath of a storm may reduce these expenses substantially. The locality must be prepared, however, to take advantage of "bargain sales" after the storm, when some property owners may wish to vacate the hazard area. It may also be possible to obtain reduced acquisitions costs through the use of eminent domain authority.

The expenses associated with fee simple acquisition can be reduced in a number of other ways besides waiting for a post-disaster bargain. First, a locality may seek to acquire land several years in advance of development, when its current market value is relatively low. This form of "land banking" enables local governments to preserve the most suitable sites for public use and to avoid paying inflated prices for land needed for public facilities. It

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[47]N.C.G.S. §401 et seq. In addition, municipalities are authorized to purchase property in fulfillment of urban development and growth management policies under N.C.G.S. §160A-457, which authorizes cities to acquire property by voluntary purchase for historic preservation, for the beautification of urban land, for sound community development and growth, for scenic area conservation, and for other growth management oriented purposes.

[48]Chapter 536, 1985 Session Laws.

also provides advance notice of where public facilities are to located, which can influence the location of private development. Courts have generally supported cities' right to acquire land in advance of need. Condemnation for a future use was upheld by the United States Supreme Court in 1923.[49] In North Carolina, there is no specific enabling legislation for advance site acquisition, but the concept does receive support from statutes which allow the reservation of school sites in accordance with a comprehensive land use plan as part of a subdivision regulation ordinance.[50] Advance site acquisition for other purposes has never been directly challenged in North Carolina courts, but has received some judicial support.[51]

Official mapping is another technique for keeping acquisition costs down. An official map is a legislatively adopted map which reflects a municipality's decision to locate streets, parks, and other public facilities at the places marked and to acquire the property for the facilities. The map is implemented by a prohibition against improvements in areas earmarked for acquisition and may be enforced by injunctive relief and denial of the rights to compensation for unauthorized improvements, though there is generally a variance procedure. This technique can significantly reduce a municipality's expenditure for land acquisition by suppressing rising development expectations which lead to higher market values for the earmarked parcels. North Carolina enabling legislation does not expressly authorize the use of official mapping; however,

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[49] Rindge v. Los Angeles County, 262 U.S. 700 (1923).

[50] N.C.G.S. §160A-373 (cities), §153A-331 (counties).

[51] Vance County v. Royster, 271 N.C. 53 (1967), upheld the condemnation of land for construction of a public airport. The holding stated that it is immaterial that only a small segment of the public will be likely to make actual use of the airport in the immediate future, since the airport is necessary for projected future demands.

the use of mapping and land reservation is authorized in conjunction with subdivision regulation for school sites.[52]

The costs of fee simple acquisition might also be reduced through the use of preemption of "right of first refusal." This mechanism would essentially allow the local government to insert itself in the place of a property buyer in any local land transaction. In other words, the locality would automatically be in a position to oversee all land transactions and to spend its limited resources in acquiring only those lands which are truly threatened by development (actually in the process of being sold for development uses). This technique has been used extensively in France and by the State of Oregon, but would probably require enabling legislation before it could be implemented in North Carolina.

Another method for reducing acquisition costs is to purchase properties and resell them with restrictive covenants attached. Placing publicly owned land back into private hands, where possible, may do much to reduce the overall costs of the transaction while the covenant maintains restrictions on the use of the land. However, localities which acquire land should examine other public goals and objectives, such as parkland and recreation, before disposing of parcels acquired to reduce storm hazard exposure.

Acquisition costs may also be reduced by taking advantage of all available outside funding sources, especially state and federal government grants. Historically, where acquisition has been used most extensively as a mitigation tool, there has been substantial federal and state financial contribution.[53] For instance, §1362 of the Federal Disaster Assistance Act

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[52]N.C.G.S. §160A-372 (cities); N.C.G.S. §153A-331 (counties).

[53]Jon A. Kusler, Floodplain Acquisition: Issues and Options in Strengthening Federal Policy, Washington, DC: U.S. Water Resources Council, October 1979.

provides for federal funds for the purchase of federally-insured properties damaged by a storm, under certain conditions and subject to funding constraints. A locality may also be able to coordinate its acquisition efforts with private organizations, such as the Nature Conservancy and the Trust for Public Land, that are actively involved in land acquisition for conservation. These organizations are often better able to undertake extensive acquisition programs than are single jurisdictions of local government. Although their acquisition decisions are typically based on non-hazard objectives, a community may be able to influence these private conservation purchases in several ways. This may be done, for instance, simply by better communicating the local government perception of what acquisitions will be in the public interest or by convincing the private group that purchasing parcels in hazard areas will serve multiple social objectives. The locality may also be able to negotiate a cost-sharing arrangement, in which the local government, through some form of financial contribution, is entitled to share in specific decisions concerning acquisition or management of land.

Even when acquisition costs can be kept down through one of the above methods, the community must address the issue of how to finance the inevitable local expenses involved in acquisition. The direct approach is simply to finance these expenses through general revenue funds, but of course either local taxes must be raised, or funds diverted from other local needs, to pay for acquisition costs. Because acquisition of hazardous lands reduces overall or community-wide damage exposure and potential consequent legal liability, it can be argued that general revenue financing makes sense from an equity point of view. Alternatively, the funds could be raised by special means, including the collection of an impact fee from new development or through special

district levies and assessments. Both of these methods are discussed in Section III (b) below.

B. Purchase of Development Rights/Donation of Easements

Where the fee simple purchase of hazardous lands is, for various reasons, not feasible, a locality may consider the purchase of less-than-fee-simple interests in land. One such approach is to acquire the rights to develop high-hazard parcels. Under this arrangement, a local government would pay the landowner the fair market value of the development right in exchange for agreeing to leave the land in an undeveloped state for a specified period of time, but often in perpetuity. The transaction is usually accomplished through a restrictive covenant which runs with the property. Throughout this section we will refer to this technique as the Purchase of Development Rights (PDR).

PDR is equivalent in legal terms to the community acquiring a negative easement over a property, a property right which forbids the landowner from making certain uses of his land. The Historic Preservation and Conservation Agreements Act of 1979[54] facilitates the use of negative easements by municipalities and private non-profit organizations for the protection of special lands. The statute applies to agreements for the preservation of historic structures and to agreements to retain land substantially in its natural condition for agricultural, forestry, outdoor recreation, or natural uses. The Act states that "[n]o conservation or preservation agreement shall be unenforceable because of 1) lack of privity of estate or contract, or 2) lack of benefit to particular land or person, or 3) the assignability of the

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[54]N.C.G.S. §121-34 et seq.

benefit to another holder..."[55] The statute recognizes conservation agreements as interests in land and makes such agreements enforceable by the holder by injunction or by other equitable remedy. Property subject to PDR agreements is to be assessed on the basis of the true value of the property, reflecting the reduction in value caused by the loss of the land's development rights.

As with fee simple acquisition, the legal status is clear, but a number of immediate practical questions arise. First, in what manner are development rights to be acquired? Does the jurisdiction use its powers of eminent domain, or instead simply bargain for them on the open market, acquiring development rights only from those who wish to sell them? This question may have significant implications for the ability of PDR to protect large blocks of high hazard land. For instance, relying on voluntary sales may permit substantial development in an otherwise undeveloped high hazard area, or it may do little more than shift new development from some parcels to other parcels within the hazard area. Through the use of eminent domain over the entire area, this potential "checkerboard effect" may be prevented.

There is, as well, the question of exactly what development rights are being purchased by a locality. Clearly, extensive residential development should be precluded, but should this include private recreational uses and developments which do not place substantial amounts of public and private property at risk? The greater the economic use which remains for the property owner, the greater will be the parcel's remaining fair market value, and the less costly will be the development rights purchase. Exactly what uses are permitted after development rights have been purchased may also influence

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[55] N.C.G.S. §121-38.

overall property at risk in other areas. For instance, if private recreational activities are permitted in PDR circumstances, this may in turn induce further residential and other development in adjacent areas where development rights have not been purchased. These types of development influences and side effects should be considered when defining the rights to be purchased and the types of uses and activities that will be permitted.

While a leading reason for preferring development rights acquisition over fee simple acquisition is that public expense will be less, PDR may still be a very expensive mitigation approach. In areas where market demand for developed uses is high, the purchasing of a development right will constitute the major portion of the parcel's fair market value.[56] Because of this fact, PDR may be no more financially feasible than fee simple acquisition. A locality can, however, investigate alternative techniques for keeping down the costs of PDR. For instance, the Maryland Agricultural Land Foundation, a state-funded agency which purchases development rights from farmers, seeks to get the most from its limited funding by giving preference to parcels where the following ratio is the highest: **[development rights (easement) value - asking price] / development rights value.**[57] Under this arrangement farmers wishing to sell their development rights submit bids to the state foundation, which in turn gives preference to high value parcels with low sale prices. A similar procedure might be applied in coastal communities. A jurisdiction might designate a general area of high storm hazard from which it will accept

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[56]Robert E. Coughlin and Thomas Plaut, "Less-Than-Fee Acquisition for the Preservation of Open Space: Does It Work?" AIP Journal, October 1978.

[57]Owen J. Furuseth and John T. Pierce, Agricultural Land in an Urban Society, American Association of Geographers, 1982; C.A. Nielson, "Preservation of Maryland Farmland: A Current Assessment," 3 Univ. of Baltimore L. Rev. 429 (1979).

bids for development rights sales--in turn maximizing local monies by purchasing those rights which consist of the "best deals." A system could also be developed by which to evaluate the extent of relative storm hazard for each parcel (e.g., distance from the ocean) and then incorporating this information into the evaluation procedure so as to get the largest hazard reduction for the dollar.

The period of time for which development rights are purchased will also have significance for the cost of a PDR program. The Maryland program requires that development be restricted for a minimum of 25 years. A shorter period of time may serve the needs of the locality (in directing growth to certain areas) and preserve for the landowner a greater portion of the market value of the land, thus reducing the overall cost of development rights to the local government. In other words, instead of purchasing the development rights in perpetuity, the locality may find it more economically efficient to "lease" them for shorter periods of time.

PDR can be used effectively in collaboration with development regulation. On the one hand, restricting development in a particularly hazardous area of the jurisdiction may prevent the checkerboard effect that sometimes results from a voluntary PDR. In turn, PDR may serve to soften the economic effects of development regulations and reduce as well the political oppositions typically engendered by regulatory programs.

While not widely used, the prime example of PDR has been in protecting farmland. Suffolk County, New York, King County, Washington, and the State of Connecticut have used the PDR concept to protect farmland,[58] and a PDR program

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[58]Myrl E. Duncan, "Toward a Theory of Broad-based Planning for the Preservation of Agricultural Land," 24 Nat'l Res. J. 61 (1984).

has recently been proposed for Forsyth County, North Carolina.[59] Under this proposal the county would spend $1 million each year to purchase development rights to prime farmland in the county. These lands could not be developed for at least 25 years. At the end of this period, the landowner would be given the option of buying back the development rights at their new current market value. As currently proposed this program would be completely voluntary.

As an alternative to the purchase of development rights, a locality might investigate encouraging the donation of scenic or conservation easements. Landowners can be encouraged to make such donation in large part because of the income tax deductions permissible under §170 of the Internal Revenue Code. For easements to qualify as charitable deductions, the development restrictions must run with the land in perpetuity and bind all subsequent owners. Under regulations promulgated in 1980, the IRS is now required to make a determination that the easement "will yield a significant public benefit." This does not appear, however, to be a significant impediment to receiving the federal charitable deduction. In addition, Chapter 793 of the 1983 North Carolina Session Laws encourages the donation of easement interests in real property, or the donation of fee simple interests, to state or local governments. This new law allows state tax credits for certain conservation donations.

The locality can take either an active or a passive role in soliciting easement donations. It may, for example, actively search out and encourage these donations by landowners in hazard areas. By contrast it may simply

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[59]Cyril Zaneski, "Preserving Farmland: County Questions Proposal for Slowing Urban Sprawl," Winston-Salem Journal, January 29, 1984.

await landowner's voluntary offers of easement donations. In either case, the jurisdiction must carefully evaluate the significance of each easement donation for local storm hazard mitigation. Accepting easements located in the wrong places simply because they are free may do more harm than good in the long run. Perpetual negative easements may lock the locality into land use and development patterns that it may later find inappropriate or undesirable. In the case of extreme coastal hazard areas, this is unlikely to be a significant problem, but in certain situations it may prove to be an important consideration.

If an easement is accepted, the jurisdiction and donating party should seek a clear understanding of the precise restrictions which will be applied to the use of the land. Experiences of the U.S. Park Service and others with easements indicates that substantial difficulties can arise where misunderstandings about easement restrictions exist.[60] This possibility highlights the importance of educating landowners about easement restrictions both at the initial time of donation and during any subsequent sale or transfer of the land. The locality should ensure that the instrument granting the easement is immediately recorded in the county land records so that subsequent purchasers or creditors are placed on notice and the community's easement rights are protected. These rights should include specific, positive rights of entry in order to facilitate public inspection and ensure compliance with easement provisions. Administrative processes need to be devised to detect these violations at an early point.

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[60]Coughlin and Plaut, "Less-Than-Fee Acquisition for the Preservation of Open Space: Does It Work?" AIP Journal, October 1978.

C. Transfer of Development Rights

One potentially effective approach to reducing the amount of property subject to coastal storm hazards is to permit the transfer of development rights from a high storm hazard zone to a non-hazard or "safe" zone in another part of the jurisdiction.[61] The transfer of development rights (TDR) is an innovative approach to development management which is being used in only a few cases in the country. The basic concept underlying TDR is that ownership of land includes a right to develop the land, a right which may be separated from other ownership rights and transferred to someone else. For example, under a TDR system, an owner can sell this development right to another property owner who under the system must collect a specified number of development rights before developing his or her property at a desired density. There is considerable variation in the goals sought to be achieved and in the procedure used to administer transfer of development rights systems; the system has been used for historic preservation, farmland, and open space preservation, as well as managing growth.

Commentators have theorized that the use of TDR can substantially eliminate the value shifts and inequities of zoning by allowing the market to compensate owners who under a normal zoning scheme would have the development potential of their land restricted with no compensation.[62] Transferable

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[61]See generally O.M. Carmichael, "Transferable Development Rights as a Basis for Land Use Control," 2 Fla. St. L. Rev. 35 (1974); John Costonis, "Development Rights Transfer: An Exploratory Essay," 83 Yale L. J. 75 (1973); Jerome G. Rose, "The Transfer of Development Rights: A Preview of an Evolving Concept," 3 Real Estate Law Journal 331 (1975); Rose, Transfer of Development Rights, New Brunswick, NJ: Center for Urban Policy Research, Rutgers University, 1975.

[62]For further discussion, see Rose, "Transfer of Development Rights: A Preview of an Evolving Concept," 3 Real Estate Law Journal 331 (1975); and Merriam, "Making TDR Work," 56 N. C. L. Rev. 77 (1978).

development rights have not been used in North Carolina, and enabling legislation would probably be necessary in order to implement a TDR system. However, because of the publicity TDRs have received elsewhere, an explanation of the concept should prove informative. First, a TDR system could be either voluntary or mandatory. Under the latter, a locality would simply zone the storm hazard area so that fewer units of development are allowed (or prohibit new development entirely), and the owner of land within this zone would then be permitted to transfer all or some of this unused development density to parcels in designated safe areas or to sell the TDRs on the open market to others who own land in areas designated for development. The locality would then permit increased levels of development in the "safe" zone as a result of possessing extra development rights, thus creating a natural market for transferable development rights. A voluntary approach would simply present the transfer as an additional option for the landowner--a way of maintaining the land in its undeveloped use if the landowner wishes. The landowner in this case would still have the option of developing his land or selling it for development purchases.

The TDR approach raises a number of sticky practical issues. First, there are several alternative institutional arrangements for operating a TDR program. On one hand, the transfer of development rights can be left entirely to market dynamics, with the locality only involved in designating "sending" and "receiving" zones and determining the number of rights to be allocated. Whether a selling landowner receives a fair price for his rights will depend simply on what the market will provide. While there are policy decisions which must be made in the initial allocation of rights, the local government adopts an essentially hands-off stance once the system is created. An alternative institutional structure would have the jurisdiction play a more

direct and active role in the development rights transaction itself, perhaps serving as a broker--buying and selling rights as needed. This in turn helps to ensure that an adequate price is obtained, thereby overcoming short-term market fluctuations. While the latter approach would permit greater control over the price and quantity of rights sold, it would also require greater government expense and oversight. An intermediate position might permit the local government to enter the market at occasional critical points while leaving the bulk of development rights transfers to the dynamics of the local market.

Another initial difficulty is devising a methodology for assigning rights. They might be allocated strictly according to acreage (e.g., one right per acre) or according to the market value of the property. Eventually the question will arise as to whether additional rights should be allocated. If new supplies of development rights are needed, a practical and fair procedure for allocating additional TDRs must be devised.

The locality must also decide how rights transferred from hurricane-prone sites can be used. If a developer purchases ten development rights from land in a high hazard area and seeks to apply them in a less hazardous receiving zone, what rights is he or she entitled to? Each additional TDR, for example, might translate into a certain amount of additional floorspace or square footage allowed in the receiving zone. In the case of residential development, these additions may be measured in terms of additional dwelling units or bedrooms.

The use of TDRs can also be viewed as a form of compensation when restrictions are placed on development in storm hazard areas. For instance, although an oceanfront landowner may be prevented from developing his land (by an open space or recreational zoning classification), he or she may be able to

realize a portion of its development potential by transferring allocated development rights to areas of the jurisdiction less susceptible to storm hazards. Viewing TDR as primarily a form of compensation raises several questions; chief among them is the extent of compensation deemed to be desirable or equitable. At what point will the market value of a development right be unacceptably low as a form of compensation? If full or substantial compensation is a goal, this may require a more active role for government in the development rights market, say, by entering the market to buy rights at times when demand is low.

A large-scale TDR program requires extensive information and knowledge about local market conditions and land development trends, and this can represent a major limitation. How large, for example, should the receiving zone be, and by how much should the locality raise permissible densities, to ensure an adequate demand for development rights? How readily will landowners in sending zones sell their development rights and under what conditions? One reasonable approach to these empirical limitations is to develop a modest TDR pilot program, with relatively small receiving and sending zones which can be monitored closely over time.

III. Taxation and Fiscal Incentives

The specific mitigation provisions included in this broad category are designed primarily to affect indirectly the use of hazardous parcels and the quantity and type of development to occur in storm hazard zones. In contrast to the public acquisition of storm-prone lands, a taxation policy might seek to reduce development by decreasing the holding costs of open space and vacant land, in turn reducing the opportunity costs of not developing such lands for

more intensive uses. While taxation and fiscal policy can encompass numerous specific tools and mechanisms, primarily attention is focused on differential property taxation and special assessments and impact fees.

A. Differential Taxation

The use of differential taxation is based on the theory that, by reducing the property tax burden on undeveloped parcels of land, pressures to convert the parcels to more intensive uses will be reduced by decreasing holding costs and increasing the profitability of current uses. Almost every state now has a provision for some form of preferential assessment.[63] The uses which are typically eligible for property tax relief are farm and forestland, open space, and recreational uses. These are all uses which could occur in coastal high hazard areas and by their presence reduce the amount of property and people exposed to the storm threat.

Three basic variations of differential assessment are currently in use: pure preferential assessment, deferred taxation, and restrictive agreements.[64] Under the first type of program, preferred land uses are assessed for local property tax purposes not at their fair market value (i.e., the potential development value), but rather at their value in their current uses. If the land is in farmland, for instance, it is assessed according to its agricultural use value, usually based on a state-determined capitalization formula. If the benefitted landowner decides after several years of receiving

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[63]Robert Coughlin and John Keene (eds.), The Protection of Farmland: A Reference Guidebook for State and Local Governments, USGPO, 1981; John Keene, et al., Untaxing Open Space, Washington, DC: Council on Environmental Quality, 1976.

[64]Keene, Untaxing Open Space, Washington, DC: Council on Environmental Quality 1976.

the lower assessment that he wishes to develop his land, he is still permitted to do so, without having to repay the property taxes foregone as a result of the use-value assessment. In contrast to this pure approach is that of deferred taxation. The difference here is that the landowner changing the use of his land is required to repay a portion of the tax benefits he has received. However, the recapture period is typically not very long, with five years perhaps the average. In addition, most states using this approach require the landowner to pay interest on the recaptured fund, usually at a below-market rate. A third approach, the use of restrictive agreements, is best exemplified by California's Williamson Act.[65] Here, in order for qualifying landowners to obtain lower tax assessments, they must be willing to enter into written agreements to keep their land in its current use for a minimum period of ten years. This contract is a "rolling-front" agreement which is self-renewing each year unless the landowner explicitly notifies the locality of an intention to change the use. There are also provisions which permit the landowner to break his contract subject to certain penalties.[66]

Legislation permitting preferential assessment of farmland and forestland has been enacted in North Carolina.[67] Since preferential assessment may provide a haven for the land speculator who holds farmland or forestland at a lower interim cost while waiting for the land to appreciate, North Carolina uses a deferred taxation system to increase the likelihood that the tax will

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[65]Gustafson and Wallace, "Differential Assessment as Land Use Policy," J. of the American Institute of Planners, 1975.

[66]See Coughlin et al., Saving the Garden: The Preservation of Farmland and Other Environmentally Valuable Landscapes, Philadelphia: Regional Science Research Institute, 1977.

[67]N.C.G.S. §105-277.2 et seq.

have the effect of permanently holding the land out of development. Under this deferred taxation policy, the land is taxed at use-value assessment until the land is converted to a non-agricultural use, when the difference between the amount paid under the use-value assessment and the amount that would have been due under a market value assessment, for the past five years, becomes due. Under this provision, only commercial farm and forest land is eligible for preferential assessment, but N.C.G.S. §105-278 provides a separate tax break for historic properties, which are assessed at 50% of market value.

While differential taxation has been used in most states as a technique to preserve farmland, its effectiveness at retaining land in undeveloped uses is generally found to be low.[68] Preferential assessment may indeed reduce holding costs somewhat or even substantially, but in the face of high market prices, and thus high opportunity costs of maintaining land in open space, the pressures to develop will generally far outweigh the tax incentives.[69] Consequently, differential assessment is likely to be most successful in situations where development pressures are slight to moderate and where landowners are actively interested in maintaining the present undeveloped use of the land.

Differential assessment will also be a more effective tool at reducing development of hazardous sites when used in collaboration with other

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[68]See Henke, "Preferential Property Tax Treatment for Farmland," 53 Oregon L. Rev. 117 (1974); Keene et al., Untaxing Open Space, Washington, DC: Council on Environmental Quality, 1976; Coughlin et al., Saving the Garden: The Preservation of Farmland and Other Environmentally Valuable Landscapes, Philadelphia: Regional Science Research Institute, 1977; Coughlin and Keene (eds.), The Protection of Farmland: A Reference Guidebook for State and Local Governments, Washington: USGPO, 1981.

[69]J.H. Dressler, "Agricultural Land Preservation in California: Time For a New View," 8 Ecol. L. Q. 303 (1979); Myrl E. Duncan, "Toward a Theory of Broad-based Planning for the Preservation of Agricultural Land," 24 Nat'l Res. J. 61 (1984).

approaches, such as the regulation of new development, the fee simple purchase of land, and the transfer of development rights. For instance, reducing the permissible development density in a hazard location together with preferential assessment may reduce opportunity costs to the landowner enough to reduce actual conversion of hazard lands to developed uses.

To maximize the effects of these tax benefits, a locality could consider establishing mechanisms for funneling tax benefits to those lands with the greatest hazard reduction potential. This might entail, for example, the reduction of local assessments/rates of taxation in excess of what is provided under uniform state differential assessment provisions, thus providing greater tax benefits for parcels of open space, forest, and farmland which are designated as particularly hurricane-prone. These additional tax benefits would be tied directly to the zones delineated on hazard boundary maps. Obviously, this particularized approach would require state enabling legislation.

B. Special Assessments and Impact Fees

People who build in and inhabit coastal hazard areas often impose substantially greater costs on the public than those who dwell elsewhere. These costs are realized when a hurricane or coastal storm strikes or threatens to strike a locality. As mentioned in Chapter 2, there are public costs of evacuation, search and rescue, temporary housing, debris clearance, and the reconstruction of public facilities such as roads, utilities, water and sewer lines, and so on. One public policy approach is to acknowledge that additional public expenses will be entailed by permitting development in hazardous areas and to assess those who will ultimately benefit from the expenditures. This approach can be accomplished through several means.

One technique is to attempt to tie more closely benefits received and costs incurred through the use of special benefit assessments. A special assessment, while not technically a tax, is a method of raising revenue in which all or part of the cost of a facility (such as a road improvement, sewer, or water system) is charged to a property owner who is so situated in relation to the facility as to derive a special benefit from the improvement. The tax charged each property owner is usually proportionate to the frontage along which the facility abuts his property, the area of the land served by the improvement, or the value added to the land served by the project. Special assessments are typically confined to a geographical district in which property owners are determined to receive a direct and substantial benefit in excess of the general benefits received by the public at large.[70] N.C.G.S.

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[70]Donald Hagman and Dean Misczynski, Windfalls for Wipeouts: Land Value Capture and Compensation, Chicago: ASPO, 1978.

§§160A-217 to 236 grant cities the authority to levy special assessments and govern the exercise of the authority. Litigation attacking special assessments is usually based upon procedural grounds.[71] Challenges to special assessments face little chance of success unless the plaintiff can show that the improvement does not confer a special benefit on the assessed property.[72]

Applying the special assessment concept to storm hazard management, a locality would thereby designate an area in which "special storm services" are provided, and in which residents would be subject to the special assessment. This approach raises a number of issues. The first is how the extent of the special assessment is determined and justified. Imposing a special assessment may require a number of assumptions, and rather rough estimates, about exactly what public costs are associated with an actual or potential hurricane. The magnitude of these costs will, of course, depend on the assumed size and severity of the storm event, among other things. It would also be difficult to determine what "special storm services" would be needed, upon whom the special assessment should be levied, and upon what basis the assessment is calculated, an ad valorem property tax or a levy on the number of dwelling units.

A variation on the theme of requiring private parties who impose public costs to pay for them is the <u>impact fee</u>. Impact fees are becoming very popular with local governments in North Carolina and around the country. In theory, the impact fee levy is designed to recoup and mitigate the overall "impacts" of a project or development on the community at large--impacts that

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[71] <u>See Broadway v. City of Asheboro</u>, 250 N.C. 232 (1959).

[72] <u>See Southern Railway v. City of Raleigh</u>, 9 N.C. App. 305 (1970), and <u>City of Raleigh v. Mercer</u>, 271 N.C. 114 (1967).

may extend beyond the immediate environs and requirements of a discrete project or development. For instance, while a special assessment may be levied to cover the immediate costs associated with the floodproofing of sewer and water service, an impact fee would cover broader and more diffuse consequences of development in a hazardous area, less clearly related to services or benefits received directly by a specific site or development. An impact fee is not designed to cover the costs of a specific improvement by which a particular development will reap a special benefit, but is designed to require the developer (and future residents who purchase these properties) to compensate the public for the additional costs of these consequences.

The impact fee may be instituted as a separate instrument, or more typically attached to the exactions process during development review and approval.[73] In some states, the impact fee may also represent a way of getting around legislative and court-imposed limitations on the extent of exactions permissible (e.g., restricted to the installation of roads, sewers, and other facilities, or the donation of open space, school sites, and other land).[74] In North Carolina, however, impact fees are considered beyond the authority of a local government to impose without specific enabling legislation, which in turn restricts the purposes and extent to which impact fees may be assessed. For instance, the municipalities of Dare County (Kill Devil Hills, Kitty Hawk, Manteo, Nags Head, and Southern Shores) have been authorized to impose "facility fees" on new development to recover the capital costs of community service facilities. "Community service facilities" have

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[73]Hagman and Misczynski, Windfalls for Wipeouts, Chicago: ASPO, 1978.
[74]Nancy Stroud, "Impact Taxes: The Opportunity in North Carolina," Carolina Planning, Fall 1978.

been defined narrowly: only "streets and drainage projects, open space and water access projects, emergency refuge shelters and fire department capital improvements" qualify, and the amount of the fees must be directly related to the specific, quantified additional costs of the new development.[75] If authorized, however, the impact fee's promise of a formal procedure for calculating and assessing impacts may present a greater level of certainty for developers than currently exists under the highly negotiated exaction process. Adjusting the expectations of the development community and creating a relatively clear and consistent set of public storm safety obligations may well be an important local objective.

IV. Capital Facilities and Public Infrastructure Policy

Coastal development--its type, location, density, and timing--is highly influenced by capital facilities such as roads, sewer, and water services. Such public investments have been aptly termed "growth shapers." In this section we will briefly review the potential role to be played by the location, type, and timing of capital facilities in reducing local storm hazards. Issues relating to the financing of these facilities have been discussed in a general way in the taxation and financial incentives section above. The use of particular pricing policies may also significantly affect patterns of development, but this strategy is not discussed here.

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[75]Chapter 536, 1985 Session Laws. See also Chapter 488, 1985 Session Laws, allowing the city of Raleigh to impose impact fees to purchase open space and drainage improvements.

Policies to Prevent Location of Public Facilities in High Risk Areas

There are two primary dimensions of capital facilities which have implications for local storm hazard management; one is geographical--where capital facilities are placed, and the other is temporal--when they are put in place.[76] With respect to the first dimension, a locality can develop an explicit set of capital facilities extension policies designed to avoid high hazard areas, thus reducing the amount of development and property which will be attracted to the area and reducing the potential threats to lives and property. This approach can only become an effective deterrent, however, if development in high hazard areas is dependent upon (or deems highly attractive) the existence of public facilities. If, as is often the case in resort areas, coastal development is able to obtain water through individual site wells and dispose of wastewater through septic tanks, a reorienting of sewer and water facilities by the locality will do little to impede growth in hazardous zones. It may then be necessary for the locality to foreclose other service/facility options available to developers by restricting the issuance of septic tank permits, for example. But without valid health reasons, foreclosing such alternative options for development may be legally problematic.

Utility extension policy, in and of itself, is only subject to legal challenge if it fails to meet the procedural requirements of the Local Government Finance Chapter (Chapter 159) of the North Carolina General Statutes. The use of public infrastructure policy in order to restrict or

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[76]See Michael Nugent, "Water and Sewer Extension Policies as a Technique for Guiding Development," 2 Carolina Planning, Winter 1976.

direct the growth of a city, however, may be subject to a variety of challenges. Within the city limits, a city may be required to provide equal service to all its residents, once it provides a service to any of them.[77] The city may extend utility services beyond the city limits, but only within reasonable limits and for the public benefit.[78] The city, when considering the extension of services beyond its limits, must consider the amount of territory to be serviced, its distance from the city, and the effect that extension will have on customers' rates and the city's capital debt structure.[79] If the city extends services beyond the city limits, it has some discretionary power to condition the provision of the services. The agreement to provide extraterritorial services is contractual in nature, subject to the usual rules of bargain and contract. Rates may be higher for extraterritorial customers.

Redirecting capital facilities, and the development which accompanies them, into "safer" areas of the locality can be facilitated through several means. One is the clear delineation of an urban services area or district in which the jurisdiction agrees to provide certain facilities or services. The service district might also entail a temporal dimension, for example, including sufficient land to accommodate ten or twenty years of future growth under various assumptions.

The urban services area technique has several advantages. It provides a long-term perspective on growth and development and permits developers, residents, and the local government to visualize where and when public

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[77] Fulgham v. Town of Selma, 238 N.C. 100 (1953); Abbott v. Town of Highlands, 52 N.C. App. 69 (1981).

[78] Town of Grimesland v. City of Washington, 234 N.C. 117 (1952).

[79] Public Service Co. of North Carolina v. City of Shelby, 252 N.C. 816 (1960).

facilities will become available in the future, and where they cannot be expected. This, in effect, modifies long-term expectations about where future development will and will not be acceptable to the community. Development pressures may tend to shift naturally as a result of this public designation, as developers, landowners, and others realize that certain facilities will not be made available outside the designated areas. However, restriction of public facilities, which curtails the overall amount of development which can take place in a community, may raise suspicions of "no growth" objectives. Consequently, the local government should make a good faith effort to designate a service area in "safer" parts of the locality which are sufficient to satisfy growth demands, so as to enhance the political and legal acceptability of the urban service area approach.

In more intermediate terms, the locality needs a policy instrument by which to systematically identify, finance, and sequence specific capital improvements. This is generally the function of a capital improvement program (CIP). Ideally, the CIP follows closely designated service boundaries, as well as the comprehensive plan, zoning, and other regulatory and planning provisions. The CIP provides a specific framework for making short-term (annual) decisions about which improvements to make and where. Avoidance of storm hazard areas can easily be incorporated into this instrument and decision framework as a specific CIP policy.

A close connection between the designation of service areas, the capital improvement program, and the overall planning process (including the local comprehensive plan) in a jurisdiction is essential. Such a close functional linkage will tend to enhance the combined effectiveness of each policy or technique in advancing overall local objectives and will emphasize their legal authority. From a practical standpoint, the concept of guiding growth through

capital facilities should be closely linked to the objective of reducing the public costs of such facilities and the extent of public investment at risk in high storm hazard areas. The latter consideration is, by itself, a legitimate argument for denying facility extension into hazard areas and provides a sound legal rationale for a hazard-sensitive capital facilities extension policy.[80]

Several recent hurricane hazard mitigation planning efforts illustrate the potential role of capital facilities in guiding growth into less hazardous areas. The recent Surf City, North Carolina, hurricane hazard mitigation plan suggests the use of sewer service extensions as a means to divert growth to less hazardous areas of the locality:

> The Town should actively encourage development in the southern section of the town. Specifically, it is the area where future high density development should be concentrated. Additionally, if an actual sewer system is developed in the near future, it should be designed to serve these areas rather than another section of the community where development in hazard areas would be encouraged by such a system.[81]

The hurricane hazard mitigation and reconstruction plan for the town of Nags Head contains similar recommendations, particularly in an attempt to discourage further growth in an incipient inlet area:

> In the short term, the Town will explore the possibility of limiting future water service extension in the largely undeveloped area in the Whalebone incipient inlet area. While this does not preclude future growth, it ensures that the town will not be a willing participant in placing property at risk.[82]

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[80]Nugent, "Water and Sewer Extension Policies as a Technique for Guiding Development," 2 Carolina Planning, Winter 1976.

[81]Town of Surf City, North Carolina, Hurricane Evacuation, Hazard Mitigation, and Post-Disaster Reconstruction Plan, prepared by George Eichler and Associates, 1984, p. 13.

[82]Town of Nags Head, N.C., Hurricane Hazard Mitigation and Post-Storm Reconstruction Plan, prepared by Coastal Resources Collaborative, Inc., 1984, p.57.

It should be remembered that public investments encompass more than sewers and roads, and include numerous structures and buildings from town halls to schools to police and fire stations. Again, it may be possible to locate these investments in areas which are less susceptible to storm forces, in turn serving to reduce the quantity of actual public property at risk and discouraging the location of other private development. By locating public structures in specific strategic location, and by constructing them to certain specifications, it may be possible to use them as storm shelters.

B. Relocation or Strengthening Capital Investments After the Storm

Opportunities may exist after a storm has occurred to implement a community's capital facilities objectives. It may be possible, if the facilities are sufficiently damaged, that roads and sewers can be rebuilt in areas which are less susceptible to damage from the next storm. Even if the facilities are not relocated, they may be repaired and reconstructed in ways which make them stronger or less susceptible to storm forces. Roads and sewers can be elevated, for instance, and sewer and water lines can be floodproofed. Also, placing power and telephone lines underground after the storm will help ensure safer evacuation when the next storm threatens.

It may be possible as well that public facilities can be reconstructed in ways that not only reduce the possibility of their own damage but which reduce other storm-related hazards. As before, the presence of certain public facilities will influence development patterns. If certain facility repairs are not permitted to occur after a storm has hit, this may preclude or discourage the private redevelopment of this area. This technique was used subtly in the Baytown, Texas, case.[83] The option of selling out and leaving

[83]See Baytown, Texas, Hazard Mitigation/Post-Disaster Policies, Appendix II.

the Brownwood Subdivision was made much more attractive to homeowners because they were uncertain that sewers and roads would be restored or maintained.

A similar approach might be taken with the rebuilding or reconstruction of damaged public buildings such as town halls and fire stations. If sufficiently damaged, it may be logical to move these structures to safer sites in the community. After Hurricane Camille, for instance, the Pass Christian Town Hall was rebuilt on higher ground, and consequently much more protected from future storm damage than it would have been if rebuilt in the same location. When structures are not relocated, it may be possible to repair or rebuild them in ways that reduce their susceptibility to future storm damage, such as through elevation. It may be desirable as well to rebuild public structures in ways which permit their usage as storm shelters.

V. Information Dissemination

Classical economic theory supposes that the more informed consumers are, the more rational and allocatively-efficient their market decisions will be. This implies an additional set of mitigation strategies which aim primarily at supplementing and enlightening individual market decisions regarding the hurricane and storm threat. Several approaches can be taken in this vein.

A. Real Estate Disclosure Requirements

The first approach is to seek mechanisms and processes which facilitate the effective informing of potential buyers of the actual risks associated with location in a high hazard district. Hazard information can be provided in several ways. State legislation might require that real estate agents inform prospective buyers about the potential dangers from storm forces.

Exactly this approach was proposed in Texas, but was not enacted due to stiff opposition from real estate and development interests.[84]

While no other examples of real estate disclosure can be cited with respect to storm hazards, this technique has been used in California in an attempt to inform prospective homebuyers of the risks of living near earthquake fault lines.[85] Under the Alquist-Priolo Special Studies Zones Act, a real estate agent or individual selling property must disclose to the prospective buyer the fact that the property lies in a "special studies zone" (earthquake fault zone). A study by Risa Palm indicates, however, that this requirement has had little measurable effect on the market behavior of housing consumers. Among the problems identified are a tendency for homeowners to place a low priority in the earthquake threat, the issuance of the disclosure in the latter stages of a home purchase, a downplaying of the importance of the earthquake hazard zones, and a disclosure technique (a single line that says simply "in Alquist-Priolo zone") that conveys little or no real information about the earthquake risk. As Palm observes, "At present, real estate agents are disclosing at the least sensitive time in the sales transaction, and are using methods which convey the least amount of information about special studies zones."[86]

Consequently, if a similar disclosure approach is to be applied to hurricane and storm hazards in an effective way it must learn from the California experience. Specifically, the disclosure must be provided early in

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[84]Texas Coastal and Marine Council, Model Minimum Hurricane Resistant Building Standards for the Texas Gulf Coast, Austin, Texas, June 1981.

[85]Risa Palm, Real Estate Agents and Special Studies Zones Disclosure: The Response of California Home Buyers to Earthquake Hazards Information, Boulder, CO: Institute of Behavioral Science, University of Colorado, 1981.

[86]Palm, supra at 102.

the sales transaction, preferably during the initial agent-purchaser meeting, and the disclosure must convey real and accurate information about the location and nature of the hazard. Not only should the disclosure form or process be labeled in a meaningful way (i.e., the home is in a "storm hazard zone" as opposed to an ambiguous "special studies zone"), it must provide a full description of the nature of storm related risks. Strong resistance from the real estate industry in coastal areas can be expected, and efforts to convince them of the utility of a disclosure process may well be essential to its success. More passive types of hazard disclosure might also be useful. Included in this category are requirements that hazard zone designations be recorded on deeds and subdivision plats and that public signs be erected indicating the boundaries of storm hazard areas (and perhaps the location of past storm damage).[87]

B. Community Awareness Programs

A different approach is to institute programs which attempt to directly educate the housing consumer about storm risks. These programs might take the form of brochures and other materials distributed to new and prospective residents of the community, informing them of the nature and location of storm hazards and information about what to look for in a new home or business structure (such as elevation and floodproofing). For existing residents, this approach may be one of educating them about actions they can take to enhance the integrity of their existing structures (such as installing "hurricane clips") and reducing future property damages.

A locality might also attempt to disseminate hazard information on the "supply side." This technique might take the form of construction practice

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[87]See Model Amendments, §4(c), Appendix II.

seminars for coastal builders and developers, introducing both conventional and innovative approaches to building and designing structures and to siting and planning the orientation of buildings in vulnerable locations. This information approach was proposed as a primary mitigation strategy following Hurricane Alicia in 1983.[88] The success of such a strategy, however, depends essentially on the integrity of builders and developers, and those who are conscious and conscientious about storm threats are probably already planning their projects accordingly.

Perhaps the most significant impediment to this type of private sector mitigation is that real estate development is a competitive industry in coastal regions, and the incurring of substantial mitigation costs by one developer may place him at a competitive disadvantage. This is a major reason why building codes, subdivision restrictions, zoning ordinances, and other legally binding jurisdiction-wide requirements are to be preferred--they set general rules for all developers to adhere to and in this sense create a common set of expectations which place all developers on an equal footing.

VI. Conclusion

This chapter has sought to demonstrate that no hurricane hazard mitigation program should lack readily available tools and techniques for implementation. By using a growth management approach to mitigation, localities can select from a variety of devices ranging from the simple and

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[88] FEMA, Interagency Hazard Mitigation Report, covering Brazoria, Chambers, Fort Bend, Galveston, Harris and Matagorda Counties, September 1, 1983; FEMA, Interagency Post-Flood Recovery Progress Report, Denton, Texas, December 1983.

familiar to the complex and exotic. Ordinary downzoning, for example, can significantly reduce the exposure of people and property in high hazard areas.

But North Carolina coastal communities should not limit themselves to traditional and less flexible devices, since many innovative techniques are easily applicable. Special use permits, performance zoning, and planned unit developments can increase local control over the characteristics of each new development and help ensure that it meets local needs. Incentive zoning, exactions, and impact fees allow the public to receive hazard mitigation or other benefits as a byproduct of development pressures. Public interests in hurricane protection, as well as open space and beach access, are even more firmly secured through one of the land acquisition strategies. Transferable development rights, taxation, and capital facilities programs can work to guide overall patterns of growth without site-by-site review. Finally, information dissemination may be the most cost-effective, yet least used, mitigation technique. There is much that could be done towards informing residents, developers, and homebuyers of potential coastal hazards, at little cost to the local government. Moreover, even if information dissemination cannot halt continuing development of the coast and increased hazard exposure, public education can only help promote awareness of and cooperation with other hazard mitigation programs.

Chapter 6

Mitigation During Reconstruction

While the occurrence of hurricanes and coastal storms may bring substantial death and destruction, there is the positive potential that future risks can be reduced through conscientious planning during reconstruction and recovery. The mitigation opportunities following such a disaster will tend to be more far-reaching than those which normally exist. Unfortunately this "window of opportunity" is brief, and coastal localities are typically not prepared to take advantage of these mitigation opportunities.

This chapter seeks to provide local officials with information that may assist them in preparing for reconstruction and recovery in advance of the storm event. It begins with a review of the federal context in which recovery from hurricanes and severe coastal storms will occur, then goes on to introduce a number of concepts and planning techniques that may be useful in promoting mitigation at the local level following such a disaster.

I. The Federal Role in Post-Disaster Response and Reconstruction

The primary role played by the federal government following a disaster is the provision of disaster assistance as provided for under the Disaster Relief Act of 1974.[1] A wide range of financial assistance is available both to individuals and state and local governments. The Federal Emergency Management Agency (FEMA) has the primary responsibility for overseeing the administration

[1] P.L. 93-288, 42 U.S.C. §5121 et seq.

of these post-disaster assistance programs, which come into effect following a presidential declaration of an emergency or major disaster.

Many of the federal disaster assistance programs--the §406 Hazard Mitigation Plan, the Interagency Hazard Mitigation Team, Disaster-Proofing Requirements, and Relocation Programs such as §1362, for instance--have been mentioned in previous chapters. Local governments will need to make themselves aware of the details and requirements of these programs, but it would not be appropriate for this Guidebook to attempt to explain them here. Though FEMA should be consulted for relevant details, the thrust of the disaster assistance regulations reinforces the necessity for state and local hazard mitigation planning.[2] Coastal governments can no longer count on federal disaster aid to bail them out, because disaster assistance will be subject to increasingly stringent cutbacks, needs tests, and local contribution requirements. Accordingly, local governments should approach post-disaster reconstruction with a focus on their own resources.

II. Local Approaches to Mitigation During Reconstruction

This section will describe approaches that localities themselves can take, both prior to and after a hurricane has occurred, to ensure that future storm damages and loss of life are reduced. Many of these concepts have been introduced and suggested in the new CAMA land use planning guidelines. What follows seeks to elaborate substantially on how, more precisely, coastal localities can implement these concepts. Again, as in other chapters of this report, emphasis is placed on growth management as a mitigation strategy.

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[2] 44 C.F.R. Subpart M. See, e.g., FEMA, Making Mitigation Work: A Handbook for State Officials, DAP 12, June 1986.

A. Special Demands and Pressures Following a Hurricane

While most of the development management techniques described above are equally relevant to post-storm circumstances, there are certain factors which make the post-storm situation unique and its decision making demands special. The first of these factors is the multiplicity and magnitude of the tasks which must be undertaken in the post-storm context. They range from such immediate concerns as the clearance of debris, the location of adequate water supplies, and the restoration of public utilities, to less immediate questions about redevelopment and reconstruction. An additional factor is that even those activities which are not immediate do require relatively rapid actions and decisions (and even more rapid analysis and information-gathering) before the decisions can be made. A locality recovering from a hurricane or severe storm should be prepared to effectively manage this process and should have the appropriate institutions and tools available to bring this rational management about. It should be reiterated that we are not concerned here with the emergency management or immediate recovery issues (e.g., clearing debris from roads, securing earth moving equipment, securing uncontaminated drinking water, etc.). Rather we are concerned here with questions of how the jurisdiction rebuilds and redevelops following the disaster.

Following a hurricane or severe coastal storm, a local jurisdiction will typically confront a number of economic, political, and social pressures which affect redevelopment. Disaster research indicates that there is often a strong desire on the part of local residents to return to pre-disaster normalcy, and that redevelopment and reconstruction actually occurs quite rapidly. It is not uncommon for property owners to return to their homes immediately following a storm to begin cleanup and repairs. Concomitant with this desire, property owners often apply substantial political pressure on

local officials to facilitate quick reconstruction. Unless daunted by the prospect of legal liability for storm damage as discussed in Chapter 7, local officials often feel compelled to loosen normal building and regulatory requirements and, to the extent that they can, to "grease the wheels" for storm victims.[3]

Elected officials often define their political obligation during the recovery phase in this way--as essentially facilitators. A dramatic influx of redevelopment funds into the community, including federal disaster assistance and insurance payments, has often served to fuel a sense of urgency concerning reconstruction. The implications of these redevelopment pressures for mitigation are several. First, it will often be politically and psychologically difficult for local officials to resist the role of "facilitators" and assure a role as a "regulator" or "mitigator." This suggests the need to plan in advance for such disasters, preparing post-storm redevelopment plans, for instance, which make tough redevelopment decisions in advance and away from the immediate demands of disaster events. Moreover, the existence of these pressures to rebuild quickly indicates that local officials concerned about taking advantage of mitigation opportunities must themselves act quickly.

In many post-disaster circumstances not only are certain mitigation opportunities lost (e.g., relocating residential structures back from the water) but the resulting form of redevelopment serves to increase the extent of future hurricane and storm risk. Research indicates that, following major destructive events, reconstruction will tend to permit those economic forces

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[3]See, e.g., Kathleen Levden, Recovery and Reconstruction after Hurricane Camille: Post-Storm Hazard Mitigation on the Mississippi Gulf Coast, Dept. of City & Regional Planning, UNC-Chapel Hill, 1985.

in existence prior to the disaster to reappear at an even more rapid rate. The hurricane may serve to clear certain private development sites (i.e., older, low density residential uses) and typically prompt the construction of higher density/more intensive forms of commercial and residential uses.[4] While normal economic pressures may have brought these changes about slowly over time a destructive hurricane can speed up the growth process dramatically. If post-storm redevelopment forces are not managed, however, the result will only be a greater amount of property at risk to future hurricanes and storms. The institutional approaches presented below represent methods by which local governments can plan in advance to control and direct redevelopment impulses.

B. A Post-Storm Reconstruction Plan

A locality should, to the extent possible, foresee alternative damage scenarios from hurricanes and severe storms and have in place a set of policies or planning instruments which will facilitate post-storm decision-making. In this way, a substantial portion of the reconstruction decision-making can be undertaken prior to the actual storm event. Advance planning permits a less pressured, more deliberative set of decisions concerning reconstruction options and allows government officials to devote their post-disaster time and energies to unexpected or "contingent" issues which could not be completely foreseen prior to the event. The locality should always be

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[4]Ralph D. Cross, Impact of Hurricane Tidal Surges on Subsequent Land Use Changes and Water Resource Allocation, Mississippi State University, Water Resources Research Institute, July 1976; Jane L. Hegenbarth, Gulf Shores, Alabama From 1979 to 1984: Its Redevelopment and Growth Following Hurricane Frederic, Chapel Hill, NC: UNC Center for Urban and Regional Studies, June 1985.

prepared to take stock of factors and circumstances that have not been considered (or not considered fully) in pre-storm planning.

The actual product of pre-storm reconstruction planning can take several forms. On the one hand the jurisdiction may develop very specific and detailed reconstruction/redevelopment plans, indicating sites and locations which should not be re-developed, areas where changes in uses and activities should occur during redevelopment, where certain capital improvements should take place, and so on. Such a detailed plan would provide a blueprint for reconstruction decisions after the storm. Its primary advantage is that it reduces the information-gathering and decision making pressures on local officials after the storm (assuming that local officials generally concur with the substance and content of such plans). One of the disadvantages of such a detailed redevelopment plan is that for it to be accurate it must be updated frequently (i.e., land use circumstances change). A second limitation is seen in the fact that it must make specific assumptions about the extent, location, and nature of damages, as well as the political and economic opportunities which may emerge after the storm (e.g., the nature of demands to rebuild, amount of external disaster relief). These are factors which undermine any very precise program or design for reconstruction.

A contrasting approach is the development of a set of general policies concerning reconstruction following the storm.[5] A policy-oriented plan would provide general guidance to more specific reconstruction decisions. For instance, a reconstruction policy may state that rebuilding shall not occur in areas where homes have been destroyed an average of 50% or more. This policy

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[5]Timothy Beatley, Development Management to Reduce Coastal Storm Hazards: Policies and Processes, Chapel Hill, NC: UNC Center for Urban and Regional Studies, 1985.

would not attach itself to a particular location or site until after the storm occurred. Such policies would simplify public decisions, but would depend heavily upon contingent factors and an analysis of the relationship between reconstruction and other community objectives. Such an approach has the advantage of being more flexible and sensitive to the numerous contingent factors which will exist in the aftermath of the event. Such a plan or set of policies (whether a detailed redevelopment plan or more general reconstruction policies) should address at least the following issues:

- Identification and mapping of coastal hazards, identification of high hazard areas (presumably occurring prior to the event), and a process for updating this information following the storm.
- A process for identifying the extent and nature of actual damages from the storm event, by geographical location and zone.
- Identification of instruments and tools that can be applied in the post-storm context to address hazard reduction goals. In the case of a detailed redevelopment plan, these mechanisms may be designed to "spring into place" following the event. More general policy plans may simply identify the range of alternatives, leaving for post-storm decision makers to choose which are most relevant.
- Identification of redevelopment opportunities (in addition to hazard reduction) that may be present should certain locations, types, and magnitudes of damage result. Again, the extent of detail and advance precision can vary tremendously.
- Description of a post-storm decision-making process by which potential reconstruction decisions are structured and organized in logical fashion, and in which relevant actors and decision makers are brought together to solve reconstruction problems.

C. The Need for Additional Institutional and Decision-making Structures

As we have established, post-storm reconstruction places unique decision-making pressures and requirements on local officials, which in turn require special institutional and decision-making arrangements to cope effectively with them. Several of these specific arrangements are described briefly below. This discussion is meant to be exploratory and not necessarily

intended to be recommendations for organizing reconstruction--rather, as possible approaches which may or may not be relevant in particular situations.

1. Post-storm damage assessment

Critical to public decisions concerning redevelopment and reconstruction is a clear understanding of the magnitude, type, and causes of damages from the storm. Moreover, the assessment of local damages must occur quickly. A sensible approach is to prepare for this need by creating, in advance of the storm, a damage assessment team. Such a team would be organized so as to come into existence immediately following the emergency phase and should be comprised primarily of individuals with appropriate technical expertise. Procedures for estimating and documenting the extent and nature of storm damages should be established in advance of the storm (e.g., damage assessment forms, base maps, field guides). The local government must invest adequate local resources and authority in this group for an expeditious damage assessment process to work.

More specifically, the damage assessment team might be assigned the following responsibilities:[6]

a) to assess the extent and location of storm damage, both to public and private structures and facilities and the natural environment;

b) to document the type and location of storm forces, including the identification of the following:

   1) incipient inlet areas

   2) high wave action areas and areas of high erosion

   3) high flooding and overwash zones

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[6]David J. Brower, William E. Collins, and Timothy Beatley, Hurricane Hazard Mitigation and Post-Storm Reconstruction Plan for Nags Head, North Carolina, Chapel Hill, NC: Coastal Resources Collaborative, Ltd., 1984.

c) from the above information, to determine, to the extent possible, the likely causes of damage (e.g., faulty construction, proximity to an incipient inlet).

The damage assessment team(s) would collect this information and present it to the recovery task force, preferably in graphic form and consistent with the damage area delineation scheme suggested below. The damage team should also be asked to compare the actual damages incurred in the community with the hazard maps available prior to the storm and to adjust the delineation of the hazard areas accordingly.

The precise composition of this damage assessment team will depend upon the resources and expertise available in the locality. It might include some of the following individuals:

- town (county) planning director
- town (county) building inspector
- town (county) engineer
- town (county) tax assessor
- town (county) public works director
- town (county) health department director
- local real estate agents/appraisers
- environmental scientist/individuals familiar with coastal dynamics and processes
- local CAMA permit officer

It is important that this group of individuals be appointed before the storm, so that they may organize and develop appropriate damage assessment forms and procedures without post-storm pressures. The assessment team will also serve as an expert advisory group during the period in which specific reconstruction decisions are being made. For instance, in the case of a

proposal to prohibit reconstruction in a particular portion of the town, they may be called upon to provide more detailed information about the degree of damages.

As an example, the storm hazard mitigation plan for Ocean City, Maryland, proposes the creation of three different sets of damage assessment teams.[7] An initial damage assessment team is the first in the field, providing initial inspection of damage (to be completed in a couple of hours) and is responsible for determining whether an emergency should be declared, whether a redevelopment moratorium should be enacted, and whether state and federal disaster aid should be requested. The second stage of damage assessment would involve more detailed records of damages, and different teams would be organized to assess different types of damages (e.g., private residences, mobile home, etc.). A third team will accompany federal and state damage assessment teams and will assist in the preparation of damage survey reports required for obtaining disaster assistance.

2. Recovery or reconstruction task force

The creation of a special task force to deal with the unique issues and problems of reconstruction has occurred in a number of disaster circumstances and is a result of recognition that normal local decision-making capability often needs to be supplemented. Under the North Carolina program, coastal localities are required to consider the creation of such a group. For instance, the Onslow County hurricane hazard mitigation and post-disaster reconstruction plan proposes a recovery task force with the following responsibilities; it shall:

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[7]Stanley M. Humphreys and Larry R. Johnston, Reducing the Flood Damage Potential in Ocean City, Maryland, prepared for the Maryland Dept. of Nat'l Resources, April 1984.

(1) Review the nature of damages, identify and evaluate alternate program approaches for repairs and reconstruction, and formulate recommendations for handling community recovery.

(2) Recommend to the County Commissioners the declaration of a moratorium on repairs and new development.

(3) Set a calendar of milestones for reconstruction tasks.

(4) Initiate orders for repairs to critical utilities and facilities.

(5) Recommend the lifting of a moratorium for "minor" repairs.

(6) Recommend the lifting of a moratorium for "major" repairs to conforming structures.

(7) Evaluate hazards and the effectiveness of mitigation policies and recommend the amendment of policies, if necessary.

(8) Initiate negotiations for relocations and acquisitions of property.

(9) Recommend the lifting of moratorium on "major" repairs (with approved changes to conform).

(10) Participate in federal hazard mitigation planning.

(11) Recommend the lifting of moratorium on new development.[8]

Thus, a primary function of such a body is to receive and review damage reports and other analyses of post-storm circumstances and to compare these circumstances with mitigation opportunities identified prior to the storm to discern appropriate areas for post-storm change and innovation. Where needed, it can review in a more specific fashion alternative mechanisms for bringing these changes about and go about harnessing internal and external resources for achieving these ends. Essentially, then, a primary function of this group is comparing contingent factors and circumstances (physical, economic, political) with pre-storm mitigation opportunities, to arrive at and implement a set of post-storm changes. Such a task force would also ideally undertake a

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[8]Onslow County, N.C., Hurricane Storm Mitigation and Post-Disaster Reconstruction Plans, prepared by Henry Von Oesen and Associates, April 1984.

similar process for non-mitigative local objectives and opportunities. Among these other goals which would be considered during reconstruction decision-making might be the following:

(1) enhancement of local recreational and open space opportunities; enhancement of public access to beach and ocean;

(2) enhancement and restoration of local natural ecosystems;

(3) reduction of traffic congestion, noise, and other transportation-related problems;

(4) enhancement of the long-term economic vitality of the local commercial and industrial base;

(5) others.

The composition of the reconstruction task force also presents a question, to which several answers exist. One possibility is to assign these responsibilities to a completely new group of individuals, with a broad-based representation of community interests. Such a group might be composed of the following:

- one or more elected officials
- planning director or planning department representative
- public works official
- one or more representatives of the business community
- representatives of adjoining communities.

Such a group would have the advantage of a fresh perspective on development opportunities in the locality as well as perhaps a stronger political base. A major issue in using a citizens' task force for reconstruction planning is the extent to which this body is directly accountable to the elected governing body or has some degree of independent decision-making authority.

A second option is to assign reconstruction planning responsibilities primarily to the local planning board. Allocating responsibilities to this group would consequently have the advantage of capitalizing on the existing knowledge and expertise of the development process and the actions involved in it. Unlike the creation of a new recovery committee, commissioners would generally not have to be brought up to speed on development issues. Moreover, using the planning board would still serve to insulate the elected local board or council from many reconstruction decisions (at least at a detailed level of consideration), a highly desirable feature given the number and gravity of decision-making requirements local officials are typically faced with in the aftermath of a hurricane.

Another option is simply to place these reconstruction opportunities squarely and completely in the hands of elected officials, with this body serving the function of the task force. This option has the advantage of placing reconstruction issues and decisions in the hands of those officials who will be ultimately responsible for their ramifications, and may also be more politically expeditious. A major disadvantage is that elected officials are typically faced with myriad and numerous decisions in the storm aftermath, and it may seem appropriate to reduce rather than add to their decision-making responsibilities.

The storm mitigation plan for Ocean City again proposes several different recovery and reconstruction committees to more efficiently address all the necessary issues. A Disaster Recovery Task Force would oversee recovery decision-making and would perform many of the supervisory tasks mentioned above. In addition, a Property Acquisition Committee would be established which would have the primary responsibility for identifying and recommending properties for acquisition after the storm. A Permitting Task Force would be

established principally to inform non-resident property owners of damages incurred by the property and post-disaster conditions and requirements imposed by the city.[9]

D. Regulating Development Following the Hurricane

It is important that coastal localities establish, in advance of a hurricane, a set of reconstruction permitting procedures by which to control and manage post-storm redevelopment demands. Control over the issuance of building permits typically represents an effective way for local governments to manage the timing and sequence of reconstruction. Development moratoria and the concept of triage are important supplements to this process and are described below.

1. Delineation of damage and hazard zones: The "Triage" Concept

A primary task of the local damage assessment team, in conjunction with the reconstruction task force, is to graphically designate damaged areas in the community by severity level. A three-tiered delineation would function much like a "triage" does in emergency medicine: "major," "moderate," and "minor" damage areas would be designated, perhaps according to the following damage criteria:

(a) major damage areas: where buildings experience damages amounting to 50% or more of their market value;

(b) moderate damage areas: where buildings experience damages amounting to over 25% but under 50% of their fair market value;

(c) minor damage areas: buildings receiving damages of less than 25% of their fair market value.

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[9]Humphreys and Johnston, Reducing the Flood Damage Potential in Ocean City, Maryland, prepared for the Maryland Dept. of Nat'l Resources, April 1984.

These damage cut-off points are largely for illustration and, of course, could be considerably different. The triage suggests that a community prohibit reconstruction in major damage areas (at least in the short term) and permit immediate rebuilding in minor damage areas. The bulk of the task force's immediate attention should be directed to determining whether structures in moderate damage areas ought to be allowed to rebuild and if so, under what conditions. In addition, existing designation of local hazard zones (e.g., flood hazard areas) should be reviewed and modified to reflect changes in natural processes and topography and new knowledge gained about these processes. For example, if a new inlet has been created, this should be designated and considered by the task force or governing body when making reconstruction decisions.

The triage damage zone concept, while largely untested, has been incorporated, in one way or another, in a number of local disaster planning programs.[10]

2. Temporary reconstruction moratoria

After the storm a locality may be swamped with requests by individuals to rebuild their structures immediately. Typically the pressure to rebuild is great, and local governments are not prepared to say "no" to such requests. One effective approach to this problem is the immediate declaration of a temporary moratorium on rebuilding. This would provide sufficient time for the local damage assessment team to do its job and the task force to consider appropriate mitigation opportunities. Once the damage assessment is

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[10]Rogers, Golden and Halpern, Hurricane Evacuation and Hazard Mitigation Study for Sanibel, Florida, November 1981; J. Eugene Haas, Robert W. Kates, and Martyn J. Bowden (eds.), Reconstruction Following Disaster, Cambridge, MA: MIT Press, 1977.

completed, the moratorium can be lifted for minor damage areas. A time limit to the moratorium, such as thirty or sixty days from its initial designation, is probably advisable. As well, the jurisdiction may wish to permit the immediate rebuilding of certain "lifeline" structures and facilities, such as hospitals, regardless of the damage zone they are located in.

E. Some General Strategies for Post-Hurricane Mitigation

What follows below is a very general description of several key reconstruction and redevelopment strategies which could be adopted to promote hazard mitigation. This is by no means a complete listing, but is illustrative of the kinds of strategies which could be pursued. What follows represents to a large degree the types of issues and policies which should be developed and contained in a community's post-hurricane reconstruction plan.

1. Moving development away from the hazard zone following the hurricane

Under this strategy, local officials would seek to encourage or require substantially damaged structures to rebuild at greater distance from the ocean or other hazard zones. This could be accomplished in several ways. Property owners might be permitted to build at greater densities or permitted to circumvent certain building requirements (e.g., sideyard requirements), in exchange for locating at a greater distance from the hazard area. An alternative approach would be to amend the local zoning ordinance to make existing development seaward of a certain desired setback line nonconforming uses. Once substantially damaged, the ordinance would prohibit the redevelopment of such structures seaward of this line.

2. Reducing Permissible Density of Development in Hazard Zone

This strategy would seek to accomplish similar objectives. It would permit redevelopment in the hazard zone, but only at reduced intensity. Such an approach would seek to reduce the extent of people and property at risk. For instance, following a devastating hurricane a locality might rezone an inlet hazard area so that permissible residential densities were reduced from 10 dwelling units per acre to one dwelling unit per acre. As with the setback strategy above, this lowered density could be accomplished in several ways. The community could simply rezone such areas following the disaster, or it could permit the transfer of development potential to some other more acceptable location in the community (e.g., where elevation is higher and flooding potential lower). This would act as a form of compensation for the lower permissible potential.[11] As in the setback case above, the locality could also make certain high density uses nonconforming prior to the hurricane. For instance, the locality could designate high-rise hotels and condominiums in oceanfront zoning districts as nonconforming uses, prohibiting their reconstruction following a hurricane.

3. Prohibition of reconstruction at higher densities

As observed earlier, the political and economic pressures following a major disaster may work towards increasing the intensity of development in hazardous areas. One strategy a locality may wish to adopt in advance of a hurricane is that while it will permit redevelopment to pre-existing densities, any increases in the intensity of hazard zone development will not be acceptable.

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[11]See Model Amendment 1 (3), Appendix II.

4. Reconstruction according to more stringent building and construction standards.

One strategy is to permit redevelopment of the same intensity and type, but require that the structures and accompanying facilities are built to more stringent construction standards. This has been the primary approach expressed in many of the original hurricane hazard mitigation and post-disaster reconstruction plans prepared under the new North Carolina Mitigation Guidelines.[12] To a great extent this strategy may constitute an aggressive local effort to ensure that reconstruction adheres to existing NFIP and state building code standards. However, a locality may wish to impose additional requirements, for instance requiring additional elevation for structures or certain design features which make roads, sewer and water lines, and other public facilities less vulnerable to future hurricanes.

5. Public acquisition of hazard area properties

As we have seen in Chapter 5, one of the most effective approaches to hazard mitigation is public acquisition of hazard zone properties--acquisition both of undeveloped parcels and damaged structures. A primary local strategy might be to systematically prepare for post-storm opportunities to acquire high hazard areas. A locality could identify in advance where priority areas are located and develop in advance as well decision-making and funding mechanisms to ensure rapid acquisition. In conducting a pre-disaster site analysis, the locality could identify acquisition areas which would satisfy multiple community objectives, for instance giving higher priority to

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[12]Timothy Beatley, Development Management to Reduce Coastal Storm Hazards: Policies and Processes, Chapel Hill, NC: UNC Center for Urban and Regional Studies, 1985.

acquisition in areas where public beach access is badly needed. For acquisition of damaged structures, the locality could identify in advance areas in the jurisdictions where relocation could from the hazard area occur (either actual relocation of damaged structures or relocation of people into new structures).

III. Conclusion

The post-storm aftermath can be an opportunity to achieve substantial progress in hazard mitigation, but only if a community is prepared to take advantage of it. Because local governments can no longer rely on federal aid to bankroll reconstruction efforts, they must plan in advance to facilitate orderly rebuilding. Whether the reconstruction plan is specific or general, it should recognize the unique pressures of the post-storm period, guarding against piecemeal and haphazard redevelopment at pre-existing or even greater densities.

To carry out the mitigation mandate of the reconstruction plan in the tense post-storm atmosphere, a local government will often require special institutions and authority in order to act quickly and decisively. A previously constituted damage assessment team can examine the extent, causes, and location of storm damage immediately after the storm, in time for the information to be of use to local officials. Correspondingly, the Reconstruction Task Force can pinpoint areas requiring special attention or offering particular opportunities for mitigation. The Task Force could recommend or exercise regulatory control over rebuilding, including such special techniques as triage to delineate damage zones and a temporary reconstruction moratorium. Triage and moratoria are designed to allow a

breathing space in which to take advantage of the clean slate offered by the storm. By starting over in a planned, orderly fashion, a coastal locality can implement mitigation strategies such as reconstruction at lower densities and in different locations and public acquisition of land, thereby emerging from the storm's destruction as a safer and more attractive community.

Chapter 7

Legal Considerations in Using Growth Management to Reduce Hurricane and Coastal Storm Hazards

Introduction

Legal constraints on local government growth management programs can work both to help and to hinder coastal storm hazard mitigation. On one hand, the constitutional rights of private property owners and limits on local government authority set an outer boundary on how and how much localities can restrict coastal development. On the other hand, if local governments do not act properly to protect private property from natural hazard damage, they could in some circumstances be legally liable for the resulting harm. These two forms of liability have been described as "a dilemma for local managers."[1] Litigation claiming that local government is responsible for the loss of private property values can arise before the storm, with challenges to the constitutionality of development regulation, or after the storm, when property owners claim government actions contributed to storm-related physical damage.

It may seem that a locality is open to suit no matter what it does, but a well-designed hazard mitigation program can avoid both horns of the dilemma without great difficulty. The following catalogue of potential legal challenges should not be construed as indicating that all or any of them are likely to arise. This chapter will outline the most prominent landmarks along the legal boundaries of permissible growth management and hazard mitigation,

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[1]Kusler, Liability as a Dilemma for Local Managers, Pub. Admin. Rev., Special Issue 1985, p.118.

starting with challenges to the validity of development regulations and then addressing potential local government liability for hazard damage.[2]

PART 1. CHALLENGES TO GROWTH MANAGEMENT

Local growth management programs designed to reduce community exposure and vulnerability to hurricanes and coastal storms must operate within various constitutional and statutory parameters surrounding the protection of private property rights. However, it is important to recognize at the outset that development management measures designed specifically to reduce hurricane and coastal storm hazards are at the heart of the police power rationale of protecting the public health, safety, and welfare, and courts give much weight to the objectives of a growth management program in evaluating its validity. The inherent importance and urgency of reducing damage to life and property from coastal storms, emphasized by the CAMA hazard mitigation planning requirements, will help assure local development programs of a favorable judicial reception, so long as the policy and implementation techniques are reasonable.

A growth management program must overcome potential challenges based on several types of constitutional or statutory limitations. First, an action may be challenged as unauthorized by existing delegation of authority from the state. Second, a growth management program is subject to several potential challenges based on constitutional provisions: due process, taking of private

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[2]The chapter draws on C. Luther Propst, Examination of Constitutional and Statutory Constraints on the Use of Development Management to Reduce Hurricane and Coastal Storm Hazards (1985), and David Blatt, The Shadow After the Storm: Local Government Liability for Coastal Hazard Damage (1986), Chapel Hill, NC: UNC Center for Urban and Regional Studies.

property without just compensation, and equal protection. These challenges most often arise out of both federal and state constitutional provisions, but may arise out of a provision found only in either the federal constitution or the constitution of a state. The range of remedies available for successful challenges to development regulations is currently an unsettled question and may be a controversial element in a growth management challenge. The traditional judicial remedy of invalidation may be supplemented by financial liability under certain circumstances.

I. CHALLENGES BASED UPON INADEQUATE AUTHORITY

Growth management techniques available to local governments to reduce hurricane and coastal storm hazards can be broadly divided into four categories: land and property acquisition, public spending, taxation, and development regulation.[3] Municipalities and other units of local government, however, have no inherent authority to acquire property, to levy taxes, to make expenditures, or to exercise regulatory powers. As discussed in Chapter 4, all units of local government are creations of the state and possess only those powers delegated to them by the state.[4] The question of whether a locality has adequate authority to take an action therefore presents itself as a threshold issue in any challenge to a local development regulatory action.

There are two elements in a challenge to the authority of a local government to take action: 1) whether the proposed purpose is within the

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[3]D. Brower, C. Carraway, T. Pollard and L. Propst, Managing Development in Small Towns, (Planner's Press 1984).

[4]McQuillin's Law of Municipal Corporations, section 44.05 (taxation), section 24.07 (regulatory powers), section 39.17 (expenditures), and section 28.02 (acquisition), (Callaghan and Company 3rd ed. 1981).

authority of a locality, and 2) whether the specific technique or method is within the local government's authority. Delegations of authority from the state usually authorize local governments to act for any legitimate governmental purpose,[5] and the protection of life and property from coastal storm hazards is recognized as an eminently valid public purpose. Consequently, a challenge to the use of a specific growth management tool or technique is more likely to arise than a challenge to the purpose of a hazard mitigation program. The legal authority for the use of particular tools and techniques has been discussed in Chapter 5, and should be investigated and established by each local government in the process of developing a hazard mitigation program. In addition to having proper statutory authorization, local regulations must also not conflict with state or federal laws. Overall, invalidation of a local ordinance for lack of sufficient enabling legislation is rare, but not unheard of. Invalidation on these grounds can be overcome by amendment to a municipality's home rule charter or by enactment of specific enabling legislation by the state.

II. CHALLENGES BASED UPON CONSTITUTIONAL LIMITATIONS

The use of local government authority to manage development is subject to several constitutional provisions which limit government action affecting private property rights. Provisions in either the United States Constitution or state constitutions may provide the basis for constitutional challenges to local actions. The federal constitution establishes minimum guarantees applicable to the federal government and made applicable to state and local

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[5]McQuillin, supra, §10.31.

governments by the Fourteenth Amendment. State constitutions may provide additional provisions limiting local growth management actions or state courts may interpret state constitutional limitations more rigorously than the federal provisions.[6]

The principal constitutional limitations to local growth management efforts are found in three major constitutional provisions: due process, taking of private property without just compensation, and equal protection.

A. Due Process

The U. S. Constitution guarantees all citizens due process of the law. The Fifth Amendment applies the provision to federal actions and the Fourteenth Amendment applies a due process guarantee to actions by the states. As creations of the state, local governments are subject to the Fourteenth Amendment due process clause, which reads: "nor shall any State deprive any person of life, liberty, or property, without due process of law."

Article I, Section 19 of the North Carolina constitution contains a similar provision to the federal due process clause known as the "law of the land" clause. The North Carolina Supreme Court has generally interpreted this provision as having the same breadth and effect as the federal due process clause.[7] However, interpretation of other state constitutional provisions sometimes varies significantly from the corresponding federal interpretation.[8]

1. Procedural Due Process

Due process of law provides two independent guarantees: procedural due process and substantive due process. Procedural due process requires that

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[6] Responsible Citizens in Opposition to the Flood Plain Ordinance v. City of Asheville, 308 N.C. 255 (1983); see also Constitutional Issues, supra at 34.

[7] Lea Company v. N.C. Board of Transportation, 308 N.C. 603, 610-11 (1983).

[8] See Board of Supervisors of Fairfax County v. DeGroff Enterprises, 214 Va. 235, 198 SE2d 600 (1973) for a taking discussion.

citizens be given: 1) adequate notice of governmental action, and 2) a reasonable opportunity to be heard by an impartial tribunal when affected by a governmental action. Procedural due process plays an important role in administrative rule-making and in administrative and judicial decision-making.

The procedural requirements for local government activity and decision-making are usually specified in administrative procedures acts or state land use control legislation.[9] To ensure procedural due process, courts generally require close compliance with these statutory requirements. If no statute specifies the procedures to be used in local actions, courts review the procedures used directly under the constitutional due process clause to ensure adequate notice and opportunity to be heard.[10]

2. Substantive Due Process

a. Standard of review

A claim based upon substantive due process challenges the fundamental fairness of governmental action. Growth management ordinances will usually withstand substantive due process challenges under a standard of review which upholds ordinances if they bear a reasonable relationship to the accomplishment of a legitimate governmental objective, and are not unduly oppressive in application to specific landowners. Aside from the taking claim, which is related to substantive due process but is a distinct constitutional challenge, an ordinance may encounter due process challenges if either its objective or the means chosen to effectuate the objective are deemed invalid.

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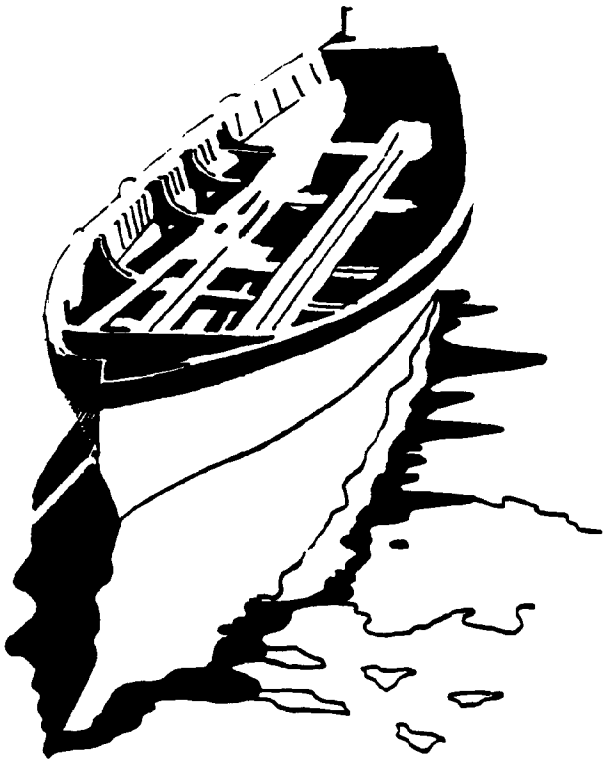
[9]See, e.g., CAMA, N.C.G.S. §§113A-117 to 113A-123.

[10]Procedural due process is discussed in K. Davis, Administrative Law, (West Publishing Co. 3d ed. 1972), and Gellhorn and Boyer, Administrative Law and Process in a Nutshell, (West Publishing Co., 2d ed. 1981).



In response to a challenge to the per se validity of zoning, in Village of Euclid v. Ambler Realty Company,[11] the United States Supreme Court upheld the facial validity of zoning as a proper exercise of the police power. This decision established the standard of judicial review applied in most challenges to land use regulations: "[i]f the validity of the legislative classification for zoning purposes be fairly debatable, the legitimate judgment must be allowed to control." This standard, which grants local ordinances a presumption of validity, remains the standard of review commonly applied in challenges to growth management actions. To overcome this presumption, the party challenging an ordinance must show that the ordinance is clearly invalid.[12] This standard of review upholds ordinances unless they

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[11] Village of Euclid v. Ambler Realty Company, 272 U.S. 365 (1926).
[12] Constitutional Issues, supra at 46.

are "clearly arbitrary and unreasonable, having no substantial relation to public health, safety, morals, or general welfare."[13]

The leading North Carolina Supreme Court decision on the validity of growth management is Responsible Citizens in Opposition to the Flood Plain Ordinance v. City of Asheville, 308 N.C. 255 (1983), which upheld a floodplain ordinance enacted pursuant to the requirements of the NFIP, against due process, taking, and equal protection challenges under the federal and state constitutions. The Court explained its substantive due process analysis as follows:

> In short, then, the court is to engage in an "ends-means" analysis in deciding whether a particular exercise of the police power is legitimate. The court first determines whether the ends sought, i.e., the object of the legislation is within the scope of the power. The court then determines whether the means chosen to regulate are reasonable. . . . [T]his second inquiry is really a "two-pronged" test. That is, in determining if the means chosen are reasonable the court must answer the following: (1) Is the statute in its application reasonably necessary to promote the accomplishment of a public good and (2) is the interference with the owner's right to use his property as he deems appropriate reasonable in degree? [citation omitted][14]

The Asheville opinion continued by equating the "reasonable in degree" analysis (the second prong of the means analysis) with the analysis in a taking claim.[15]

b. Types of substantive due process challenges

Potential challenges to a growth management ordinance alleging a violation of substantive due process fall into three categories: 1) a governmental action has an improper objective; 2) a governmental action utilizes a means with no reasonable relation to a legitimate objective; and 3) a governmental action is unduly oppressive in its application to specific

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[13] Id., at 395.

[14] Responsible Citizens in Opposition to the Flood Plain Ordinance v. City of Asheville, 308 N.C. 255, 302 SE2d 204, 208 (1983).

[15] Id. at 263, 302 SE2d at 209.

property. Since the Supreme Court upheld the validity of zoning in Euclid, the facial validity of most land use regulations has been upheld. The most important state and federal statutes relating to coastal growth management have all been sustained against facial constitutional attack.[16] Consequently, most suits focus their challenge on the validity of a particular ordinance as applied to a specific parcel. In a successful challenge to the validity of an ordinance as applied to a specific parcel, the court generally prohibits application of the ordinance to the claimant's property, or grants other remedies to the property owner, rather than invalidating the entire ordinance.

In terms of the objectives of growth management, regulations aimed at protecting lives and property from coastal hazards are on solid legal ground. No recent decision has struck down floodplain or storm hazard regulations for lack of authorization by general zoning or police power enabling statutes.[17] Courts almost always uphold regulations against challenges to the legitimacy of the objective when a legitimate purpose of the regulation is protection of the public health and safety from natural hazards. The United States Supreme Court has aptly summarized the judicial deference given local governments to enact regulations to protect the public health and safety. The Court stated that when threats to human life are involved a legislature may adopt "the most conservative course which science and engineering offer."[18]

There are purposes potentially related to hurricane hazard reduction programs which courts may deem invalid. For example, courts have often

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[16] Texas Landowners Rights Ass'n v. Harris, 453 F.Supp. 1025 (1978) (National Flood Insurance Program); Bostic v. U.S., 753 F.2d 1292 (1985) (Coastal Barrier Resources Act); Adams v. DNER and Everett v. DNER, 295 N.C. 683 (1978) (Coastal Area Management Act); Issuance of CAMA Minor Development Permit to Ford S. Worthy v. Town of Bath, 82 N.C. App. 32 (1986) (Coastal Area Management Act).

[17] American Land Development Company v. City of Keene, 41 F.2d 484 (1st Circuit 1930) is an early decision upholding floodplain regulations.

[18] Queenside Hills Realty Co. v. Saxi, 328 U.S. 80, 83 (1946).

invalidated attempts to restrictively regulate an area until public purchase is possible. Restrictive or open space zoning designed to reduce the market value of property and discourage development prior to public acquisition may be deemed impermissible.[19] However, the presence of long-term plans for public acquisition in an area will probably not undermine the legitimacy of regulations based upon valid objectives independent of reducing the market value of a parcel for acquisition.[20] In addition, large-lot zoning and other restrictions on density or population growth which are intended to exclude low-income housing or racial minorities have also been found unconstitutional by some state courts.[21] Unless hazard mitigation is used purely as camouflage, a growth management technique reasonably related to real coastal hazards should not be affected by an exclusionary zoning challenge

In terms of the means chosen to accomplish growth management goals, courts rarely inquire into the relationship between the means selected by a legislative body and the objective of an ordinance. The choice of methods to achieve a legislative objective generally withstands challenge if to "any degree or under any reasonable circumstances, there is an actual relation between means and the end."[22]

There are, however, a few situations in which courts may inquire into the rationality of the relationship of the means to the objective of an ordinance. Ordinances that contain patently flawed or inaccurate technical data or

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[19]See, e.g., Burrows v. City of Keene, 432 A.2d 15 (N.H. 1981).

[20]J. Kusler, Our National Wetlands Heritage: A Protection Guidebook, (Environmental Law Institute, 1983) p.85; See Turner v. County of Del Norte, 24 Cal. App.3d 311, 101 Cal. Rptr. 93 (1972).

[21]See, e.g., Southern Burlington County NAACP v. Twp. of Mt. Laurel, 67 N.J. 151, 336 A.2d 713 (1975), Surrick v. Zoning Hearing Bd. of Upper Providence, 476 Pa. 182, 2382 A.2d 105 (1977).

[22]Stephenson v. Binford, 287 U.S. 251, 272 (1932); See also Plater, "The Takings Issue in a Natural Setting: Floodlines and the Police Power", 52 Texas Law Review 201, 226 (1974).

standards that bear no rational relation to the stated objective of the ordinance have been successfully challenged, but invalidation of land use ordinances on these grounds is rare. Most decisions recognize that imperfections are inherent in hazard area mapping and flood data collection and accept that approximations must be used. "[W]here the susceptibility of a site to flooding is in question, courts will apply the presumption of validity and uphold the locality's determination unless it is clearly erroneous."[23]

The claim that an ordinance violates substantive due process because it is unduly oppressive as applied to a specific parcel is closely related to and may overlap the claim that an ordinance results in a taking of private property without just compensation.[24] Substantive due process challenges are, however, separate and distinct from claims alleging that an ordinance constitutes a taking of private property without just compensation. One commentator has stated that: "[d]espite chronic confusion in judicial language in cases where zoning or other land use regulations are challenged under the due process clause of the Fourteenth Amendment, it is clear that such regulations may be held invalid on substantive due process grounds without a finding that they amount to a de facto taking . . . ."[25] In "as applied" substantive due process cases, the usual remedy for the injured landowner is invalidation of the ordinance or other regulation as applied to his property, essentially a judicially-imposed variance, while the regulation in general remains in force.

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[23]The Conservation Foundation, Flood Hazard Management and Natural Resource Protection: Community Action Guide. p.VII-13. (Prepared for FEMA, 1980). See also Dingman and Platt, "Floodplain Zoning: Implications of Hydrologic and Legal Uncertainty," 13 Water Resources Research 519 (1977).

[24]See Responsible Citizens v. Asheville, 308 N.C. 255 (1983).

[25]Cunningham "Inverse Condemnation as a Remedy for 'Regulatory Takings'," 8 Hastings Constitutional Law Quarterly 517, 518 (1981).

In sum, invalidation of land use ordinances on any substantive due process grounds is unusual. Development management actions legitimately enacted and implemented to prevent and reduce damages from hurricanes and other coastal storms and having any logical relation to that objective should have no trouble withstanding substantive due process challenges.

B. The Taking Claim

The most controversial and misunderstood limitation to local growth management actions is the constitutional prohibition against the taking of private property for public use without just compensation. The Fifth Amendment to the United States Constitution--which states "nor shall private property be taken for public use without just compensation"--prohibits federal actions which have the effect of confiscating private property. The Fourteenth Amendment to the United States Constitution--providing "nor shall any state deprive any person of life, liberty, or property without due process of law" -- extends the Fifth Amendment taking prohibition to state and local actions.[26] The North Carolina constitution contains a similar prohibition

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[26] Chicago, Burlington, & Quincy R.R. v. Chicago, 166 U.S. 226 (1897). The taking issue in land use regulation is widely discussed, including the following books and articles: F. Bosselman, D. Callies, and J. Banta. The Taking Issue, (Washington, D.C.: Council on Environmental Quality, 1973); D. Mandelker, Land Use Law, (Charlottesville, Va.: Michie Publishing Co. 1982); Freilich, "Solving the 'Taking' Equation: Making the Whole Equal the Sum of its Parts," 15 Urban Lawyer 447 (1983); Note, "Open Space Zoning and the Taking Clause: A Two-Part Test," 46 Missouri Law Review 868 (1981); Kusler, "Open Space Zoning: Valid Regulation or Invalid Taking," 57 Minnesota Law Review 1 (1972); Plater, "The Takings Issue in a Natural Setting: Floodlines and the Police Power, 52 Texas Law Review 201 (1974); Berger, "A Policy Analysis of the Taking Problem," 49 New York University Law Review 165 (1974); Siemon, "Of Regulatory Takings and Other Myths," 1 Florida State University Journal of Land Use and Environmental Law 105 (1985).

against the taking of private property without just compensation in the "law of the land" clause.

It is settled that actual seizures of private property for public use and physical encroachments upon private property resulting from governmental actions or ordinances violate the taking prohibition.[27] For example, the New Jersey Supreme Court has ruled that public construction of a sand berm on private property along the oceanfront to protect against storm damage without permission of or compensation to the landowners constituted a taking.[28]

The most frequent and controversial application of the taking issue in growth management is the taking of private property by regulation, rather than by physical occupation.[29] In Pennsylvania Coal Co. v. Mahon,[30] the Supreme

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[27] Pompolly v. Green Bay Co., 80 U.S. (13 Wall.) 166 (1871) established that the flooding of private land by a public dam effected a taking of that land. More recently, the United States Supreme Court has affirmed that government-authorized "permanent physical occupations" must be compensated, even when damages from the invasion seems rather trivial. Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419, (1982).

[28] Lorio v. Sea Isle City, 88 N.J. Super. 506, 212 A.2d 802 (1965). But see Carolina Beach Fishing Pier v. Town of Carolina Beach, 277 N.C. 297, 177 S.E.2d 513 (1970), in which the Town constructed a berm along the shore where private lots had earlier existed. The property owner alleged that the town's actions constituted a taking of private property without just compensation. Since the seaward extent of plaintiff's lots in North Carolina is the mean high tide line and had been completely below the mean high tide line before the town constructed the berm, the court held that plaintiff's lot had been taken by the sea, and title thereto had vested in the state. The sea washed away the entire lot, so title to the lot was divested and the landowners taking claim against the town therefore failed.

[29] Important decisions upholding ordinances include the following: San Diego Gas and Electric Company v. City of San Diego, 450 U.S. 621 (1981) (open space zoning); Agins v. City of Tiburon, 447 U.S. 255 (1980) (low density zoning); Penn Central Transportation Company v. New York City, 438 U.S. 104 (1978) (landmark preservation); Zabel v. Tabb, 430 F.2d 199 (5th Cir. 1970) (wetlands protection); Turnpike Realty Company, v. Town of Dedham, 362 Mass. 221, 284 N.E.2d 891 (1972), cert denied 409 U.S. 1108 (1973) (floodplain regulation); Just v. Marinette County, 56 Wis.2d 7, 201 N.W.2d 761 (1972) (wetlands protection). Major decisions finding a taking include the following: Kaiser Aetna v. United States, 444 U.S. 164 (1979) (navigational servitude doctrine); Morris County Land Improvement Company v. Township of Parsippany-Troy Hills, 40 N.J. 539, 193 A.2d 232 (1963) (wetlands regulation); Lorio v. Sea Isle City, 88 N.J. Super. 506, 212 A.2d 802 (1965) (physical invasion); Seidner v. Town of Islip, 56 N.Y.2d 1001, 439 N.E.2d 352, 453 N.Y.S.2d 636 (1982) (oceanfront setback).

[30] Pennsylvania Coal Company v. Mahon, 260 U.S. 393 (1922).

Court established the most commonly cited analysis in taking challenges to land use regulations. In a frequently quoted opinion of Justice Oliver Wendell Holmes, the Supreme Court held that: "[T]he general rule at least is, that while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking."[31]

Judicial review in regulatory taking challenges involves application of several potential factors, including the degree to which regulated property retains economic value, the purpose of the regulation, and its effect on investment-backed expectations. These factors may be categorized into two fundamental inquiries which the United States Supreme Court recently has indicated constitute the essence of regulatory taking analysis: 1) the character of the governmental action in question, and 2) the economic impact of the regulation as applied to the specific property.[32] Courts thus balance the public purpose served by the regulation against the extent and nature of the restriction imposed on the individual parcel.

In evaluating the character of the governmental action, a useful distinction often drawn is whether a regulation seeks to prevent a harm to the public or to confer a public benefit. Courts are more likely to uphold land use regulations which they perceive as designed to prevent a public harm, such as a nuisance or a threat to the public safety, than regulations perceived to confer a public benefit. In the former type of ordinance, courts hold that landowners have no right to threaten public safety or to maintain a public

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[31] Id., at 415.

[32] Penn Central Transportation Company v. City of New York, 438 U.S. 104, 124 (1978).

nuisance. These ordinances may be sustained even if a landowner is left with no economically beneficial use of a parcel.[33]

With respect to the burden imposed upon the specific parcel, the primary factor is whether the restriction leaves the landowner with an economically feasible use of the parcel. The difference in the value of the property after the regulation compared to the value before the regulation is not dispositive, so long as some economically reasonable use remains. The general rule is that a diminution in property value, even a substantial one, resulting from a regulation does not constitute a taking.[34]

Most regulations designed to reduce hurricane damages do not fall clearly into either the prevention of public harm or the conferral of public benefit category. If a court views a regulation primarily as preventing a public harm, the regulation's probability of being sustained is quite high. If a court perceives a regulation primarily as conferring a public benefit and views the objective as valid, its analysis turns to the impact of the ordinance on the value of the parcel in question.

In summary, courts are almost certain to uphold a regulation designed to reduce community vulnerability and exposure to coastal storm damages when the regulation does not deny a landowner all economically reasonable use of a parcel. Regulations which do have the effect of denying a landowner all economically reasonable uses of a parcel present a much closer question. If no reasonable use of the parcel remains, the decisions are divided as to the

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[33] Goldblatt v. Hempstead, 369 U.S. 590 (1962); also see Consolidated Rock Products v. Los Angeles, 57 Cal.2d 515, 370 P.2d 342 (1962), appeal dismissed 371 U.S. 36 (1962); and Hadacheck v. Sebastian, 239 U.S. 394 (1915), both upholding ordinances which prohibited uses of land considered to be a nuisance.

[34] See Kusler, "Open Space Zoning: Valid Regulation or Invalid Taking," 57 Minnesota Law Review 1, 33 (1972).

validity of the ordinance. The importance the court places upon the regulatory objective; the reasonableness of the expectations of the landowner given the size, the location, and the character of the specific parcel; and the equities of the particular facts in controversy, rather than the application of any clearly enunciated principles, seem to determine the outcome of these cases.

Most regulations addressing important public needs and showing sensitivity to landowner's property rights will be upheld. According to Daniel Mandelker, "[a] court following the Supreme Court's lead will declare a land use regulation unconstitutional only in an especially harsh and insupportable set of circumstances. The court must be willing to discredit the municipality's justification for its land use program. It must be willing to believe that the benefits conferred by the program do not justify the burdens it imposes. Finally, a landowner must have demonstrated through application to the municipal authority that no constitutionally permissible land use is allowable."[35]

Courts are more likely to invalidate land use regulations--either as a taking, a violation of substantive due process, or on various other grounds--when enactment or enforcement of an ordinance involves procedural irregularities or ad hoc and post hoc planning and land regulation rather than even-handed implementation of an approved hazard mitigation plan.[36] However, if a hazard mitigation development restriction is challenged in court, local governments should take care to document the hazards to be avoided by the

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[35]Mandelker, "Land Use Takings: The Compensation Issue," 8 Hastings Constitutional Law Quarterly 491, 504 (1981).

[36]Burrows v. City of Keene, 432 A.2d 15 (N.H. 1981); Mandelker, "Land Use Takings: The Compensation Issue," 8 Hastings Constitutional Law Quarterly 491, 501-02 (1981).

regulations in order for courts to appreciate the importance of hazard mitigation when balancing community interests with the often more immediate impact an ordinance may have on an individual landowner.

1. Types of Regulations Challenged as Takings

Though the setback requirements promulgated under CAMA have not been challenged, courts without exception have upheld restrictive oceanfront setback ordinances which limit the use of oceanfront parcels in order to limit storm damages, to protect public beach processes, and to prevent damaged or abandoned structures from becoming public nuisances, so long as the ordinance does not prohibit all construction on an entire parcel.[37] On the other hand, oceanfront setback ordinances which prohibit any construction on an entire beachfront lot have received mixed judicial response. New York, for one, has struck down oceanfront setback ordinances as applied to specific parcels in situations where the ordinance prohibits construction on an entire parcel.[38]

Many state courts permit oceanfront setback ordinances which render entire parcels unbuildable when the necessity of the construction setback is

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[37]For example, see Rolleston v. State, 245 Ga. 576, 266 S.E.2d 189 (1980), which upholds a refusal to allow a beachfront property owner to construct bulkhead for erosion control because of nuisance effect on neighboring landowners; and Godson v. Town of Surfside, 150 Fla. 614, 8 So.2d 497 (1942). In a related area, the U.S. Supreme Court recently held that the conveyance of a lateral easement for beach access as a condition of granting a development permit was an invalid taking, since the need for the easement was not related to the impact of the development or to the State's purported policy justification. Nollan v. California Coastal Commission, 55 U.S.L.W. 5145 (June 23, 1987).

[38]Seider v. Town of Islip, 56 N.Y.2d 1001, 439 N.E.2d 352, 453 N.Y.S.2d 636 (1982). See also Lemp v. Town of Islip, 90 Misc.2d 360, 394 N.Y.S.2d 517 (Sup.Ct. 1977).

well-documented.[39] The sum of the holdings in most states, according to one coastal management authority, is that "courts will be willing to uphold regulations prohibiting location of permanent structures on hazardous oceanfront lots, provided there is adequate evidence showing that: 1) improper development of such lots can harm neighboring properties and natural features; 2) there are important public benefits to be met by proper management, such as protecting public safety in storms and reducing disaster relief, infrastructure repair and other public costs; and 3) practical uses of the property that are compatible with its natural character can be carried out, such as beach access, camping or recreation."[40]

Floodplain and wetland development controls have become well established in law, as federal and state statutes such as the NFIP have authorized and encouraged local governments to establish floodplain and wetland zoning. Court decisions now almost unanimously uphold restrictive floodplain and wetlands regulations. Responsible Citizens v. Asheville is, of course, a prime example of the judicial approval of floodplain ordinances. This attitude represents an evolution from early decisions which often struck down floodplain and wetlands ordinances.[41]

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[39]Decisions upholding oceanfront setbacks which prohibit construction on entire parcels include the following: Speigle v. Borough of Beach Haven, 46 N.J. 479, 218 A.2d 129 (1966) cert. denied, 385 U.S. 831 (1966), 166 N.J. Super. 148, 281 A.2d 377 (App. Div. 1971); Inhabitants of Town of Boothbay Harbor v. Russell, 410 A.2d 554 (Me., 1980); McCarthy v. City of Manhattan Beach, 41 Cal.2d 879, 264 P2d 932 (1953), cert denied 348 U.S. 817 (1954); see Maloney and O'Donnell, "Drawing the Line at the Oceanfront: The Role of Coastal Construction Setback Lines in Regulating Development of the Coastal Zone," 30 University of Florida Law Review 383 (1978); Shows, "Florida's Coastal Setback Line--An Effort to Regulate Beachfront Development," 4 Coastal Zone Management Journal 151 (1978)

[40]D. Owens, Coastal Law (North Carolina Division of Coastal Management).

[41]See Dooley v. Town Plan and Zoning Commission, 151 Conn. 304, 197 A.2d 770 (1964); Bartlett v. Zoning Commission, 161 Conn. 24, 282 A.2d 907 (1971); Sturdy Homes, Inc. v. Township of Redford, 30 Mich. App. 53, 186 N.W.2d 43 (1971); Morris County Land Improvement Co. v. Township of Parsippanny-Troy Hills, 40 N.J. 539, 193 A.2d 232 (1963).

Courts almost always sustain large minimum lot size zones which are legitimately related to a valid public purpose, such as hurricane and coastal storm hazard reduction or environmental protection, rather than to invalid exclusionary objectives.[42]

Recently, several decisions have upheld regulations which prohibit land uses that threaten public health and safety or that have substantial detrimental impacts on the use and enjoyment of nearby lands or bodies of water.[43] These decisions, which essentially involve prevention of harm to the public, indicate that courts often sustain certain regulations that prevent essentially all income producing development on a parcel.[44] Restrictive regulation of floodways, coastal high hazard areas, public trust lands and waters, and sensitive environmental systems such as wetlands--when accompanied by a showing that development will increase the flood hazard, impair disaster relief and recovery efforts, endanger nearby property in a storm, or destroy the ecological integrity of important natural systems--may well be sustained.

In summary, the taking challenge to growth management actions need not be treated as an absolute or overwhelming limitation to effective local regulations implemented to reduce hurricane and coastal storm damages. The spectre of the taking clause may be more of a limitation to effective action than the clause itself.

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[42]See Steel Hill Development, Inc. v. Town of Sanbornton, 469 F.2d 956 (1972); County Commissioners of Queen Anne's County v. Miles, 246 Md. 355, 228 A.2d 450 (1967).

[43]See Just v. Marinette County, 56 Wis.2d 7, 201 N.W.2d 761 (1972) and Graham v. Estuary Properties, Inc., 399 So.2d 1374, 1380-81 (Fla. 1981).

[44]J. Kusler, Our National Wetlands Heritage, supra p92.

C. Equal Protection

The Fourteenth Amendment of the United States Constitution provides in part: "nor [shall any State] deny to any person within its jurisdiction equal protection of the laws." The Constitution of North Carolina, like that of most states, also contains provisions guaranteeing equal protection of the law. State courts generally construe these state provisions as having the same force and effect as the Fourteenth Amendment's equal protection clause.[45]

Any local government action which creates a classification raises equal protection questions. The doctrine requires that legislative and administrative classifications give similar treatment to similarly situated persons with respect to the purposes of a statute or ordinance. Unless fundamental rights such as voting or "suspect" classifications such as race are involved, equal protection requires only that classifications have a rational basis and bear a reasonable relationship to a permissible governmental objective.[46]

Challenges alleging equal protection violations are closely related to and often overlap substantive due process challenges. The judicial standard of review is similar. Recognizing the similarities between the two constitutional doctrines, the Supreme Court has called equal protection a "more explicit safeguard of prohibited unfairness" than due process.[47]

In the growth management context, equal protection requires that valid reasons support regulatory classifications and that property which is similarly situated be treated similarly. Courts generally defer to

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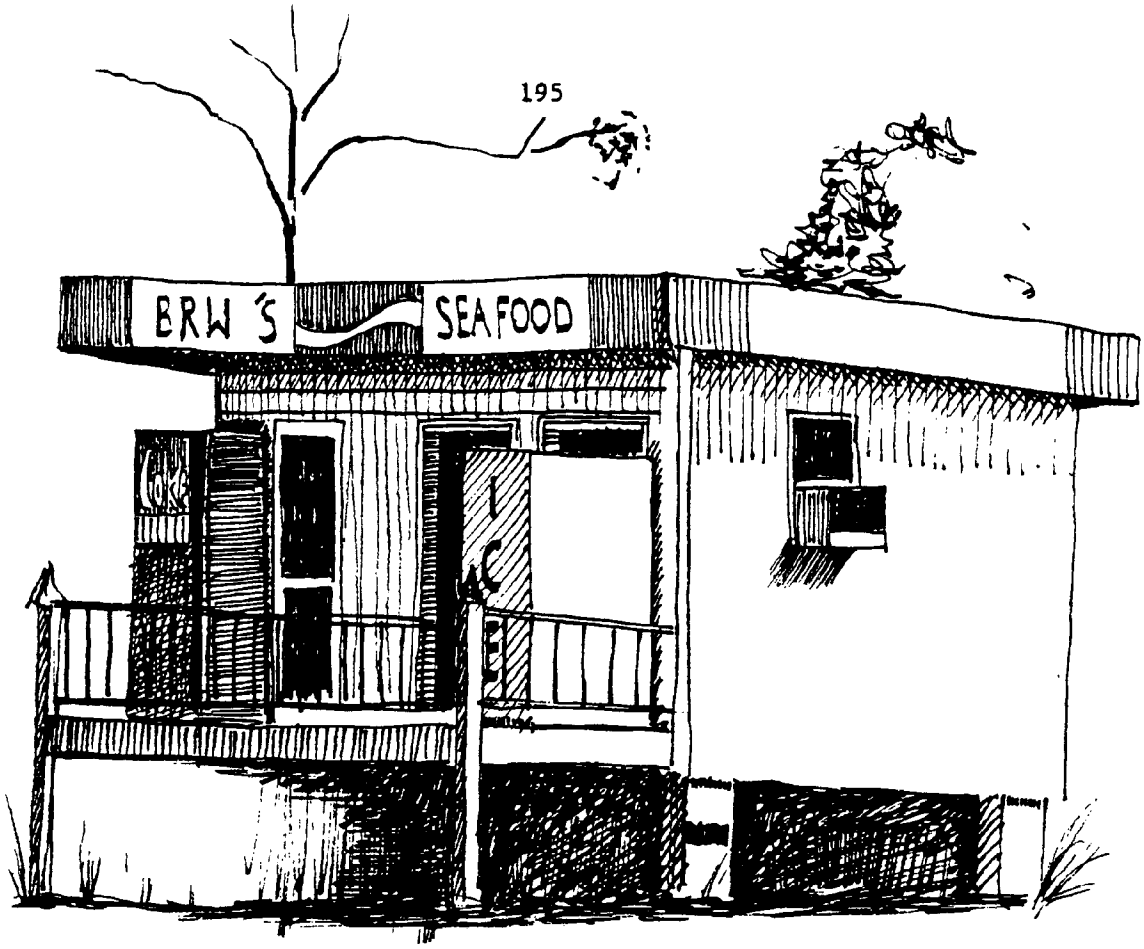
[45]N.C. Const., Art. I §19; Godschalk, Brower, McBennett, and Vestal, Constitutional Issues of Growth Management, supra pp. 77-78.

[46]See Village of Belle Terre v. Boraas, 416 U.S. 1, 8 (1974).

[47]Bolling v. Sharpe, 347 U.S. 497, 499 (1954).



"wholly irrelevant to the achievement of the state's objective."[48] For example, courts usually sustain regulations which apply only to parcels undeveloped at the effective date of the regulation or which apply only to proposed uses and not existing uses. The equal protection clause requires only that there be a legitimate reason for such distinctions.[49]

Equal protection does not require that all areas subject to a regulatory program come under regulation at once. For instance, courts permit the mapping and regulation of different areas or natural systems as sufficient data for the areas or natural systems is generated.[50]

Classification of land based upon vulnerability to hurricane and coastal storm damage is valid against an equal protection challenge. Land use

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[48] Constitutional Issues, supra at 77, quoting McGowan v. Maryland, 366 U.S. 420, 425 (1961).

[49] E.g., Zahn v. Board of Public Works, 195 Cal. 497, 234 P. 388 (1925), affirmed 274 U.S. 325 (1927).

[50] J. Kusler, Regulating Sensitive Lands, supra at 159.

classifications have been struck down only in cases of patently unfair or unreasonable classification.[51] The North Carolina Supreme Court stated in the Asheville floodplain case: "It is clear that an ordinance which regulates only the use of land in a hazardous area and does not regulate the use of property outside the hazardous area is a reasonable classification. Indeed, to do otherwise would be unreasonable."[52]

III. DAMAGES

Three recent judicial developments could provide the basis for federal courts awarding money damages as a remedy for invalid local growth management measures, in addition to the normal remedy of overturning the local ordinance. First, the Supreme Court has ruled that municipalities are subject to the federal antitrust laws. The threat of financial judgments against local governments and local officials led Congress to intervene with enactment of the Local Government Antitrust Act of 1984. This act removes the specter of huge damage awards against local governments but not that of invalidation on antitrust grounds. Second, the Supreme Court has indicated that land use regulations may subject localities to damages under Section 1983 of the Civil Rights Act of 1871. Third, the Supreme Court has finally held that money damages may be available as a remedy for a temporary regulatory taking.

Recent federal court decisions indicate that land use regulations, like other local ordinances, promulgated as part of a conspiracy to enrich municipal officials or to unfairly restrain competition are not immune from

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[51] In City of Welch v. Mitchell, 95 W.Va. 377, 121 S.E. 165 (1924), for one, the court invalidated a floodplain ordinance which regulated development on one side of a stream but not the other.

[52] Responsible Citizens in Opposition to the Flood Plain Ordinance v. City of Asheville, 308 N.C. 255, 302 S.E.2d 204, 212 (1983).

Evangelical Lutheran Church of Glendale v. County of Los Angeles,[62] the Court held that the Constitution required compensation when regulations temporarily deprived a landowner of all use of his land.

The Lutheran Church case did not reach the merits of the floodplain issue, thus leaving open the question of whether there had actually been a taking, but the majority opinion "realize(d) that even our present holding will undoubtedly lessen to some extent the freedom and flexibility of land-use planners and governing bodies of municipal corporations when enacting land-use regulations."[63] The extent to which land use regulation will be constrained in the future suggests many troubling and unanswered questions for local governments: how long a denial of use must be to constitute a taking; when the damages meter begins to run; and especially, how much economic value may be reduced before creating a regulatory taking.

The decision is much too recent to be able to assess its impact, and opinions vary as to its effect on local governments. Justice Stevens' dissent foresees a flood of litigation, with "a significant adverse impact on the land-use regulatory process." The prospect--no matter how unlikely--of having to pay money damages if a challenged land use restriction is later found unconstitutional might have a chilling effect on future land use regulation. On the other hand, it is important to remember that successful taking claims are quite rare, and may become rarer still if courts hesitate to strike down a regulation because they know a local government would have to pay dearly for a mistake in judgment.

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[62] 55 U.S.L.W. 4781, No. 85-1199, (June 9, 1987).
[63] 55 U.S.L.W. 4786.

PART 2: LIABILITY

Many analysts are becoming increasingly concerned over potential local government liability for coastal hazard damages.[64] Municipal liability for torts and antitrust violations has already created a palpable threat to local government insurance coverage and fiscal solvency, so the prospect of legal liability for hurricane damage or other coastal hazard injuries cannot be welcome news. Nonetheless, governments are being warned that they face a trend of increasing coastal hazard liability. The asserted causes for this trend are twofold, scientific and legal.

Scientifically, hurricanes, coastal wind and wave processes, beach erosion, and other natural processes have become better understood, to the point that coastal hazards and their effects on the natural and built environments are not random factors, but can be effectively identified, predicted, and mitigated. Legally, local governments have become increasingly subject to suit as they become more involved in coastal area management while the traditional impediments to government tort liability are being steadily eroded.[65] As one commentator states:

> The law of local government liability for hazards is complicated and rapidly evolving and yet the trend across the nation is unmistakable. Local governments are liable for damages resulting from natural or technological hazards where the local government had or should have had

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[64]Kusler, Liability as a Dilemma for Local Managers, Pub. Admin. Rev., Special Issue 1985, p.118; Platt, Local Government Liability Regarding Coastal Hazards, in Preventing Coastal Flood Disasters: The Role of State and Federal Response, Ass'n of State Floodplain Managers (Proceedings of a Symposium, Ocean City, Md., May 23-25 1983); Somerville, Government Tort Liability, 10 Urban Lawyer 376 (1978); "Storm-Torn Coast to See Gust of Suits," Nat'l. L. J. 3/10/80; Conference Report, Legal Issues in Emergency Management, Senior Exec. Policy Center, FEMA, August 1984.

[65]Huffman, Government Liability for Harm Resulting from Disaster Mitigation: A Comparative Study, Government Liability Project, Lewis & Clark Law School (1985) at i.

knowledge of the potential hazards and participated in some way (even if quite passively) in an action which resulted in hazard losses.[66]

Nonetheless, the situations in which governments can find themselves legally liable for coastal hazard damage are many and varied. The conceptual danger is unmistakable, and commentators unanimously warn that the floodgates of litigation are about to open.[67]

I. Threshold Obstacles

Though legal trends may have opened the floodgates, the resulting storm of litigation has struck local governments with all the force of Hurricane Gloria. Liability suits simply have not been a common characteristic of the post-disaster aftermath, possibly because of the legal hurdles a potential plaintiff must surmount before even presenting his case. There are three sets of factors which may help explain the relative infrequency of hazard damage suits against local governments, one rooted in social attitudes, one in the lingering legal immunities of government, and one in the legal disabilities of particular potential plaintiffs.

A. Act of God

From one perspective, the notion that a lawsuit against the local government should be the response to lives and property lost to natural hazards seems bizarre and peevish. Though acts of the Deity are often invoked to mask human failings, it is indisputable that no damage and no loss would occur without the destructive cooperation of nature. Consequently, many

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[66]Kusler, supra at 120. See also Hildreth, Legal Aspects of Coastal Hazards Management, in Edge (ed.), Coastal Zone '80, Vol. II, Proceedings of Second Symposium on Coastal & Ocean Mgmt., Am. Soc. of Civil Engineers (1980), at 1370.

[67]"Storm-Torn Coast," supra; Platt, supra at 119-120; Hunter, "The Liability of State and Local Government for Emergency Management," in Legal Issues in Emergency Management, supra at 18-20.

coastal residents and landowners tend to bear a stoic, fatalistic attitude, that coastal hazards are an inevitable part of life, and the damage that results is not anyone's fault.

Moreover, in the aftermath of a coastal disaster, reconstruction and rebuilding, rather than recrimination, are likely to be uppermost in many residents' minds. Coastal residents and property owners may feel the need to put the past behind them and unite to get on with the job of putting their lives and homes back together, especially since help is likely to be forthcoming after the storm. In most cases, either federal flood insurance or disaster assistance will be available, so that litigation is unnecessary as a source of immediate compensation for property losses. Residents who consider themselves lucky to escape a storm with their lives, or without more extensive property damage, may be more than happy to accept insurance proceeds and emergency loans without a thought of suing local government.[68]

The extent to which attitudes of fatalism and community solidarity actually inhibit hazardous damage litigation is an empirical question, and there are some indications that friendly attitudes toward local government either fade away in time or are changing entirely, at least in California. With such a litigious population, plaintiff-oriented courts, and a plethora of dangerous natural hazards, local governments as well as builders, lenders, developers, and insurers--and almost anyone having anything to do with the coastal development process--have been mentioned as possible defendants in California coastal hazard damage litigation.[69]

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[68]Wendell, Legal Aspects of Flood Warning and Evacuation in Baker (ed.), Hurricanes & Coastal Storms, Papers Presented at a National Conference, Florida Sea Grant College, April 1980, at 28.

[69]Somerville, supra at 389; "Storm-Torn Coast," supra.

In addition, the notion that a hurricane is an Act of God has independent legal significance as well. According to some legal theories, exceptional natural hazards of sufficient magnitude are a form of force majeure, absolving governments and other potential defendants from liability since nothing human effort did or did not do could have avoided the damage.[70]

B. Sovereign Immunity

Even in plaintiff-oriented courts like California's, suing local government is not as simple as suing a private party, thanks to the monarchical anachronism of sovereign immunity. In its barest form, sovereign immunity means that the state (including its municipal subsidiaries), as an independent sovereign, cannot be sued in its own courts without its consent. As a practical matter, sovereign or, more accurately, governmental immunity has been severely eroded in most states by statute or judicial decision.

An early distinction arose between immune governmental activities--those inherently governmental functions such as legislation and adjudication which only governments could perform--and non-immune proprietary functions--those like transit and utility services which private firms or persons could do. The governmental/proprietary distinction understandably began to break down as state and local governments assumed more diverse functions. An alternate distinction developed between discretionary and ministerial functions, in

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[70]This theory was used by a Louisiana appellate court to overturn the trial court's finding of local government liability for flood damage in Gabler v. Regent Development Co., 470 So.2d 149 (La. App. 1985). The North Carolina Supreme Court also adopted this view in Midgett v. N.C. State Highway Commn., 260 N.C. 241 (1963), which held that an inverse condemnation plaintiff must show that a flood damage was a foreseeable result of highway construction and not an Act of God. A later case, Lea Company v. N.C. Board of Transportation 308 N.C. 603 (1983), overruled Midgett on this point, adopting the Black's Law Dictionary definition of Act of God as an event occurring wholly without human agency. According to the Lea Company court, foreseeability of the damage was the important factor, not the relative contributions of man and nature.

which the government is liable for injuries caused in routine, technical, or executory activities, but is immune from liability for losses resulting from policy or legislative functions involving elements of judgment, choice, or discretion on the part of public officials who are accountable to the voters and not to the courts.[71]

Whatever the formulation of sovereign immunity, the scope of immune activities has been steadily shrinking. "It is pretty standard throughout all fifty of the United States that every state court that has looked at it has said that governmental immunity is anachronistic."[72] In North Carolina, the state government has legislatively waived its immunity through the procedures of the Tort Claims Act, which makes the state and its agencies liable for torts to the same extent as a private party.[73] Local governments, unless acting as agents under the control of the state--which courts might consider to be the case when exercising CAMA permitting authority--are not subject to the Tort Claims Act but are protected by the governmental/proprietary distinction.[74] Counties and cities are not liable for negligent torts committed in the performance of a governmental function, unless they choose to waive this immunity by purchasing liability insurance, in which case localities are liable up to the amount of their coverage.[75]

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[71]Schwartz, Legal References on Earthquake Hazards and Local Government Liability, Ass'n of Bay Area Govts. (1978) at 1-19; Platt, supra, at 303-4; Hunter, supra.

[72]Richman, "State/Local Cases in Tort Claims," in Legal Issues in Emergency Management, supra at 7.

[73] N.C.G.S. §143-291 et seq.

[74]Guthrie v. N.C. State Parks Auth., 307 N.C. 522 (1983); Koontz v. City of Winston-Salem, 280 N.C. 513 (1972); Wiggins v. City of Monroe, 73 N.C. App. 44 (1985); Note, Local Government Sovereign Immunity: The Need for Reform, 18 Wake Forest L. Rev. 43 (1982).

[75]N.C.G.S. §§153A-435 (counties), 160A-485 (cities).

The distinction between which local government activities are governmental and which are proprietary is by no means clear. At one extreme, the government as a landowner or constructor of public works can clearly be held liable for dangerous conditions or negligent behavior since its position here is most closely analogous to a that of a private party. On the other hand, local governments have a legal monopoly on land planning and development regulation and often have an effective monopoly of access to studies and data about local coastal processes and hazard conditions.[76] If government actions in regulating coastal development can be analogized to pure legislative policy-making, then immunity is likely. But even in regulatory areas, governments could find themselves owing a legal duty to their citizens and residents, the breach of which can make them liable in tort.

Although it is generally considered a matter of immune policy whether or not to adopt flood control measures--and governments are not liable for having none at all--once a government does embark on flood control it must do so with all reasonable care and is liable for negligent implementation.[77] The government is responsible for implementing whatever coastal development policies it decides to adopt in a manner which does not risk unreasonable harm, and here there is a direct analogy to private tort liability. Under §323 of the Restatement of Torts, a person who voluntarily undertakes to provide a duty or service can be held liable for negligently performing that task.[78] Negligence in policy implementation will depend on case-by-case judicial interpretation, but it has been interpreted to include a faulty

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[76]Richman, "State/Local Cases in Tort Claims," in Legal Issues in Emergency Management, supra.

[77]Shoaf & Aklufi, A Summary of the Rules of Liability in Water Damage Cases, November, 1980 Cal. State Bar J., at 459-461; Platt, supra at 304-5; Kusler, supra at 120.

[78]Restatement of Torts 2d, §323; Shoaf & Aklufi, supra; Hunter, supra.

warning of expected flood levels,[79] failure to clean out a catchbasin,[80] and failure to safely accommodate foreseeable storm runoff.[81] North Carolina cases indicate that localities can be liable for negligent operation of sewer or drainage systems.[82] .

C. Contributory Negligence

It is hard to imagine that a person who loses life and property in a coastal hazard is always completely without fault while the local government is made to bear the cost. Even the most stubborn coastal resident or developer knows that hurricanes, storms, and wave action batter coastlines and have often destroyed lives and property. If people want to take the risk of building on the coast, then why should they not bear their own losses entirely?[83] The intuitive appeal of this argument is reflected in the affirmative legal defenses of contributory negligence and its cousin, assumption of risk. The negligence of a plaintiff which is a proximate contributing cause of his injuries (not necessarily the major cause) is a complete bar to recovery in North Carolina and a partial bar in most states.[84]

Contributory negligence is undoubtedly a major reasons why there are not more coastal damage suits against local governments. The developer who plans

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[79] Connelly v. State, 3 Cal. App.3d 744; 84 Cal. Rptr. 257 (1970).

[80] Carlotto, Ltd. v. City of Ventura, 47 Cal. App.3d 931; 121 Cal. Rptr. 171 (1974).

[81] Myotte v. Village of Mayfield, 54 Ohio App.2d 97; 375 N.E.2d 816 (1977); Accurate Die Casting Co. v. City of Cleveland, 2 Ohio App.2d 386, 442 N.E.2d 459 (1981).

[82] Ward v. City of Charlotte, 48 N.C. App. 463 (1980); Mitchell v. City of High Point, 31 N.C. App. 71 (1976).

[83] See the discussion of voluntarily borne risk in Chapter 2.

[84] Bigelow v. Johnson, 303 N.C. 126 (1981); Wallsee v. Carolina Water Co., 265 N.C. 291 (1965). Most states effectively employ comparative negligence, whereby if a plaintiff is 40% at fault he recovers only 60% of his damages from the defendant (in some jurisdictions if a plaintiff is over 50% at fault he recovers nothing). W. Prosser, Handbook of the Law of Torts, §67 (4th ed. 1971).

a coastal complex, the contractor who builds it, the bank who finances it, and the owner who purchases it are all likely to be aware of the general hazards of coastal development, and may even be aware of site-specific dangers if this information is available. Thus, in many or even most cases, where negligence or fault has contributed to losses from coastal hazards, the fault belongs to the injured parties themselves.

If contributory or comparative negligence winnows out builders, developers, and owners of coastal properties, who is left as a potential plaintiff to sue local government? One possibility is the adjacent landowner or resident who suffers injury from beach erosion, wave action, or other gradual coastal processes as a result of development activity sanctioned or undertaken by the local government. Another likely possibility is a second buyer, renter, or guest, or a successor in title to the original developer or owner who takes possession with little or no knowledge of the vulnerability of the property to catastrophic or gradual coastal hazards. One commentator states that the recipient of a development permit would be barred by contributory negligence from bringing suit against the issuing government, but his successór in title could maintain an action.[85]

However, for the conduct of private parties to be considered contributorily negligent, they must act unreasonably in the face of some actual or constructive knowledge of the coastal hazard risks. Individual landowners and even developers are not accustomed to taking all the risks of a site upon themselves, but are used to relying on arguably proprietary government functions such as hurricane warnings and weather forecasts, flood hazard maps, and structural hazard mitigation programs to help protect them

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[85]Platt, supra at 307.

from coastal dangers. Consequently, local governments may want to require developers and buyers to sign disclaimers of government liability. "Such disclaimers can help reduce potential liability suits by successors in title to the permittee although disclaimers are no panacea, particularly where negligence is involved."[86] A more effective strategy would be to require the investigation and disclosure of hazards to investors, borrowers, purchasers, and residents of potential coastal hazards at particular sites, to put potential plaintiffs on notice of the risks they are encountering.[87]

II. Theories of Liability

If potential storm-damaged plaintiffs could surmount the obstacles of the Act of God notion, sovereign immunity, and contributory negligence, how would they formulate their legal claims? The legal theories which have been and might be applied to coastal hazard liability suits can be divided into two broad classifications: liability without fault, predominantly inverse condemnation; and negligence, or fault-based liability. These doctrines tend to overlap when applied to actual fact situations, and their coastal incarnations are often speculative extrapolations from inland contexts. There are very few cases in which local governments have been sued for coastal hazard damages, and the similar cases which do exist tend to involve periodic riverine flooding and drainage systems.[88] These precedents, however, lack only imaginative litigants and jurists to apply them to the coastal environment.

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[86]Kusler, supra at 121.
[87]Hildreth, supra at 1379.
[88]Platt, supra at 300.

A. Liability without Fault: Inverse Condemnation

As its name suggests, inverse condemnation is a cause of action for a property owner whose property rights have been impaired or destroyed--"taken" or condemned--by government without paying for it first as provided for in state and federal constitutions' just compensation clauses.[89] Since inverse condemnation is a constitutional cause of action and necessarily involves deliberate, discretionary government policy, sovereign immunity is generally not applicable. The Fifth Amendment and the "law of the land" clause are basic limits on the power of government, since government can only regulate and not take private property under the police power. Whether a land use or development management regulation amounts to a compensable taking or is a valid, noncompensable exercise of the police power is a question that defies easy categorization and provides perennial fodder for litigation. Consequently, local governments, especially those in areas like the coast which have tried to limit or manage development, are very familiar with inverse condemnation as a means to challenge development management as a regulatory taking.

Inverse condemnation liability can arise when government promotes or facilitates development which later causes permanent, physical injury to private property. Most inverse condemnation cases are inland, involving either physical appropriation of property or the diversion of floodwater onto it by government public works, usually road or highway construction. However, North Carolina boasts one of the few reported cases where government was sued for actual coastal hazard damage, Midgett v. N.C. State Highway Commn., 260 N.C. 241 (1963) (Midgett I), which established the contours of North Carolina's inverse liability doctrine.

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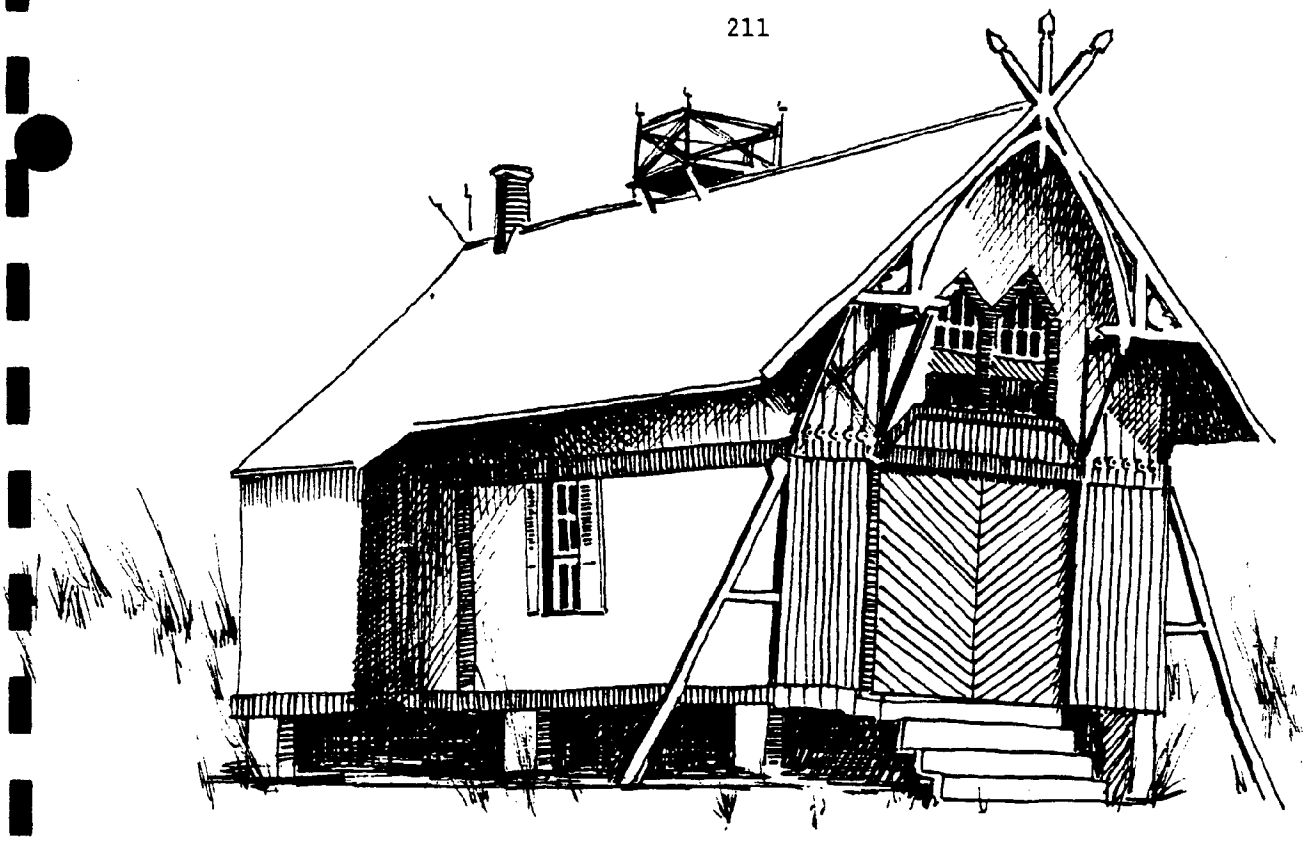
[89] D. Mandelker, Land Use Law §8.19 (1982).

Midgett originated in the Ash Wednesday Storm of March 1962. The plaintiff, a Nags Head landowner, claimed that the State's construction of an elevated roadway on the soundward side of his property formed a dam which kept storm overwash from draining away, thus taking his property by creating a permanent, intermittent floodway. The State's demurrer was sustained at trial, but the Supreme Court held that the plaintiff had stated a cause of action in inverse condemnation. According to Midgett I, the plaintiff could recover damages for a taking if he could show that the flooding was reasonably foreseeable and directly resulted from a permanent structure built by the government. The right of natural water overflow was a property right, which, if interfered with as alleged, would amount to a taking as a permanent nuisance.

Unfortunately for Mr. Midgett, upon retrial he was nonsuited and appealed again to the State Supreme Court. The court found, in Midgett v. N.C. State Highway Comm'n., 265 N.C. 373 (1965) (Midgett II), that the plaintiff had made a prima facie case that the storm overwash and the subsequent damages were foreseeable and not an Act of God, but had not shown that the construction of the highway had actually caused substantial, permanent damage to his property. It turns out that drainage culverts under the highway had been blocked with debris at the time of the storm, and the Court suggested that, unless the drainage system was inherently insufficient as constructed, the plaintiff had suffered no taking but a "mere injury" through the negligent omission of state employees in not cleaning out the culverts, for which the State was not then liable under the Tort Claims Act.

A more recent case has refined and updated the inverse condemnation doctrine, though in an inland flooding context. In Lea Co. v. N.C. Board of Transportation, 308 N.C. 603 (1983), the plaintiff owned an apartment complex



near an interstate interchange which backed up floodwaters and damaged the property. In affirming the plaintiff's condemnation judgment, the Court reinforced Midgett I's holding that an easement for periodic flooding can be a taking, and found that the plaintiff had demonstrated that the flood damage--up to the 100-year flood level--was a direct and foreseeable result of the road construction.

As the cases demonstrate, there are two key elements in a North Carolina inverse condemnation suit: foreseeability and causation. A hypothetical coastal plaintiff must be able to show that hazard damage to his property was the reasonably foreseeable result of government activity. Given the sophistication of hurricane forecasting, hazard mapping, and coastal hydrography, not to mention empirical experience with storm-wrought devastation, it should not be too difficult to demonstrate that most if not all of the damage resulting from coastal hazards is reasonably foreseeable by a local government. In fact, the Lea Company court determined that the

widespread use and recognition of the 100-year flood concept rendered the 100-year flood level foreseeable as a matter of law, so that a government defendant would be deemed to understand the dangers of a 100-year flood, even if it had no actual knowledge. By contrast, the decision also held as a matter of law that flooding above the 100-year level was too remote and speculative to be foreseeable.

Proving causation presents the potential plaintiff with a harder nut to crack. In the context of a hurricane or other coastal hazard, it is not easy to segregate damage caused by government projects from the overall havoc of the storm. The showing of proximate cause will always present a difficult set of obstacles for a plaintiff damaged by a natural hazard, especially where the hazard was widespread and affected many people, while the damage was randomly concentrated on a few specific people and properties. Nonetheless, governments cannot be liable for any proportion of damages beyond that which they have been proven to cause.[90] In the Lea Company case, the trial court found that flood damage resulting from waters up to the 26-year flood level would have occurred anyway, while the inadequate highway culvert was responsible for causing flood damage from the 26-year to the 100-year flood levels.

Inverse condemnation suits could become more of a threat to coastal governments if California inverse condemnation doctrines were more widely applied. In a line of cases beginning with Albers v. County of Los Angeles, 62 Cal.2d 250, 42 Cal. Rptr. 89 (1962), the California courts abandoned the foreseeability element and held local governments liable for property damages which happened to result from a conjunction of natural hazards and public

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[90]See City of Kings Mountain v. Goforth, 283 N.C. 316 (1973).

works, in a standard approaching strict liability. For instance, local governments have been held liable in inverse condemnation for such acts as approving subdivision plans in Sheffet v. Los Angeles County, 84 Cal. Rptr. 11, 3 Cal. App.3d 720 (1970), and Blau v. City of Los Angeles, 32 Cal. App.3d 77, 107 Cal. Rptr. 727 (1973), where the street pattern in Sheffet resulted in the flooding of the plaintiff's land and in Blau was said to have caused a landslide. The local government can be liable for increased risk resulting in eventual property damage even if the risk was unforeseeable and the government used all reasonable care, because "The traditional tort concepts of foreseeability and fault have been eliminated from inverse condemnation actions."[91]

According to the California doctrine, a local government engaged in construction, infrastructure improvements, or any form of physical development takes a "calculated risk" that no damage to private property will result. If damage does result, and if the government action is a proximate cause, the government is liable. Though the factual backgrounds of several inverse condemnation cases resemble negligence, courts have considered property damage to result from the normal operation of public improvements rather than negligent maintenance or repair in order to enable recovery by injured property owners.[92]

To apply the California doctrine to coastal hazards, if the government approved a subdivision, as in Sheffet and Blau, where the plan involved dune leveling, canal construction, or other alterations increasing the chances of overwash and storm surge damage in the event of a hurricane, the government

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[91] Yee v. City of Sausalito, 141 Cal. App.3d 917,921 (1983).

[92] For a discussion, see Blatt, The Shadow Before the Storm, supra, pp. 21-28 and cases cited therein.

would assume the calculated risk that a storm large enough to cause substantial damage will not strike. If the hurricane does in fact strike and the development configuration can be shown to have been a proximate cause of damage to other property, the government would be liable. The developer and builder of the subdivision, by contrast, as private parties could only be liable for negligent damage to other property (unless nuisance or trespass were somehow applicable).

If the inverse condemnation theory is taken to its logical coastal conclusion, any local government which approved, permitted, contracted for, constructed, or was in any other way involved in coastal development which can be shown to have contributed to natural hazard damage would be forced to compensate the injured landowner. Even in North Carolina, any coastal public works or infrastructure which have the potential for increasing the foreseeable risk of natural hazard damage (to the extent of being a legal proximate cause) could be the basis for liability in inverse condemnation. For instance, a municipal seawall or groin which erodes an adjacent landowner's beach would create an inverse condemnation claim for the value of the lost beach, even though the construction of the seawall was entirely reasonable and worth far more to the public as a whole than the value of the landowner's private cost.[93] However, the North Carolina courts seem far less hospitable than their California brethren to natural hazard inverse condemnation claims, and are likely to require strong showings of both the foreseeability of the damage and its proximate causation by the government improvement.

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[93] C.f. Carolina Fishing Pier, Inc. v. Town of Carolina Beach, 277 N.C. 297 (1970), where the town's construction of a berm might have given rise to a suit in inverse condemnation had the plaintiff actually held title to the disputed property.

The two other forms of liability without fault, trespass and nuisance, also involve only damage to property. Trespass is the actual physical invasion of another's property, while nuisance is the unreasonable interference with the use and enjoyment of another's property.[94] The North Carolina courts have indicated that neither of these common-law causes of action are available against local governments; where property damage such as creating a floodway easement would be trespass as against a private party, an action against a government defendant must sound in inverse condemnation.[95]

B. Negligence

Since inverse condemnation for natural hazard damage may not be very significant outside California, most analysts of local government liability for coastal hazard damage have focused their attention on negligent torts.[96] Aside from the essential element of fault, coastal hazard liability in the negligent tort framework has two features which set it apart from inverse condemnation and other aspects of liability without fault. First, sovereign immunity, to the extent it has survived Tort Claims Acts and the governmental/proprietary distinction, is still applied extensively, and almost exclusively, to tort claims. Secondly, tort liability is not restricted to damage to property. Local governments could conceivably find themselves liable for causing personal injury and even death, for even with the best prediction, evacuation, and mitigation plans, the possibility of hazard-

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[94] Prosser, supra §§13, 86-91.

[95] City of Kings Mtn. v. Goforth, supra; Lea Co. v. N.C. Board of Transportation, supra; Ward v. City of Charlotte, 48 N.C. App 463 (1980).

[96] "Negligence--Are You Guilty," 12/23 the Flood Report, Vol. 1, No. 5, p.1; Kusler, supra; Platt, supra; Conference Report, Legal Issues in Emergency Management, supra.

related fatalities is real.

1. Elements of Negligence Liability

At the basic conceptual level, the tort of negligence has three elements: a legal duty or standard of care owed by the defendant to the plaintiff, the defendant's breach of this duty, and the breach proximately causing damage to the plaintiff.[97]

Insofar as they are not immune, local governments, like other legal persons, owe a duty of reasonable care under the circumstances. But to whom the duty is owed and how far it extends are critical limitations. The concept of foreseeability is applied to keep everybody from being liable to everyone for everything, and it could be used to restrict government liability for coastal hazard damage. "There is no negligence in the air, so to speak," said Justice Cardozo in the famous Palsgraf case, meaning that the duty of care and thus liability could only extend to persons and things that would be foreseeably injured by the defendant's conduct.[98] A local government owes no duty to protect its citizens against a completely overwhelming and unpredictable coastal hazard--one which would constitute an Act of God in the traditional Midgett I sense--but, as this Guidebook demonstrates, most coastal hazards can be anticipated and planned for.

This raises the question of when a duty of care is imposed by the law of negligence. Two exceptions have largely swallowed the traditional rule that there could be no liability if a government undertook no action. First, the theory of the Restatement of Torts §323 and its specific application in riparian law (once a government has undertaken a flood control project, it

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[97] Prosser, supra §30.
[98] Palsgraf v. Long Island RR. Co., 248 N.Y. 339, 162 N.E. 99 (1928).

must exercise due care) may establish a duty on the basis of the government's conduct in operating flood control and other public works projects.

Secondly, local government may be under a mandatory statutory duty to implement hazard mitigation, which automatically negates the governmental discretion aspect of sovereign immunity and may render a local government subject to the standard of reasonable care.[99] The origin of such a duty might be found, for example, in CAMA's requirement that local plans and permits conform to state guidelines,[100] in state laws requiring the development of a building inspection program,[101] or even in the land use regulation conditions attached to participation in the National Flood Insurance Program.[102] State-mandated coastal programs can help bolster local land-use restrictions against takings challenges,[103] but if state standards and guidelines are not followed, the local government's neglect could be actionable as a proximate cause of increased exposure to coastal hazards.[104] Though private parties probably cannot directly force local governments to comply with CAMA, noncompliance with statutes and regulations can at least be evidence of negligence or unreasonable conduct if lives and property are damaged as a result.

For a person injured by a coastal hazard to recover from a local government, he must prove not only that the government owed him a duty, but that the duty was breached, causing him injury. The breach of a duty of due

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[99] Schwartz, supra at 18; Hunter, supra; Kusler, supra at 120.

[100] N.C.G.S. §113A-108.

[101] N.C.G.S. §§160A-411 et seq.;153A-350 et seq.

[102] The extent to which the NFIP regulations create a binding legal obligation, either in tort or contract, was at issue in the U.S. v. Parish of St. Bernard case, 756 F.2d 1116 (1985).

[103] Ross, "Legal Issues in Land Use," in Legal Issues in Emergency Management, supra.

[104] Hunter, supra; Kusler, supra at 118-119.

care, or fault, requires that the government defendant do something wrong, and unreasonably wrong as measured by the appropriate standard of conduct (usually the "reasonable man" standard, or what a reasonable person would do under the circumstances in question).

What standards would courts use to assess a local government's reasonable conduct in coastal management or in implementing a statutory duty to mitigate coastal hazards? If they analogize from what a reasonable government would do under the circumstances, the courts might look at such factors as CAMA guidelines, NFIP regulations, practices in other coastal communities, and the defendant jurisdiction's own plans and regulations, to give content to the reasonableness standard. Consequently, governments may need to think twice before consigning consultants' reports, development guidelines, and the like to the usual round file, for such documents (in addition to placing the government on notice of the extent of potential hazards and of possible mitigation measures) could be tied into a noose of reasonable care from which to hang the negligent government in a lawsuit.

Consequently, local government negligence liability for damages hinges to a great extent on how much leeway (beyond sovereign immunity) courts will allow for policy judgments on coastal development, and to what extent coastal development management is a technical function to be measured by applying objective standards of reasonableness given by statute or regulation. This question manifestly overlaps with the governmental/proprietary dichotomy of sovereign immunity and cannot be answered in the abstract. The binding legal standard of care to which coastal governments can be held will have to await developments in future coastal liability litigation.

In addition to proving unreasonable conduct, which the inverse condemnation plaintiff need not do, the negligence plaintiff must bear the

same burden of showing causation. The injured party must show that the government's negligent conduct--for example, not warning of the extent of a storm hazard or allowing overbuilding in a sensitive area--was the proximate cause of his injuries. For instance, a plaintiff would have to show not only that his property would not have been damaged if the government had enforced setback and elevation requirements on the developer, or that he would have been able to leave the danger zone in time if the government had not permitted development which overloaded the capacity of evacuation routes, but that government negligence substantially contributed to his injuries.

A government defendant, on the other hand, would probably respond that there was no proximate or logical causation; that even if it was negligent, the plaintiff would have suffered damage anyway. Jefferson Parish, Louisiana, has succeeded with this very argument, convincing an appellate court that any negligence it or the developer may have committed was causally overwhelmed by unusually severe flooding in an Act of God.[105]

It may be possible to better understand the interactions between the elements of a negligent tort and potential coastal factual situations by examining three likely hypothetical contexts for local government hazard damage liability: a negligent failure to warn, negligence involving public infrastructure or development projects (including negligent construction and maintenance), and negligent permitting or approval of a private coastal development which increases exposure to natural hazards.

2. Negligent Failure to Warn

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[105] Gabler v. Regent Development Corp. et al., 470 So.2d 149 (La. App. 1985), cert. den., 476 So.2d 346 (La. 1985).

A negligent failure to warn of the existence or extent of natural dangers is probably the most likely situation for coastal government liability, and can be further divided into two stages--failure to warn the general public of a specific imminent hazard (such as an approaching hurricane), and failure to warn specific parties of the general risk of natural hazards in a particular location.

In the first sense, many governments have already assumed a duty of providing hurricane warnings and flood evacuation plans and programs. In implementing this duty, they must exercise reasonable care, while considering that weather and hazard forecasting are still an inexact science.[106] The problem of to whom the duty is owed raises the question of the foreseeability of the injuries resulting from a failure to warn. Plaintiffs would generally have to prove that they specifically relied on the government's warning or lack thereof, and that the government knew of their reliance.

It may seem difficult to make such a proof in practice, but it has been done. The lead case in the area of failure to warn of an imminent hazard is probably the oft-criticized Connelly v. State.[107] In Connelly, the plaintiff, a marina owner on the Sacramento River, phoned the State Department of Water Resources for information on expected flood levels, indicating that he would secure his boats so as to be safe at that water level. The Department gave the owner incorrect information, the higher-than-expected floodwaters damaged his property, and he brought suit alleging negligence. The California Appellate court overruled the trial court's sustaining of the the State's demurrer and held, over a vigorous dissent, that the general public duty rule did not bar Connelly's claim since he specifically relied on a government

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[106] See Wendell, supra.
[107] 3 Cal. App.3d 744, 84 Cal. Rptr. 257 (1970).

warning. Moreover, neither did governmental immunity bar his claim, since, once the State had undertaken the policy decision to furnish flood warnings, the negligent administration of the program was actionable under ordinary negligence principles. Though Connelly was allowed to proceed with his negligence claim, he lost on retrial, and the case is sometimes considered an anomalous aberration.[108]

However, another Western state court found a similar cause of action to exist in Brown v. McPherson's, Inc., 86 Wash.2d 293, 545 P.2d 13 (1975). In that case, the plaintiffs sued a developer and real estate broker as well as state officials, claiming that the state officials had negligently withheld information that the development was in a high-risk avalanche area, causing the broker and dealer to believe that there was no danger, and separately inducing a concerned outside avalanche expert to assume that the state would deliver a warning. The trial court dismissed the claim against the state, but the Washington Supreme Court reversed the dismissal in a 5-4 decision, holding that the state could be sued for negligence, including inducing reliance by the avalanche expert on the state's assurances, once the duty to give a warning was undertaken.[109]

More recently, a federal district court has held the National Oceanographic and Atmospheric Administration liable for the deaths of fishermen who had ventured out into a storm in reliance on a faulty weather forecast.[110] In a suit brought under the federal Suits in Admiralty Act (as opposed to a state wrongful death statute), the court found that NOAA had undertaken a duty under Restatement §323 to provide weather forecasts and had

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[108] See Schwartz, supra at 24-5.
[109] For a discussion see Schwartz, supra at 24-5.
[110] Brown v. U.S., 599 F.Supp 877 (1984).

negligently breached this duty by failing to repair a data-transmitting buoy, thus proximately causing the mariners' deaths.

The controversial nature of these few warning cases indicates a judicial reluctance to impose liability for an inherently inexact state of knowledge, but it also reflects an extreme reluctance to burden emergency management activities with the specter of legal liability--a policy argument which will carry even more weight if more governments begin to be held liable in increasing numbers.[111] But from a local government perspective, liability for weather forecasts and predictions of imminent hazards conditions is not a real problem since those aspects of emergency management are commonly dealt with at the state or federal levels of government, as in the three cases above.

However, the existence of Connelly, Brown v. McPherson's, and Brown v. U.S. portends the possibility of tort liability for more focused local emergency management activities such as the evacuation of hazardous areas. The most likely such situation is the negligent conduct or implementation of an evacuation plan, where personal injury and wrongful death could arise and ordinary negligence principles and familiar standards of care could be applied.[112] Such situations could include the police and fire departments forgetting to check to see that no one remained in certain isolated houses, misdirecting traffic to underwater roads, or failing to barricade dangerous areas.

The familiar and tractable negligence applications in the context of conducting evacuations opens up a larger area of potential liability. Just as evacuation conduct and procedures are to a large extent subject to standard

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[111]Hogan, "Overview of Legal Issues in Emergency Management," in Legal Issues in Emergency Management, supra.

[112]Wendell, supra.

operating procedures and ascertainable standards of care, overall coastal area hazard prediction and planning has reached a level of sophistication which may allow negligent tort liability to be imposed for such things as overloading the evacuation capacity of coastal areas through overdevelopment. Carrying capacity studies and similar analyses have frequently been used to calculate the maximum population densities and levels of development which will allow a population to be safely evacuated in the event of a hurricane, given a normal warning time.[113] In some places such as the Nags Head area, the population of a barrier island or other isolated coastal area may already strain or exceed the estimated evacuation capacity.[114] If a local government, relying on inadequate evacuation plans and ignoring carrying capacity constraints, allows increased population through overdevelopment, it may actually be taking an unreasonable risk with the residents' lives.

An equally significant possibility is liability for failure to disclose the general dangers of coastal hazards at a specific site. Just as the implied warranty of habitability and other doctrines protecting buyers have replaced caveat emptor,[115] local governments may also have a duty to disclose the range of potential coastal hazards to developers and residents at a particular location. A necessary precondition to claiming contributory negligence and assumption of risk is to make builders and owners aware of the hazard risks. If potential plaintiffs are not made aware, they can claim that the governments negligently failed to disclose significant risks, thus

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[113]See the evacuation capacity studies discussed in Chapter 4. See also Dept. of City & Regional Planning, Currituck County Outer Banks Carrying Capacity Study (1983), and A Carrying Capacity Study of Hatteras Island (1984), Chapel Hill, N.C.: University of North Carolina.

[114]Town of Nags Head, 1985 Land Use Plan Update, Ch. 7.

[115]Hildreth, supra at 1373; Platt, supra at 301-2.

inducing them to build in a vulnerable location which they otherwise might have avoided, consequently causing them injury.

Local governments can no longer claim that it is none of their business if a developer wants to take the risk of encountering coastal hazards because the developer may not understand the risk as well as the government does.[116] At a minimum, local governments seem to owe a duty of disclosure, arising from their greater access to knowledge about coastal hazards and mitigation measures. This type of negligent failure to disclose a known risk has arisen in California inverse condemnation cases[117] and can be analogized to the Brown v. McPherson's case, where the government knew about the potential avalanche danger.

The duty of disclosure can be easily met at little cost to the local government by recognizing high-risk zones in official land records[118] or by requiring developers or permit applicants themselves to investigate site-specific hazards.[119]

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[116]Kusler, supra at 121; Richman, "State/Local Cases in Tort Claims," in Legal Issues in Emergency Management, supra.

[117]"Storm-Torn Coast," supra.

[118]Hildreth, supra at 1379. See also Model Amendments §4(c), Appendix II.

[119]The owners of bluff-top land in Kopetzke v. County of San Mateo, 396 F.Supp 1004 (N.D. Calif. 1975) found that the facts disclosed by their investigation would make their property unmarketable--the cost of developing according to applicable standards would cost more than the land was worth--and they sued in inverse condemnation. The federal district court rejected the takings claim, stating, "To the extent plaintiffs' losses result from any inherent geologic defects in their properties, the ancient rule of caveat emptor must apply. And to the extent their losses result from the regulatory activities of the Board based on the geologic findings of the [consultant's] report, they constitute the unequal burden which citizens are frequently called upon to bear in the interests of the general welfare(citation omitted)." 396 F.Supp at 1010. More importantly, had the plaintiffs gone on and developed the property, and later suffered natural hazard losses, the County would have been insulated from liability by the owners' contributory negligence.

3. Negligence in Public Works

The second likely context of coastal hazard negligence liability is the construction, maintenance, and inspection of public works or facilities. Holding local governments liable for improperly constructing or maintaining jetties, seawalls, beach nourishment, and dredging channels is a natural coastal counterpoint to the inland flood control jurisprudence which holds governments liable for negligent flood control projects.[120]

It is important to remember that the standard of conduct to be applied to local government infrastructure may be judicially supplied by reference to NFIP flood zone construction standards, state coastal statutes and regulation, the practices of other coastal communities, and a local government's own coastal management and development plans. The neglect of such standards was an important allegation in Gabler v. Regent Development Co., 470 So.2d 149 (La. App. 1985), and in St. Bernard Parish. In Gabler, the trial court overcame all the obstacles of contributory negligence, sovereign immunity, and uncertain causality to find Jefferson Parish and the developer liable in tort for hurricane-related flood damage to private property. However, the Louisiana Appellate Court overturned the verdict, finding that the flooding was an overwhelming Act of God. Consequently, the negligence of the developer

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[120]See, e.g., Lea Co. v. N.C. Board of Transportation, 308 N.C. 603 (1983); Ward v. City of Charlotte, 48 N.C. App. 463 (1980); Mitchell v. City of High Point, 31 N.C. App. 71 (1976). California's landmark case, Hayashi v. Alameda County Flood Control District, 167 Cal. App.2d 584, 334 P.2d 1048 (1959), involved a landowner adjacent to a levee who warned the flood control district that the levee had been breached. But the district did nothing, and the plaintiff's property was damaged in the subsequent flood. The court held that the defendant could be held liable under the tort claims statute, not inverse condemnation, since the negligent maintenance and disrepair of the levee breached a duty to maintain flood control facilities. It was the negligent breach of an assumed duty, not the deliberate planning of public works, which caused the damage.

could not be a proximate cause of the plaintiffs' injuries, and the Parish was found to be not negligent at all. According to the appeals court, the parish government had made good-faith efforts to improve its drainage systems within the constraints of funding and COE regulations.[121] Moreover, even had the Parish fully adopted the consultant's recommendations which furnished part of the trial court's determination of a standard of reasonable care, it would not have made any difference with such a devastating storm.[122] The Louisiana Supreme Court refused to grant a writ of certiorari, over three dissents.[123]

But the same Parish of Jefferson is not yet off the hook, for it is also a defendant in the $130 million FEMA subrogation suit of St. Bernard Parish. Part of the government's case is based on the NFIP insurance contract between FEMA and the Parishes, but much of it is also based on ordinary negligence in conducting flood control and managing floodplain development, and would therefore establish an important precedent for associating the legal standard of coastal care with NFIP regulations.

4. Negligent Issuance of Permits

One count in the St. Bernard Parish suit is based on the third major context for local government coastal liability, negligent or improper permitting of coastal development. As this case shows, negligent permitting of development overlaps with failure to disclose hazards and the negligent operation of public facilities. Holding local government liable for issuing permits alone has been considered problematic, but some cases have hinted that

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[121] 470 So.2d at 160.
[122] 470 So.2d at 161-2.
[123] 476 So.2d 346 (1985)

it might be possible.[124] If a local government tried to avoid hazard liability by letting developers worry about coastal hazards and giving only a cursory inspection to development plans, the government might be liable for increasing the exposure of persons and property to a known risk, even if the developers are also aware of the risk. Governments owe a duty of reasonable care in regulating development, aside from full disclosure of hazards, so that in allowing a development known to be hazardous (even if the developer knows it too) would be actionable by later residents or adjacent landowners unaware of and exposed to the coastal hazard risk.

C. FEMA Subrogation

The importance of the St. Bernard Parish case warrants a separate discussion of the possible effects of the subrogation claim as an adjunct to local government negligence liability. An injured person or property owner is not the only person with standing to bring a damage suit. If the plaintiff is insured, the insurer can pay off the claim and then sue the responsible party itself in order to recoup its claim payment. The insurer as subrogee is said to step into the shoes of the insured, inheriting all appropriate causes of action, rights, and remedies while subject to all defenses, such as contributory negligence, which would have been good against the insured.[125]

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[124]Kusler, supra; Platt, supra at 307-8; County of Clark v. Powers, 96 Nev. 497, 611 P.2d 1072 (1980). One North Carolina case, Phillips v. Hassett Mining Co., 244 N.C. 17 (1956), in holding that the issuance of a state permit did not absolve the mining company from liablity for flood damage caused to another landowner, stated, "The General Assembly is without authority to take the property of one citizen and give it to another for private gain." The question of whether the government itself would be liable for damage resulting from the issuance of a development permit is an open question.

[125]Scheibel, supra.

The federal government, as an insurer under the NFIP, is suing the Louisiana Parishes as the subrogee of insured individuals. Until recently, FEMA had been reluctant to enforce NFIP conditions by suspending noncomplying governments from the program, thus injuring individual homeowners through denial of insurance coverage.[126] Consequently, as flood insurance claims payments became an increasing drain to the Treasury in an era of budget deficits, not to mention the continuing exposure of more people and property to coastal hazards, FEMA decided to counterattack the local governments directly.[127]

In 1981 the federal government initiated the first in a series of suits which grew to comprise a consolidated $130 million claim in damages against the Louisiana Parishes of Jefferson and St. Bernard, as well as the state, associated levy districts, and various builders, engineers, and surveyors.[128] The government claimed that the Parishes had exacerbated damages in four separate flooding events (including the overwhelming "Act of God" at issue in the Gabler case) through such transgressions as the negligent planning and design of drainage systems, failure to correct known defects, alterations which made drainage worse, violations of NFIP regulations, failure to inspect and maintain drainage systems, and the negligent approval of new development in areas known to be subject to flooding.[129]

The suit was not just a subrogation of tort claims, however; the government also claimed the breach of a contract based on the NFIP regulations[130].

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[126] Scheibel, supra at 17.

[127] Scheibel, supra at 12-13. Flood insurance claims are thought to be 75% subsidized by general federal revenues, with only 25% of the costs covered by premium payments.

[128] 756 F.2d at 1119; Justice Dept. Petition for Rehearing en banc in U.S. v. Parish of St. Bernard, May 21, 1985, at 4.

[129] Scheibel, supra at 13.

[130] FEMA also asserted a nuisance claim which was dropped on appeal. 756 F.2d 1119.

> The conditions which the Parishes were alleged to have breached were two in number. First, they failed to implement and enforce the specific land use and control requirements which they had obligated themselves to enforce. As a result, a number of buildings were built below the flood level elevation requirements which the Parishes promised to meet. Secondly, even more specifically, the Parishes failed to carry out unequivocal promises concerning the establishment of adequate drainage systems involving pumps, canals, levies, and culverts.[131]

On the basis of this breach of contract, FEMA sought a mandatory injunction which would force the Parishes directly to adopt sound flood control policies. The contract claims and its associated injunctive remedy were the government's major hope from the start, because the subrogation remedy to recover money damages in tort would not accomplish the goal of NFIP compliance and would be harder to win at trial due to problems of proof.

After a complicated series of legal maneuvers, U.S. v. St. Bernard Parish eventually reached the Fifth Circuit Court of Appeals for a decision on the legal remedies available. The Court of Appeals held that the FEMA had no right under the NFIP and could not pursue a contract claim. Subrogation, however, was endorsed as a viable cause of action, over the Parishes' objections.[132] FEMA was disturbed by the loss of its most promising legal theory, and both the federal government and the Parishes petitioned unsuccessfully for a rehearing en banc. The Parishes, not willing to face even subrogation liability, then petitioned the U.S. Supreme Court for certiorari--which was denied--while the government decided not to seek review of the contract issue.[133]

As it stands now, the federal government cannot sue local government directly to force compliance with NFIP regulations, but can proceed in

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[131] 756 F.2d at 1129 (Williams, J., dissenting).

[132] 756 F.2d 1116. The dissenter on the three-judge panel thought that the Parishes were liable for breach of contract, but that no injunctive relief was available since FEMA could simply drop them from the program. 756 F.2d 1128-30.

[133] Parish of St. Bernard v. U.S., cert. den., 106 S. Ct. 830 (1986).

subrogation. St. Bernard Parish will now either be settled or go back to the District Court for trial on the tort issues of negligence and causation, which carry their own set of uncertainties. The enforcement tools left to FEMA are at this point twofold: it can suspend noncomplying communities from the program, or it can seek out noncomplying communities which have suffered flood damage, sue them each, and try to prove specific elements of negligence and causation for each case. The complexity and cost of hurricane damage negligence litigation, the case-by-case variations in factual situations and legal rules,[134] and the uncertainty of recovery mean that subrogation is not likely to be an effective remedy for nationwide program enforcement.

CONCLUSION

Local governments can never be absolutely certain that their coastal hazard mitigation measures are immune from legal challenge, either before or after the storm. Nonetheless, a hazard mitigation strategy firmly based on appropriate technical data and tested legal techniques will find strong judicial support against constitutional attack and damage claims. It is possible to steer clear of both horns of the liability dilemma, but only if local governments are aware of the legal as well as the natural constraints on coastal development and development regulation.

On the one hand, hazard mitigation measures can restrict the development, use, and value of private property in an effort to protect the whole community from coastal storms. The property owner may seek to have the local ordinance invalidated on statutory or constitutional grounds or seek damages for a

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[134] 2,508 local governments are estimated to have jurisdiction over coastal shorelines, including the Great Lakes. Platt, supra at 299.

regulatory taking. However, the constitutionality of land use regulation has long been established, and the judicial construction of development management is fairly well settled. Under most circumstances, given the intrinsic importance of coastal hazard mitigation and CAMA's regulatory mandate for mitigation planning, courts will uphold any reasonable local ordinances under the rational basis test.

On the other hand, the prospects for local government liability for storm damages are much less certain. Many writers on the liability issue sound notes ranging from cautious warning to alarm. Governments are told that they must take measures now to protect themselves against the specter of liability, since possible future suits cannot be avoided by doing nothing. ". . . can you take reasonable steps to prevent damage? If you can and you don't do it, you're going to be negligent, and <u>this is one of those cases where government inaction can lead to liability!</u>"[135]

But despite the dangers of liability awards at a time of municipal insurance crises and tight budgets, government liability for coastal hazard damage does not seem imminent. The North Carolina courts have not decided any cases which are directly on point, so that potential plaintiffs would have to blaze a new trail and surmount many existing legal and factual obstacles in order to collect. Before even being allowed to present their case, plaintiffs must overcome the barriers of Act of God, sovereign immunity, and contributory negligence. They must then prove that some government act or omission proximately caused their injuries and establish the legal elements of the appropriate cause of action.

Finally, even if a local government were permitted by the CAMA and NFIP regulations to "do nothing," it can still take fairly modest measures which

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[135]Richman, <u>supra</u> (emphasis in original); Kusler, <u>supra</u>; Platt, <u>supra</u>.

may fully or partially insulate it from constitutional challenge and damage liability. For instance, instead of trying to assess and balance the risks of increased development, local governments may be more inclined to try shifting the risk onto the private sector. Proposals such as requiring disclaimers[136] and mandatory hazards disclosure in advertisements, sales contracts, and land records are aimed at forcing developer, builder, and buyer to make the calculation of what is "reasonable" themselves, and at little or no cost to the local government. This information dissemination strategy can help establish a possible contributory negligence defense for later litigation, as well as providing a factual basis for restricting hazardous developments.

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[136]See N.C. Division of Emergency Management Model Flood Damage Prevention Ordinance, Article 3, §G, Warning and Disclaimer of Liability, Appendix II.

Chapter 8

Concluding Notes

Local coastal governments in North Carolina face many pressures in planning for and responding to growth. Reviewing development proposals, providing sufficient public services for an expanding population, and meeting health, safety, and general welfare requirements all tax the time and attention of local officials. With such insistent daily demands, it is easy to put aside the uncertain and intangible threats of hurricanes. However, hurricanes are a statistical certainty along the North Carolina coast; they are bound to strike somewhere, sometime. Thus, an out of sight, out of mind approach to coastal storm hazard policy is irresponsible and dangerous while the long-term exposure of people and property continues to increase with accelerating coastal development. Planning and policies to mitigate hurricane hazards must precede the storm, or it will be too late.

Moreover, local governments cannot rely on existing state or federal programs to protect their residents' lives and property. True, many existing efforts help soften the hurricane's blow: the North Carolina Coastal Area Management Act regulates development in Ocean Hazard Areas of Environmental Concern, the National Flood Insurance Program protects against property loss, and federal disaster aid helps rebuild communities after the storm. But neither these nor any other state or federal programs have the authority or resources to understand local conditions and meet every local need. CAMA leaves most development decisions in the hands of local government; and federal programs, both for pre-storm flood insurance and post-storm disaster aid, are having their budgets slashed and new strings attached. Unless local governments take an active role in hazard mitigation, the upward spiral of destruction, reconstruction, and destruction will only continue.

This guidebook has advocated a strategy of growth management to mitigate coastal storm hazards. Based on the simple proposition that the people and property associated with new development should be located away from hazard areas, a growth management program is well within the capabilities of every local government and can be tailored precisely to suit local conditions. By using the guidebook, a coastal government can work through the complete process of applying growth management to coastal hazard mitigation and can fully implement the hazard mitigation sections of its CAMA-mandated land use plan.

Though a community's land use plan should already form the basis of any hazard mitigation program, the guidebook provides some basic background on two contexts of policymaking: Chapter 2 presents the natural hazard context of risk assessment, which determines the value a community places on reducing hurricane risks; and Chapter 3 outlines the intergovernmental context of state, federal, and local programs, within which hazard mitigation must fit. Working from this background, communities can then use Chapter 4 to determine the how and where of coastal storm hazards--what areas are subject to flooding, storm surge, and other hazards, and which are most vulnerable and difficult to evacuate.

Once a local government has analyzed what and where its hazard zones are and the degree of development restrictions to be applied to them, it must then develop a combination of instruments to achieve its hazard mitigation objectives. Chapter 5 presents a wide variety of tools and techniques, from the simple and familiar (zoning, subdivision regulation) to the complex and exotic (transferable development rights, performance zoning). Appendix II presents examples of some of these techniques. Most of them are meant primarily to reduce hazard exposure before the storm, but the post-storm

reconstruction period presents particular pressures and opportunities for mitigation. Chapter 6 discusses how local governments can plan in advance to ensure orderly rebuilding and take advantage of post-storm conditions.

In any type of development regulation, legal considerations are never far from the surface. Local governments have often hesitated to restrict or manage growth for fear of legal challenges, but failing to take action may in some cases risk more dangerous challenges. However, a properly designed hazard mitigation program should have nothing to fear from either a "taking" or a liability suit, and Chapter 7 provides a detailed discussion of what situations to avoid.

Though this guidebook is a fairly lengthy reference, the contributors hope that one theme stands out: increasing exposure to storm hazards is not an inevitable cost of coastal development, because a growth management system can help make the North Carolina coast safe for all to enjoy. The guidebook has shown that hazard mitigation is both technically and legally feasible; the rest is up to local communities.

Appendix I

The Nature of Hurricane and Coastal Storm Hazards

I. The Meteorological Event and its Characteristics

A. Nature of Hurricane

A hurricane is a cyclonic storm formed and fueled through the release of latent heat from ocean water condensation.[1] Its primary characteristics are strong circular (counter-clockwise) winds, ranging from 75 mph to as much as 200 mph, and a significant drop in barometric pressure. Atlantic hurricanes (those forming the the Atlantic Basin) generally develop during the period from June to November, with the majority of hurricanes forming in the months of August, September and October (see Figure I.1). The magnitude of hurricanes is rated according to the Saffir-Simpson Scale (see Table I.2) with a category 1 hurricane being the least severe and category 5 the most severe. Between the years 1899 and 1980, there have been 138 hurricanes which have crossed the United States coastline, for an approximate annual average of 1.7.[2] (See Table I.1.) Of these, 56 have been classified as major -- that is, hurricanes which are classified as a category 3 or larger. Florida has received the largest number of hurricane landfalls followed by Texas, Louisiana and North Carolina.

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[1]Robert Simpson and Herbert Riehl. The Hurricane and its Impact. Baton Rouge, LA: Louisiana State University. 1981.

[2]Charles Neumann et al. Tropical Cyclones of the North Atlantic Ocean, 1871-1980. Asheville, NC: National Climatic Center. 1981.

Table I.1

Number of Hurricanes (Direct Hits) Affecting U.S. and Individual States, 1899-1980, According to Saffir/Simpson Hurricane Scale

Area	Category Number 1	2	3	4	5	All	Major Hurricanes (>3)
U.S. (Texas to Maine	49	33	41	13	2	138	56
Texas (TX)	9	9	8	6	0	32	14
(North)	4	3	2	4	0	13	6
(Central)	2	2	1	1	0	6	2
(South)	3	4	5	1	0	13	6
Louisiana (LA)	5	5	7	3	1	21	11
Mississippi (MS)	1	1	4	0	1	7	5
Alabama (AL)	4	1	4	0	0	9	4
Florida (FL)	16	14	15	5	1	51	21
(Northwest)	9	6	5	0	0	20	5
(Northeast)	1	7	0	0	0	8	0
(Southwest)	5	3	5	2	1	16	8
(Southeast)	4	10	7	3	0	24	10
Georgia (GA)	1	4	0	0	0	5	0
South Carolina (SC)	6	4	2	1*	0	13	3
North Carolina (NC)	10	3	7	1*	0	21	8
Virginia (VA)	1	1	1*	0	0	3	1
Maryland (MD)	0	1*	0	0	0	1	0
New Jersey (NJ)	1*	0	0	0	0	1	0
New York (NY)	3	0	4*	0	0	7	4
Connecticut (CT)	2	1*	3*	0	0	6	3
Rhode Island (RI)	0	1*	3*	0	0	4	3
Massachusetts (MA)	2	1*	2*	0	0	5	2
New Hampshire (NH)	1*	0	0	0	0	1	0
Maine (ME)	4	0	0	0	0	4	0

Notes: Asterisk (*) indicates that all hurricanes in this category were moving in excess of 30 miles per hour. (Data derived from Hebert and Taylor (42)).

Source: Neumann et al. 1981.

Table I.2

The Saffir/Simpson Hurricane Scale

Scale No. 1 - Winds of 74 to 95 miles per hour. Damage primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage to other structures. Some damage to poorly constructed signs. And/or: storm surge 4 to 5 feet above normal. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.

Scale No. 2 - Winds of 96 to 110 miles per hour. Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major damage to buildings. And/or: storm surge 6 to 8 feet above normal. Coastal roads and low-lying escape routes inland cut by rising water 2 to 4 hours before arrival of hurricane center. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorages torn from moorings. Evacuation of some shoreline residences and low-lying island areas required.

Scale No. 3 - Winds of 111 to 130 miles per hour. Foliage torn from trees; large trees blown down. Practically all poorly constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. And/or: storm surge 9 to 12 feet above normal. Serious flooding at coast and many smaller structures near coast destroyed; larger structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Flat terrain 5 feet or less above sea level flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of shoreline possibly required.

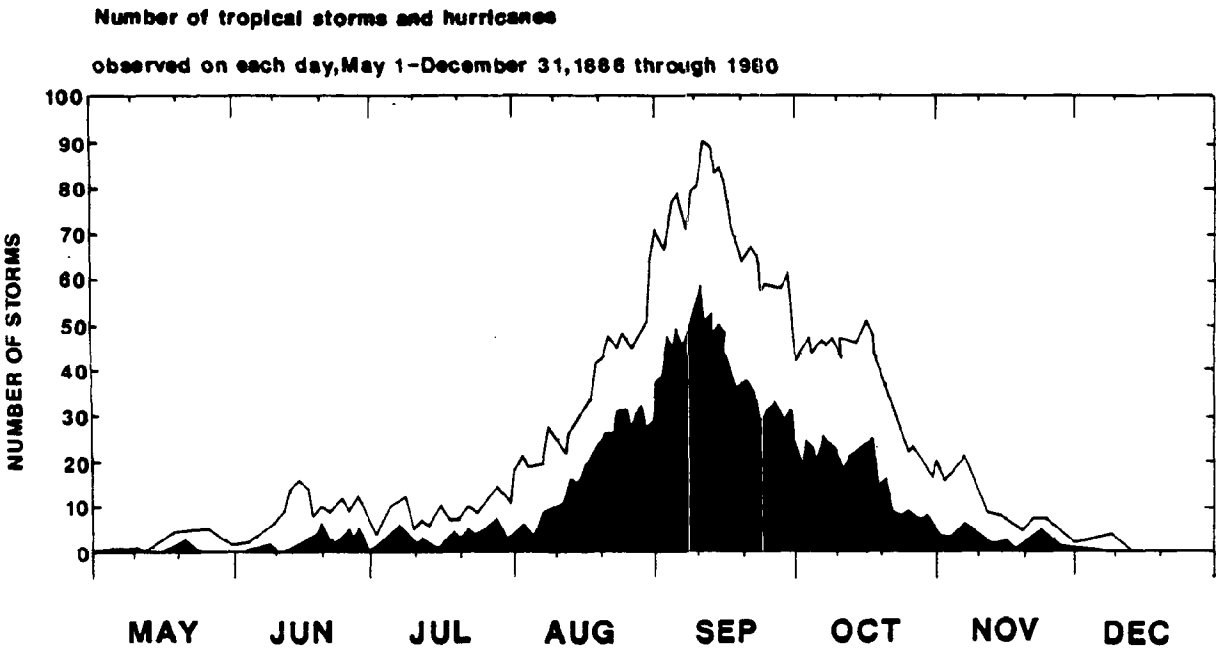
Scale No. 4 - Winds of 131 to 155 miles per hour. Shrubs and trees blown down; all signs down. Extensive damage to roofing materials, windows and doors. Complete failure of roofs on many small residences. Complete destruction of mobile homes. And/or: storm surge 13 to 18 feet above normal. Flat terrain 10 feet or less above sea level flooded inland as far as 6 miles. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yards of shore possibly required, and of single-story residences on low ground within 2 miles of shore.

Scale No. 5 - Winds greater than 155 miles per hour. Shrubs and trees blown down; considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction of mobile homes. And/or: storm surge greater than 18 feet above normal. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Massive evacuation f residential areas on low ground within 5 to 10 miles of shore possibly required.

Source: Charles J. Neumann et al., 1981.

Figure I.1

TROPICAL STORMS AND CYCLONES 1886-1980



Legend

storms and hurricanes

hurricanes

Source: Neumann et al, 1981.

A number of attributes of the hurricane phenomenon influence its effects on the natural and human environments, including: storm intensity, storm speed, storm size, and path or track of the storm.[3] Typically estimated in terms of barometric pressure and wind speed, the intensity of the storm is a critical component for predicting its influence on man. Specific elements of storm intensity include surge flooding, and wave and wind impacts. Each of these is discussed in more detail below. A second attribute is the speed at which the storm is moving. This will have several effects. For example, a faster moving storm may create hazard conditions in a particular location for a shorter period of time, with implications for the vulnerability of people and property. Also, faster moving storm has an influence on wind characteristics, as it increases wind speed in the direction the storm is moving, while decreasing the speed of wind moving in the opposite direction. Storm size is also an important factor and refers to its spatial magnitude. While intensity and size are clearly related, there can be much spatial variation for a given intensity.[4] The size of the storm clearly affects the range and extent of its impact. The orientation of the path of the hurricane to the coastline is also critical to predicting its potential impact, as well as the curvature of its track. A hurricane may strike land from a number of different orientations, with significantly different effects. The track of the hurricane will also have implications for its duration.

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[3]Don G. Friedman. Computer Simulation in Natural Hazard Assessment. Boulder, CO: Institute for Behavioral Science, University of Colorado (1974).

[4]Friedman, supra.

B. Hurricane Forces

1. Winds

High winds is often the first image people have of a hurricane. By definition a hurricane has winds of at least 74 mph, and may reach over 200 mph (see Table I.3). Hurricane-force winds for the average hurricane are approximately 100 miles in diameter and some 350-400 miles across in gale force winds.[5] For instance, Hurricane Hazel of 1954 packed hurricane winds for a diameter of 120 miles and gale force winds (40 mph) for widths of approximately 300 miles).

Wind circulation can be divided into three zones: (1) the outer zone with wind speeds as low as 20-30 mph, extending to within 20- to 30-miles of the center where winds may be as high as 120-150 mph; (2) a region of maximum (and constant) winds surrounding the eye; and (3) the eye itself, which is relatively calm. The average diameter of the hurricane eye is approximately 15 miles, commonly extending to 25 miles in larger, mature hurricanes.[6]

In addition to high sustained winds, hurricanes can generate gusts from 25 to 50 percent higher than sustained levels. As we have said, the highest winds are found in the upper right-hand quadrant of the moving hurricane directly surrounding the storm eye. The magnitudes of wind speed once the hurricane has reached landfall will depend on local characteristics of the natural and built environments. For example, trees and other natural features can slow sustained winds and in turn provide protection for people and property.

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[5]Gordon E. Dunn and Bonner I. Miller. Atlantic Hurricanes. Baton Rouge, LA: Louisiana State University Press.

[6]Dunn and Miller, supra.

Table I.3

Maximum Winds Recorded in Hurricanes

1.	*Jan. 11, 1878	Mt. Washington, N.H.	+186 mph Robinson +140 mph true velocity
2.	Sept. 18, 1926	Miami Beach, Fla.	128 mph for 5 min. 123 mph true 138 mph for 2 min., 132 mph true
3.	Sept. 13, 1928	San Juan, P.R.	150 for 5 min., 135 true; estimated 160, 1 min., 144+ true
4.	*April 12, 1934	Mt. Washington, N.H.	188 mph gusts 229, extreme 231, true 225 mph
5.	Sept. 21, 1938	Milton, Mass.	++121 for 5 min., 186 for shorter period
6.	Sept. 21, 1938	Mt. Washington, N.H.	186 mph
7.	Oct. 18, 1944	Havana, Cuba	163 mph
8.	Sept. 17, 1947	Hillsboro Lighthouse, Fla	155 mph, extreme 121 maximum
9.	Aug. 26, 1949	Jupiter Lighthouse, Fla.	132 mph, extreme 153
10.	Sept. 27-28, 1955	Chetumal, Mexico	175 mph

*The Mt. Washington velocities were not observed during hurricanes
+Extreme
++Probably some orographic effect

Source: Dunn and Miller, 1960.

2. Storm Surge

Storm surge is the most significant effect of hurricanes and the element of a hurricane most responsible for loss of life. The surge represents the "amount of water pushed upwind ahead of a hurricane advancing landward from a large body of water."[7] Surge is created through several key physical effects associated with hurricanes:

1. the pressure effect
2. the direct wind effect
3. the effect of the earth's rotation
4. the effect of waves
5. the rainfall effect.

The pressure effect results from the dramatic reduction in barometric pressure that accompanies a hurricane, causing an upward suction action on sea level. It is estimated that for each inch reduction in barometric pressure, an accompanying foot of sea level rise will result. The direct wind effect is the most significant influence on surge. Hurricane winds generate surface currents that, when confronted by a coastline, create tremendous wind "set-up" effects and result in high surge levels. The extent of this set-up effect is highly dependent upon the configuration of the coastline. For example, the existence of bays and estuaries may serve to "funnel" wind-driven surges, increasing the natural set-up, and creating a "piling-up" effect.[8] Consequently, the shallower the water close to shore, the greater will be the piling-up of surge. Because the area of greatest winds is found in the upper

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[7]Simon Baker. Storms, People and Property in Coastal North Carolina. Raleigh: UNC Sea Grant. 1978.

[8]Don Friedman. "The Storm Surge Along the Gulf and South Atlantic Coastlines." Hartford, CT: The Travelers Insurance Company (1971).

right quadrant of the moving hurricane, the area of greatest surge tends to be from 10 to 35 miles to the right of the hurricane track.[9]

The influence of the earth's rotation in the Northern Hemisphere is to increase any current's movement to the right, and the effects of this factor will depend on the precise configuration of the coastline.

The character of the surge as felt on the coast will be dependent upon a number of factors, including the following:[10]

1. Shoreline configuration
2. existence of bays and estuaries where waters can converge
3. off-shore bottom conditions (bathymetry)
4. land elevation (topography)
5. the characteristics of the storm itself (see previous sections).

It is clear that shore bottom configuration has much to do with the kind of surge experienced, and in turn the type of damages experienced. A sloping seabottom, shallow close to shore, will tend to generate, for example, a high degree of surge run-up. This run-up effect will be even more extensive in circumstance where bays and estuaries exacerbate the run-up by funneling it, thus flooding areas at greater elevation.[11] On the other hand, steeply sloping shorelines, in which water is deeper closer to shore, will reduce the surge run-up effect, but will permit breaking waves closer to shore, i.e., with attendant structural damages to buildings on the immediate shoreline. Land elevation is a key element in predicting extent of surge effect, and where land has been subsiding, for whatever reasons, we can expect more extensive effects. Evidence suggests that sea level has and will continue to rise, making the surge effects of a hurricane even more significant.

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[9] Friedman, "The Storm Surge," supra.
[10] Friedman, "The Storm Surge," supra.
[11] Friedman, "The Storm Surge," supra.

The extent and damage from hurricane storm surge is also influenced by the existence of high or low tide when the storm comes ashore. In areas along the coast where the size of the tide is substantial, this factor can sometimes mean the difference between a minor surge or a devastating surge.

3. Wave Action

Along with storm surge hurricanes can create severe wave action. The effects of waves during hurricanes can be extreme. A breaking wave carries a large momentum and can "run up" on a sloping shore to elevations considerably higher than the height of the wave itself. The extent of wave action will depend on the direction and speed of the wind and upon coastal configuration. The deeper the ocean bottom is close into shore, the greater will be the magnitude of wave action. The height of waves are estimated to be approximately 50% of the depth of the storm surge. For instance with a static storm surge of 8 feet, 4 foot waves could be expected to occur on top of this surge. In this case the total combined surge and wave height would be 12 feet. The influence of waves in generating coastal property damages has in recent years been appreciated. The National Flood Insurance Program now incorporates wave height into its computation of base flood elevations in coastal areas.

4. Rainfall and Inland Flooding

Although hurricanes can vary dramatically in the amount of rainfall they generate, this is an additional hazard associated with such storms. Large amounts of rainfall can induce major flooding in inland areas not otherwise vulnerable to hurricanes and coastal storms. Hurricane Agnes in 1972, for instance, produced tremendous property damage and loss of life in inland areas far removed from the coastline. Hurricane Camille in 1969, left over 100 dead

in Virginia and West Virginia as a result of flash flooding created by its rainfall.

5. Tornados

It is also common for hurricanes to spawn tornadoes. These are most likely to be generated by the forward right hand quarter of the hurricane in advance of the eye. Tornadoes generated by hurricanes are generally less severe than regular tornadoes, and are shorter in duration and involve shorter, narrower paths.[12] Hurricane Beulah holds the record for the largest number of tornadoes generated by a hurricane -- some 115 confined tornadoes in Texas.[13]

II. Effects of Hurricanes on the Built Environment[14]

There would be little cause for concern about hurricanes if not for the location of people and property in the direct path of these natural forces. The hurricane characteristics and forces described above create a number of different forces on buildings and facilities and these are briefly reviewed below.

A. Air Generated Forces Applied to Buildings

Figure I.2 presents graphically the different physical forces created by hurricane winds working against coastal buildings. Two primary types of wind forces depicted are: direct and suction (or negative), each working either

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[12]Joe R. Eagleman. Severe and Unusual Weather. New York: Van Nostrand Reinhold, Company. 1983.

[13]Eagleman, supra.

[14]This section is drawn heavily from John Hodges-Copple, A Review and Analysis of Building Codes and Construction Standards to Mitigate Coastal Storm Hazards. Chapel Hill: UNC Center for Urban and Regional Studies. July, 1985.

laterally (horizontally or sideways) or on roof and floor systems.[15] Direct lateral forces, for example, are those that act on windward (the direction from which the wind is coming) vertical surfaces, such as walls or piles. Negative or suction lateral forces act on the leeward (the direction toward which the wind is blowing) side of vertical surfaces, and also on surfaces which are parallel to the direction of air flow. Forces are also exerted against interior walls as a result of rapid drops in outside air pressure (not illustrated on Figure I.2).

Wind forces can also lead to the destruction of certain public facilities and infrastructure. Hurricane winds typically damage power and telephone lines. Hurricane Diana which struck the North Carolina coast in 1984 resulted in the destruction of the public water tower in Carolina Beach, as a further example.

B. Water Forces

Figure I.3 depicts the various water-generated forces exerted against a structure. These forces include both hydrostatic forces (caused by the pressure of still water bearing against one side of a surface) and hydrodynamic forces (caused by the movement of a flowing water pushing against or flowing around a surface). Other forces include the battering-ram effects that may be exerted by water-borne debris, and the scour and erosion which can result in the undermining of building foundations.

Water forces created by hurricanes and coastal storms also wreak havoc on certain public facilities and infrastructures. Roads and highways can experience severe erosion and scour, for instance. Public sewer and water lines can also be destroyed or damaged from flooding.

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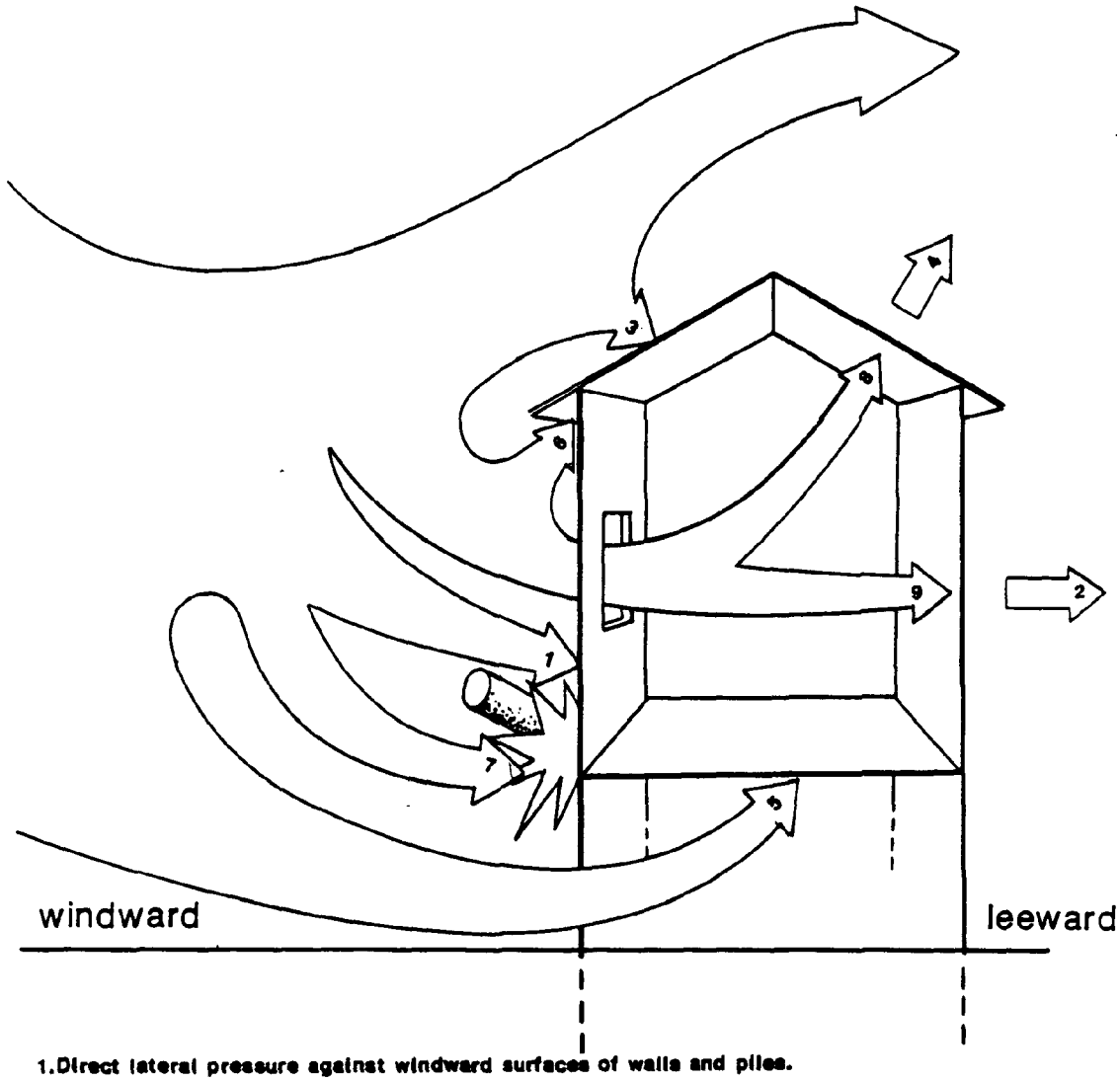
[15]Hodges-Copple, supra.

Finally, Figure I.4 provides a summary of the primary types of building damages which can result from the wind and water forces generated by hurricanes.

Figure 1.2

WIND GENERATED FORCES



1.Direct lateral pressure against windward surfaces of walls and piles.

2.Suction on leeward surfaces of walls and piles and on surfaces parallel to the wind direction.

3.Direct downward pressure on windward roof slope.*

4.Uplift suction on leeward roof slope.

5.Direct uplift pressure on floors and decks.

6.Direct uplift pressure on eaves.

7.Lateral impact pressure from debris.

8.Direct uplift pressure on interior roof surface.**

9.Direct lateral pressure on interior walls.**

*Depending on roof slope and building shape.

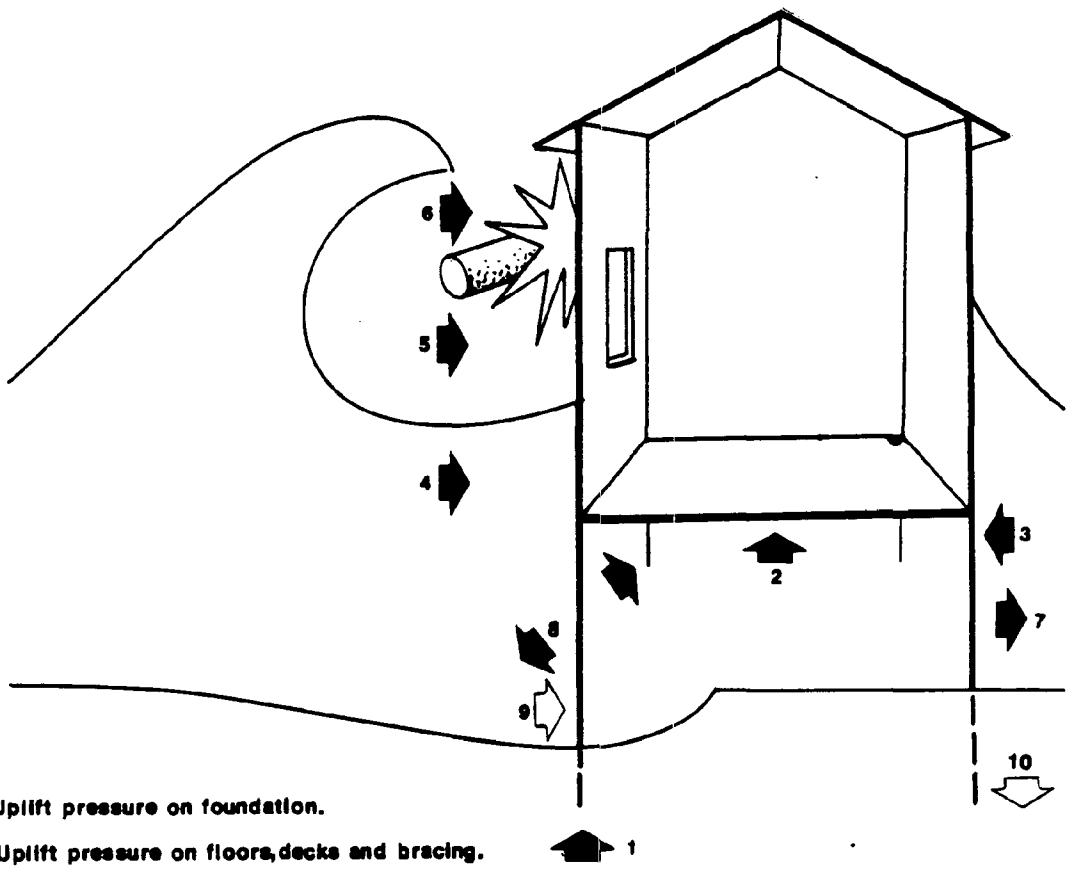
**If wind penetrates to interior of building, downward force would also affect floor.

Figure 1.3

WATER GENERATED FORCES

WATER GENERATED FORCES ACTING ON STRUCTURES.

WATER GENERATED IMPACTS ACTING ON SOILS WHICH CAN WEAKEN STRUCTURES.



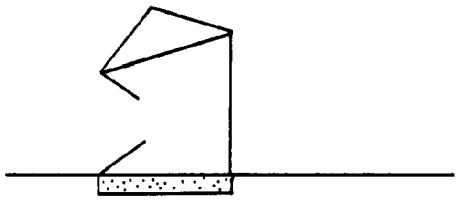
1. Uplift pressure on foundation.
2. Uplift pressure on floors, decks and bracing.
3, 4. Lateral pressure from storm surge.*
5. Lateral pressure from waves.
6. Impact from debris.
7. Hydrodynamic suction or drag on piles and other vertical surfaces.**
8. Oscillation caused by rhythmic wave action.
9. Scour/erosion.
10. Liquifaction.

*Affects all vertical surfaces with different water levels on opposite sides.

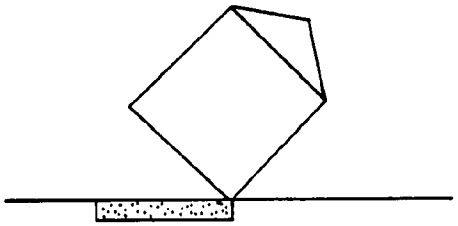
**Affects all walls, piles and other surfaces around which water flows.

Figure I.4

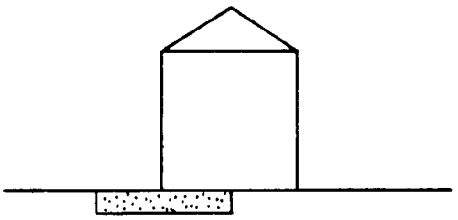
EFFECTS OF STORM FORCES ON BUILDINGS



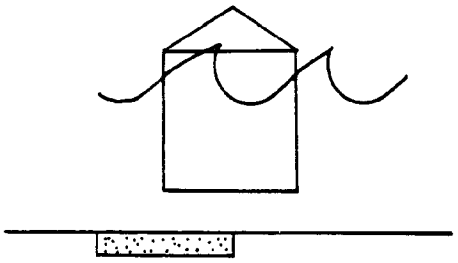
Structural collapse caused by wind or waves.



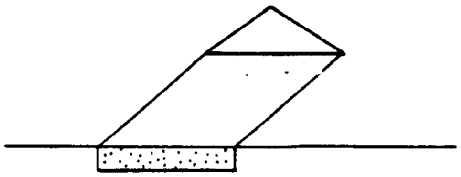
Overturning caused by wind or waves.



Lateral movement caused by wind or waves.



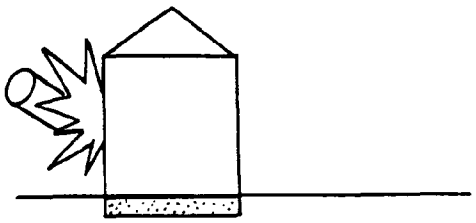
Unanchored structures float off foundation.



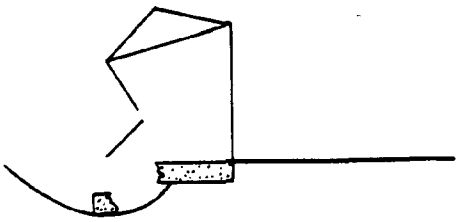
Collapse due to racking and twisting.

Figure 1.4 continued

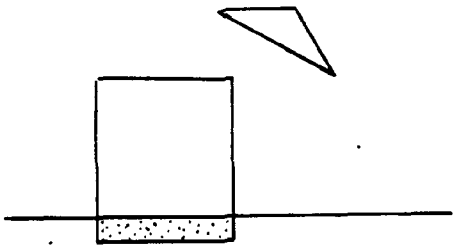
EFFECTS OF STORM FORCES ON BUILDINGS



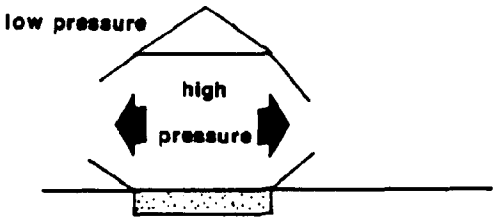
Debris battering by wind or wave driven objects.



Structural collapse caused by failure of underlying soil, either through scour, liquifaction or shoreline retreat.



Structural failure caused by connection separation caused by wind or water forces



Failure due to atmospheric pressure differences caused by hurricane spawned tornado.

SOURCE Pilkey, et al, 1983.

APPENDIX II
MODEL HAZARD MITIGATION ORDINANCES

1. Baytown, Texas: Hazard Mitigation/Post-Disaster Policies

2. Myrtle Beach, South Carolina: Coastal Protection Overlay Zone

3. Kill Devil Hills, North Carolina: Ocean Impact Residential Zone

4. North Carolina Division of Emergency Management: Model Flood Damage Prevention Ordinance

5. Model Amendments to DEM Model Flood Damage Prevention Ordinance

6. Model Post-Storm Moratorium Ordinance

Monday, Sept. 12, 1983
Tuesday, Sept. 13, 1983

ATTACHMENT 2

ORDINANCE NO. 3675

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF BAYTOWN DECLARING THE EXISTENCE OR OCCUPANCY OF STRUCTURES WITHIN THE BROWNWOOD HAZARD AREA A NUISANCE; PROHIBITING THE REPAIR, ERECTION, AND/OR CONSTRUCTION OF STRUCTURES WITHIN THE BROWNWOOD HAZARD AREA; PROHIBITING THE OCCUPANCY OF STRUCTURES WITHIN THE BROWNWOOD HAZARD AREA; CONTAINING A SAVINGS CLAUSE; REPEALING INCONSISTENT ORDINANCES; CONTAINING A PENALTY CLAUSE; AND PROVIDING FOR THE PUBLICATION AND EFFECTIVE DATE HEREOF.

WHEREAS, Hurricane Alicia has effectively destroyed all of the structures within the Brownwood Hazard Area, as this area is described in Ordinance No. 3669; and

WHEREAS, due to the extremely low elevation within the hazard area, repeated future flooding with resulting damage will definitely occur; and

WHEREAS, since houses elevated on piers received substantial damage from Hurricane Alicia, it is likely that even elevated structures would be damaged by future hurricanes; and

WHEREAS, City Council has determined that any structures built within the designated area would be a safety hazard, and dangerous for persons to occupy; and

WHEREAS, many of the homeowners within the area have indicated their intent to relocate outside the area; and

WHEREAS, it has been determined would take in excess of four million dollars to rehabilitate the water and sewer system within the Brownwood area to a properly functioning system; and

WHEREAS, the City has in the past prohibited the subdivision of flood-prone areas where the cost of providing utilities and governmental services would pose an unreasonable economic burden; and

WHEREAS, allowing the rebuilding of structures within the hazard area would create an unreasonable economic burden upon the remaining taxpayers of Baytown;

Monday, Sept. 12, 1983

costs of reconstruction of the public water and sewage systems and renders doubtful the advisability of construction upon piers; and

WHEREAS, it would be in the public interest, and would promote public safety and the public welfare to prohibit rebuilding of structures within the hazard area; and

WHEREAS, the property within the said area will still have many useable open-space purposes that will not be affected by a ban on building permits; and

WHEREAS, the existence or occupancy these highly flood-prone structures in the Brownwood Hazard Area is declared to be a nuisance, due to the safety and health hazard these structures pose, due to the unreasonable expense of maintaining service to them, and due to such other reasons as listed above; NOW THEREFORE,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF BAYTOWN, TEXAS:

Section 1: The existence or occupancy of structures within the Brownwood Hazard Area is declared to be a nuisance.

Section 2: That the repair, erection, and/or construction of structures within the Brownwood Hazard Area as described in Ordinance No. 3669, is prohibited, and building permits shall not be issued for the repair, erection, and/or construction of any structure within said area.

Section 3: The prohibition of occupancy of any structure within the Brownwood Hazard Area as adopted by Ordinance No. 3669 is extended indefinitely, and the occupancy of any structure within the Brownwood Hazard Area is hereby declared unlawful.

Section 4: All ordinances or parts of ordinances inconsistent with the terms of this ordinance are hereby repealed, provided however, that such repeal shall be only to the extent of such inconsistency and in all other respects this ordinance shall be cumulative of other ordinances regulating and governing the subject matter covered by this ordinance.

Section 5: If any provision, section, exception, subsection, paragraph, sentence, clause, or phrase of this ordinance or the application of same to any

person or set of circumstances, shall for any reason be held unconstitutional, void c invalid, such invalidity shall not affect the validity of the remaining provisions o this ordinance or their application to other persons or sets of circumstances and t this and all provisions of this ordinance are declared to be severable.

Section 6: Any person who shall violate any provision of this ordinance shal be deemed guilty of a misdemeanor and upon conviction shall be punished by a fin of not more than Two Hundred and No/100 ($200.00) Dollars.

Section 7: This Ordinance shall take effect immediately from and after its passage by the City Council of the City of Baytown, except for the penalty provision, which shall take effect from and after ten (10) days from its passage by City Council. The City Clerk is hereby directed to give notice hereof by causing the caption of this ordinance to be published in the official newspaper of the City of Baytown at least twice within ten (10) days after passage of this ordinance.

INTRODUCED, READ, and PASSED by the affirmative vote of the City Council of the City of Baytown, this the 8th day of September, 1983.

Mary Elizabeth Wilbanks
MARY ELIZABETH WILBANKS,
Mayor Pro Tempore

ATTEST:

Lynda Kilgore
LYNDA KILGORE, Deputy City Clerk

APPROVED:

Randall B. Strong
RANDALL B. STRONG, City Attorney

RESOLUTION NO. 897

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF BAYTOWN PLACING THE PUBLIC ON NOTICE THAT A PORTION OF THE BROWNWOOD SUBDIVISION IS A FLOOD-PRONE, HAZARDOUS AREA, TO WHICH THE CITY IS UNABLE TO PROVIDE CERTAIN SERVICES; AND PROVIDING FOR THE EFFECTIVE DATE.

****

WHEREAS, certain properties within the Brownwood Subdivision in Baytown, Texas are within a special flood hazard area, to-wit:

1) All of Blocks A, B, C, D, F, X, Y, AA, BB, XA, XB, XC, XD, XF, XH, XI, XJ, Lots 9, 10, 11, 12, and 13 of Block V, Lots 12, 13, 14, 15, 16, and 17 of Block Z, Lots 1 through 36 in Block XE, and Lots 3 through 29 in Block XK, of the Brownwood Subdivision, a subdivision located in Baytown, Harris County, Texas.

2) All of Block K and Lots 1, 2, and 3 of Block I of the Wooster Subdivision, a subdivision located in Baytown, Harris County, Texas.

3) The tracts known as Wooster Outlot 4; Wooster Outlots, Block 7; and Wooster Outlot, Block 9, all located in Baytown, Harris County, Texas.

4) All of Linwood Park, a subdivision located in Baytown, Harris County, Texas.

all of which is hereinafter referred to as "Brownwood," and

WHEREAS, these properties are within, and have been within for many years, the 100-year floodplain; and

WHEREAS, the Federal Emergency Management Agency has identified Brownwood as a Coastal High Hazard Area; and

WHEREAS, these designations, combined with the City of Baytown's desire to participate in the National Flood Insurance Program, places numerous restrictions on construction and repair of structures within Brownwood; and

WHEREAS, Brownwood has suffered severe flooding on repeated occasions in the past, resulting in millions of dollars in property losses; and

WHEREAS, the water and sewer systems within Brownwood have been damaged to the extent it would require millions of dollars to restore these systems to acceptable levels; and

WHEREAS, such an expenditure for the purpose of serving a small number of people would not be an appropriate expenditure of tax money; and

WHEREAS, the roads and drainage ditches are subject to flood damage causing the need for costly repairs in order to maintain them; and

WHEREAS, the City wishes to allow development of flood-prone areas only when such development 1) is appropriate in light of the probability of future flood damage and the need to reduce flood losses, 2) is an acceptable social and economic use of the land in relation to the hazards involved, and 3) does not increase the danger to human life; and

WHEREAS, the Brownwood area does not contain adequate vehicular access and escape routes when normal routes are blocked or destroyed by flooding; and

WHEREAS, the City of Baytown desires to provide public notice that there are numerous problems with using property in the Brownwood area for other than open space use; NOW THEREFORE,

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF BAYTOWN, TEXAS:

Section 1: That the public be notified that the Brownwood area, as specified above, is within the Coastal High Hazard Area and subject to severe flood hazards.

Section 2: That because Brownwood area is a high flood risk area, there are significant hazards to using property there for residential purposes.

Section 3: That the City of Baytown has determined that funds are not available at this time provide water or sewer service to this area, and if funds were available, such an expenditure would be an imprudent expenditure of tax money.

Section 4: That the City of Baytown reasserts its stated policy of strict enforcement of its flood hazard regulations.

Section 5: This resolution shall take effect immediately from and after its passage by the City Council of the City of Baytown.

INTRODUCED, READ, and PASSED by the affirmative vote of the City Council of the City of Baytown, this the 13th day of December, 1984.

ALLEN CANNON, Mayor

ATTEST:

EILEEN P. HALL, City Clerk

APPROVED:

RANDALL B. STRONG, City Attorney

ORDINANCE NO. 84-47

STATE OF SOUTH CAROLINA)
COUNTY OF HORRY)
CITY OF MYRTLE BEACH)

AN ORDINANCE TO AMEND ZONING ORDINANCE SECTIONS 32-3, 32-4 32-5 AND 32-6 TO PROVIDE FOR A COASTAL PROTECTION OVERLAY ZONE, SUPPLEMENTARY REGULATIONS, AND TO AMEND OCEANFRONT DEVELOPMENT STANDARDS

WHEREAS, a technical study of beach erosion was conducted through the South Carolina Coastal Council and by a summary report dated January 1984, it was clearly shown that it would be in the public interest to adopt revised regulations governing land use and erosion control seaward of the projected 50-year shoreline.

NOW, THEREFORE, THE COUNCIL OF THE CITY OF MYRTLE BEACH HEREBY ORDAINS that the Zoning Ordinance for Myrtle Beach be amended as follows:

(1) SECTION 32-3: ESTABLISHMENT OF ZONING DISTRICTS is amended by adding:

CP - Coastal Protection (overlay zone)

(2) SECTION 32-4: USE GROUPS is amended by adding:

28. OCEANFRONT ACTIVITIES, LIMITED

Principal Uses: Elevated sundecks, patios, walkways, gazebos, stairs, lighting, fencing, landscaping, lifeguard stands, safety equipment, sanitation receptacles, picnic tables and seating, sand dunes and vegetation.

(3) SECTION 32-5: USE, DIMENSIONAL, PARKING AND SIGN REGULATIONS is amended by adding:

ZONING DISTRICT

CP, Coastal Protection (overlay zone)

OBJECTIVES

To provide supplementary regulations for oceanfront property seaward of the projected 50-year shoreline to control erosion, preserve and maintain a recreational beach, safeguard propery and promote public safety. The "CP" designation is not a primary district classification, but is to be attached to existing district designations as an overlay which subjects affected property to supplementary regulations.

USE GROUPS PERMITTED

No.	Name
27	Pool Related Activities, Limited
28	Oceanfront Activities, Limited

Existing uses permitted in primary zoning classifications are subject to Oceanfront Development Standards contained in Section 32-6, subsection 27 of this ordinance and Coastal Protection (CP) Supplementary Regulations contained in this Section.

Special Exceptions: When permitted by the primary zoning designation, amusement rides, miniature golf courses and similar open air amusement uses may be permitted seaward of the Building Control Line by the Zoning Board of Adjustment upon such conditions as may be necessary to promote the purposes and objectives of the "CP" regulations.

DESIGNATION OF CP ZONES

All existing zoning districts lying east of Ocean Boulevard (State Highway #73) or Beach Drive are hereby designated as Coastal Protection Zones. A Building Control Line is established on those portions seaward of the projected 50-year shoreline (50-year future dune crest) as shown on the following Table of Coastal Protection Zones Building Control Line. The Official Zoning Map is hereby amended to show the boundaries of said Coastal Protection Zones and Building Control Line. The designation "CP" is added to the primary zoning classification (eg., AC-1-CP).

COASTAL PROTECTION (CP) SUPPLEMENTARY REGULATIONS

1. Building Control Line

The projected 50-year shoreline shall be a building control line and no new structures shall be erected on the seaward side of that building control line in a CP zone after the effective date of this ordinance except those specifically listed as permitted uses in Use Group 28.

TABLE OF COASTAL PROTECTION ZONES BUILDING CONTROL LINE

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) Present Ideal Dune Crest	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) 50-Year Future Dune Crest
North	1	N. Limit		0	613	--	--
			82nd Ave. N.	613	75	1,090	1,056
		5A		688	337	1,082	1,048
			81st Ave. N.	1,025	388	1,041	1,007
			80th Ave. N.	1,413	386	1,002	968
			79th Ave. N.	1,799	394	963	929
			78th Ave. N.	2,193	391	924	890
	2		77th Ave. N.	2,584	79	805	851
		6A		2,663	323	877	843
			76th Ave. N.	2,986	398	844	810
			75th Ave. N.	3,384	300	788	754
		7A		3,684	90	694	660
			74th Ave. N.	3,774	391	613	579
			73rd Ave. N.	4,165	391	500	466
			72nd Ave. N.	4,556	197	370	336
		8B		4,753	193	337	303
			71st Ave. N.	4,946	375	341	307
			70th Ave. N.	5,321	332	334	300
		9A		5,653	31	329	295
			69th Ave. N.	5,684	475	329	295
			Bridge on Ocean Blvd.	6,159	472	368	334

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) Present Ideal Dune Crest	50-Year Future Dune Crest
North (cont.)	3		67th Ave. N.	6,631	472	343	309
		9B		6,671	40	341	307
			66th Ave. N.	7,021	350	317	283
			65th Ave. N.	7,396	375	292	258
			64th Ave. N.	7,778	382	266	232
		11A		8,090	312	245	211
			63rd Ave. N.	8,156	66	240	206
					508		
	4		Highland Circle	8,744		200	166
			Sunset Terrace	9,138	394	172	138
		12A		9,300	162	161	127
		13A		10,403	1,103	98	64
			Seaside Place	10,453	50	88	54
					1,153		
	5	14A	Beach Place	11,606		78	44
		14C	Hampton Circle	12,550	944	125	91
		16A		13,900	1,350	431	397
					38		
	6		52nd Ave. N.	13,938		429	395
			51st Ave. N.	14,306	368	409	375
			50th Ave. N.	14,660	354	391	357
			49th Ave. N.	15,025	365	371	337
			48th Ave. N.	15,406	381	351	317
			47th Ave. N.	15,908	502	320	286
		17A		16,025	37	318	284
			46th Ave. N.	16,350	325	309	275
			44th Ave. N.	17,063	363	290	256
		19A	43rd Ave. N.	17,431	368	280	246
					332		

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) Present Ideal Dune Crest	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) 50-Year Future Dune Crest
					332		
North (cont.)	6 (cont.)		42nd Ave. N.	17,763	362	271	237
			41st Ave. N.	18,125	313	206	172
		19B		18,430	50	177	143
			40th Ave. N.	18,488	362	177	143
			39th Ave. N.	18,850	363	188	154
			38th Ave. N.	19,213	362	188	154
			37th Ave. N.	19,575	375	200	166
			36th Ave. N.	19,950	356	265	231
			35th Ave. N.	20,306	357	294	260
		21C	34th Ave. N.	20,663	350	352	318
			33rd Ave. N.	21,013	375	363	329
			32nd Ave. N.	21,388	362	363	329
Central	7		31st Ave. N.	21,750	25	169	135
		22A		21,775	338	169	135
			30th Ave. N.	22,113	312	175	141
		23A		22,425	50	180	146
			29th Ave. N.	22,475	356	179	145
			28th Ave. N.	22,831	330	171	137
			27th Ave. N.	23,169	62	164	130
		23C		23,231	563	163	129
			26th Ave. N.	23,794	37	183	149
		24B		23,831	363	184	150
			25th Ave. N.	24,194	162	184	150

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) Present Ideal Dune Crest	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) 50-Year Future Dune Crest
Central (cont.)	8	24C		24,356	162	276	242
			24th Ave. N.	24,581	225	305	271
		25A		24,631	50	300	266
			23rd Ave. N.	25,256	625	233	199
		25C		25,356	100	222	188
			22nd Ave. N.	25,631	275	226	192
			21st Ave. N.	26,006	375	232	198
			20th Ave. N.	26,350	344	237	203
		26B		26,381	31	237	203
			19th Ave. N.	26,719	338	224	190
			18th Ave. N.	27,094	375	209	175
			17th Ave. N.	27,450	356	195	161
		27C		27,606	156	189	155
			16th Ave. N.	27,819	213	190	156
		27D		28,069	250	191	157
			15th Ave. N.	28,119	50	191	157
			14th Ave. N.	28,469	350	193	159
		28B		28,506	37	193	159
					219		
	9	28C		28,725		197	163
		28D		29,256	531	177	143
			11th Ave. N.	29,531	275	182	148
			10th Ave. N.	29,850	319	187	153
		29A		30,175	325	193	159
			9th Ave. N.	30,294	119	195	161
		30A		30,738	444	200	166
					100		

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) Present Ideal Dune Crest	50-Year Future Dune Crest
Central (cont.)	10		8th Ave. N.	30,830	100	202	168
		30B		31,213	375	207	173
			7th Ave. N.	31,313	100	207	173
			6th Ave. N.	31,825	512	206	172
		31A		32,188	363	205	171
			5th Ave. N.	32,294	106	206	172
			4th Ave. N.	32,775	481	212	178
		31C		33,013	238	215	181
			3rd Ave. N.	33,281	268	234	200
		32B	2nd Ave. N.	33,763	481	269	235
		32C		34,006	243	274	240
			1st Ave. N.	34,225	219	219	185
					206		
South	11		1st Ave. S.	34,431		150	116
			2nd Ave. S.	34,800	369	100	66
		33A		34,925	125	94	60
			3rd Ave. S.	35,100	175	100	66
					550		
	12		Withers Swash	35,650		156	122
		34B		35,700	50	167	133
		34C	6th Ave. S.	36,425	725	304	270
			7th Ave. S.	36,763	338	330	296
		35A		36,863	100	338	304
			8th Ave. S.	37,125	262	348	314
			9th Ave. S.	37,475	350	362	328
		35B		37,500	25	363	329
					263		

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft) Present Ideal Dune Crest	50-Year Future Dune Crest
South (cont.)	13		10th Ave. S.	37,763	263	367	333
			11th Ave. S.	38,125	362	373	339
		36C	12th Ave. S.	38,475	350	378	344
					375		
	14		13th Ave. S.	38,850	330	356	322
			14th Ave. S.	39,180	07	336	302
		37A		39,275	250	331	297
			15th Ave. S.	39,525	363	327	293
			16th Ave. S.	39,888	362	321	287
			17th Ave. S.	40,250	213	315	281
		38A		40,463	150	311	277
			18th Ave. S.	40,613	537	304	270
			19th Ave. S.	41,150	75	277	243
		38B		41,225	363	273	239
			20th Ave. S.	41,588	275	263	229
	15	39B		41,863	150	255	221
			21st Ave. S.	42,013	037	252	218
		40B	Williams Ave.	42,050	069	237	203
		40D		43,719	156	250	216
			25th Ave. S.	43,875	244	255	221
		41A		44,119	256	262	228
			26th Ave. S.	44,375	475	266	232
			27th Ave. S.	44,850	194	272	238
			28th Ave. S.	45,338	375	279	245

REGION	ZONE	STATION	STREET	DISTANCE FROM NORTHERN LIMIT (ft)	DISTANCE BETWEEN ADJACENT STREETS (ft)	DISTANCE FROM CENTERLINE OCEAN BOULEVARD (ft)	
						Present Ideal Dune Crest	50-Year Future Dune Crest
South (cont.)	16	42A		45,713	375	284	250
			29th Ave. S.	45,763	50	287	253
		43A		46,625	862	361	327
					250		
		S. Limit		46,675		--	--

2. Existing Uses Non-Conforming

The regulations in this section shall apply to CP zones in lieu of the provisions of Section 32-8 for only those structures made non-conforming by the application of the CP zone designation. Section 32-8 shall apply to structures which were non-conforming under the primary zone designation.

All permanent structures including, but not limited to buildings, swimming pools, and parking lots located, under construction, or permitted seaward of the building control line on the date of enactment of this provision are non-conforming structures in any CP zone. Use of these non-conforming structures may continue in their present locations. However, the non-conforming structures will be subject to the following regulations:

(a) Reconstruction (including replacement) of existing buildings and swimming pools shall be allowed as long as the structures are not enlarged or expanded, do not exceed the gross square footage (excluding enclosed parking) which existed on the lot before the enactment of this ordinance, and do not require erosion control structures prohibited by applicable regulations. No reconstruction of a non-conforming building may be seaward of the existing building line. In addition, such reconstruction or replacement of structures is allowed only if such new structures conform to all design standards, landscaping requirements, parking requirements and drainage regulations applicable at the time of reconstruction, redevelopment, or replacement. The intent of this section is to allow the existing buildings to be replaced without exceeding the total gross square footage and setback encroachment existing on the lot prior to the passage of this ordinance.

(b) Conforming principal use buildings hereafter constructed which exceed 25 feet above grade or additions to existing conforming buildings which exceed 25 feet above grade will not be allowed if the building control setback area of said lot contains a principal use building or portion thereof.

(c) In the event that a hurricane, explosion, fire or other disaster shall damage any parking lot so that the repair cost of the parking lot exceeds sixty (60) percent of its replacement cost, reconstruction will only be allowed if design standards, landscaping requirements and drainage regulations are met subject to the primary zoning requirements.

(d) Nothing in this provision is intended to prevent or limit the ability of a property owner to make normal repairs or to perform maintenance necessary to keep non-conforming structures in a safe and sound condition in their present location.

3. Erosion Control Structures

Construction and maintenance of temporary or permanent erosion control structures are subject to Oceanfront Development Standards in Section 32-6, subsection 27 of this ordinance.

4. Pool Special Exception

A new swimming pool may be permitted seaward of the building control line as a special exception granted by the Zoning Board of Adjustment pursuant to the procedures of Section 32-9 upon the following conditions:

(a) No pool shall be constructed nearer than twenty (20) feet to the present ideal dune crest established by this ordinance, measured from the vertical portion of the pool exceeding six (6) inches.

(b) No pool related structures except decks shall be allowed.

(c) Landscaping and drainage shall comply with primary zoning requirements.

(d) The Board of Adjustment shall impose such additional requirements as it shall deem necessary and appropriate in order to insure that the purposes and objectives of this ordinance are promoted.

(e) No variance of any requirement of the primary district regulations or the "CP" overlay regulations shall be granted in connection with allowance of a pool special exception.

5. Vested Right Development

There are two types of vested rights development which are defined and permitted through these regulations. They are addressed as follows:

(a) For a structure proposed to be constructed seaward of the building control line to have a vested right to proceed with construction following the passage of these Coastal Protection (CP) Supplementary Regulations, the following conditions must be met:

1. A set of building and structural plans must have been submitted prior to the effective date of this ordinance. Such plans must comply with the zoning ordinance and building code and must include a site plan, exterior building elevations, room or unit designs, floor design, amenities design and if a parking deck is involved, all layout and exterior elevations must be shown.

2. Construction of the project must be initiated no later than December 4, 1985.

3. Once construction is initiated work must be continuous on the project. However, if multiple phases are approved pursuant to 5.(a)1 above, a period of not more than one year can elapse between the issuance of a certificate of occupancy for that phase and the initiation of construction on a subsequent phase.

(b) For a structure which is non-conforming as a result of these regulations to have a vested right to proceed with construction for a planned expansion, the following conditions must be met:

1. The owner of the property must submit plans to the Building Department by April 1, 1985 which reflect the intent of the existing building to be expanded at the time of its initial construction. The building must have been structurally designed and constructed to accommodate the planned expansion. Specifically, the following criteria must be met.

   - electrical wiring must be appropriately located in the existing building to tie in to the proposed addition;
   - plumbing lines and stub-ups should be installed for the planned addition;
   - certification from a structural engineer that the existing building is designed and constructed to allow for the planned expansion horizontally and/or vertically; and
   - fire systems of the existing building must be designed and installed to accommodate additional expansion (including fire pumps, standpipe systems and alarm systems).

2. Construction of the planned and approved expansion must be initiated by April 1, 1987.

6. Setback Impact Allowance

To relieve some of the development burden which may result from the application of the "CP" regulations and to promote removal of non-conforming uses from the Coastal Protection area, minimum sideyard requirements imposed by the primary zoning district regulations, are modified according to the impact of the Building Control Line upon the useable lot area.

For lots being redeveloped in the A-5, A-5-1, and A-5-2 zoning districts which are impacted by the Coastal Protection Overlay Zone, Base Figures for building heights permitted before imposing additional sideyard setbacks have been increased to allow the property owner greater building flexibility with the remaining buildable area during the redevelopment process.

To provide for a setback impact allowance the schedule below indicates Adjusted Base Figures which proportionally compensate the property owner for the amount of his property impacted by the Coastal Protection Overlay Zone if redevelopment of the lot occurs in a manner in complete conformance with all codes of the City of Myrtle Beach.

Percentage of Remaining Lot Impacted by Building Control Line After Deduction of Minium Yard Requirements	Height Compensation in Feet	Base* Figure	Adjusted** Base Figure
0-14	10	40	50
15-25	20	40	60
26-35	30	40	70
36-45	40	40	80
46 and more	50	40	90

*Base Figure: The maximum height a building is permitted to be constructed in the A-5, A-5-1 and A-5-2 zoning districts before additional sideyard setback requirements (in excess of 7.5 feet) are imposed in those primary zoning districts.

**Adjusted Base Figure: The adjusted maximum height a building is permitted to be constructed in the A-5, A-5-1 and A-5-2 zoning districts before additional sideyard setback requirements (in excess of 7.5 feet) are imposed in those primary zoning districts and is applicable only to those lots impacted by the "CP" overlay zone which redevelope in a manner in complete conformance with all codes of the City of Myrtle Beach.

(4) SECTION 32-6: EXCEPTIONS AND SUPPLEMENTARY REGULATIONS, Subsection 27 is hereby amended to read as follows:

Section 27 Oceanfront Development Standards

27.1 Purpose and Scope

27.1.1 Purpose

The purpose of this oceanfront development ordinance is to provide regulations that will control erosion, eliminate confusing, cluttered and haphazard development on the oceanfront, to provide standards of development that will preserve and protect the public beach and at the same time, protect adjacent private properties and to establish a review procedure.

27.1.2 Scope

The provisions of this ordinance shall apply to the construction, erection, alteration, use, location, size and materials of any seawall, bulkhead, revetment or other erosion control structure or any alteration to the primary sand dune or beach.

Section 27.2 General Provisions

27.2.1 No vertical bulkheads, seawalls or other permanent erosion control structures shall be permitted except when erosion eminently threatens permanent improvements, buildings and swimming pools, which existed on the subject property on the date this regulation was adopted, or which are constructed landward of the predicted fifty (50) year shoreline.

27.2.2 Before any erosion control structure is permitted, the applicant must demonstrate to the Coastal Council and the City of Myrtle Beach that all reasonable soft erosion control measures, such as sandscraping, sandbagging, and renourishment from an approved external sand source, have been attempted and will not protect the property identified as being eminently threatened. Every effort must be made to renourish the beach and sand dune system from an external sand source approved by the South Carolina Coastal Council and the City of Myrtle Beach.

27.2.3 Any permitted erosion control structure shall be designed and constructed conforming to guidelines, methodology and standard criteria outlined in the "Shore Protection Manual", U.S. Army Coastal Engineering Research Center, U.S. Government Printing Office. For the purpose of this ordinance the design storm shall be the ten-year storm.

27.2.4 All applications for an erosion control structure shall be prepared and stamped by a South Carolina Registered Engineer in the field of Civil, Structural, or Coastal Engineering.

27.2.5 No beach sand shall be used for backfill material during construction of any erosion control structur

27.2.6 Any erosion control structure must be located on private property.

27.2.7 Any sun deck in conjunction with the erosion contro structure must be located on private property.

27.2.8 No storm drains or pool drains shall be allowed on the beach.

27.2.9 The applicant must provide stairs to the beach when an erosion control structure is built.

27.2.10 Sandscraping shall be considered as an appropriate temporary solution to erosion, in lieu of structural control measures. However, sandscraping must be conducted in accordance with the beach scraping plan approved by the City of Myrtle Beach and the South Carolina Coastal Council.

Section 27.3 <u>Plan Submission and Review Procedures</u>

27.3.1 All applications for erosion control structures shall be submitted in triplicate to the City Building Department. At the same time, application must be made to the South Carolina Coastal Council using the appropriate forms.

27.3.2 All applications shall be reviewed by a City Staff Committee consisting of: the City Manager, Planning Director and Public Works Director.

27.3.3 The City Staff Committee shall evaluate the request to see that it conforms to the general provision. They shall report their findings to the Building Official, the applicant and the South Carolina Coastal Council. They may recommend alternatives to the applicant.

27.3.4 The Building Official shall not issue a building permit without the approval of both the City Staff Committee and the South Carolina Coastal Council. Any appeals shall be to the Zoning Board of Adjustment.

Section 27.4 Existing Erosion Control Structure

27.4.1 Permit for Repair

A permit is required to repair existing erosion control structures. However, if the cost of repair will exceed fifty (50) percent of the value of the structure at the time of the application, the criteria in the general provisions will apply. A written request to repair must be submitted to the Building Officials.

(5) Ordinance No. 84-16 adopted on April 17, 1984, is hereby repealed.

(6) This ordinance shall not become effective until March 4, 1985.

SIGNED, SEALED AND ADOPTED BY CITY COUNCIL this 4th day of December, 1984.

Mayor

Council Member

Council Member

Council Member

Council Member

Council Member

Council Member

ATTEST:

City Clerk

1st Reading: 10-23-84

2nd Reading: 12-4-84

Ordinance Number_____

AN ORDINANCE AMENDING THE KILL DEVIL HILLS TOWN CODE

CHAPTER 20 - ZONING

BE IT ORDAINED by the Kill Devil Hills Board of Commissioners that Chapter 20 - Zoning, Article IIA, OFRA-6 Residential Zone shall be amended by deleting and repealing Article IIA and adopting in lieu thereof the following:

CHAPTER 20 - ZONING

ARTICLE IIA

OCEAN IMPACT RESIDENTIAL ZONE

Section 20-10.1 INTENT

In an effort to promote health, safety, and welfare and to limit the level of peril to the public welfare associated with dwellings and other structures located in that part of Kill Devil Hills that borders on the Atlantic Ocean and which is subject to tropical storms, storm surge, hurricane, extra tropical storms, and shoreline migration, the guidelines of this section are hereby established.

Section 20-10.1 (a) PERMITTED USES

In the OIR Zone, buildings and or land shall be used for the following purposes and none other:

a) Single-family dwellings;

b) Multiple family dwellings

c) Hotels, motel and on-site accesory uses

d) Accessory buildings;

e) Home occupations that meet the guidelines of Section 20-16 (a);

f) Publically owned access area, beach bath-houses and recreational parks shall be permitted uses;

g) Fishing Piers

Section 20-10.1 (b) PROHIBITED USES

a) Cottage courts, mobile homes, trailers, trailer parks, and modular homes in excess of duplex structures, as defined in Section 20-1, shall <u>not</u> be permitted use in this zone.

Section 20-10.2 BUILDING HEIGHT LIMITS

a) No structure in this zone shall exceed a living space height of thirty-five feet, regardless of the type of construction used. Any space resulting from the addition of the roof of such structures shall not be utilized for living space or anything other than storage.

b) No structure shall have more than three levels in height of living space.

c) No structure shall exceed a total height greater than forty-two feet above the finished grade. (6-5-81, § 2.)

d) Building height shall be measured as defined in 20-1.

Section 20-10.3 SITE REQUIREMENTS

a) A minimum building site shall be fifteen-thousand (15,000) square feet in area. Such parcels shall have a minimum width of fifty (50) feet.

b) Duplex structures - structures designed for two independent dwelling units per building shall have a lot size of at least twenty-thousand (20,000) square feet.

c) All land developed for multi-family use in excess of a duplex shall not exceed a maximum density of six units per acre or a density factor of 1/6 acre per independent living unit. (7260 sq.ft.)

d) All land developed for hotel or motel use shall conform to the following guidelines:

1) Hotel/Motel Unit Defined - a hotel or motel unit shall be defined as one room or rooms connected together constituting a separate, independent housekeeping establishment for rent or lease on a daily, weekly, or longer basis and <u>not</u> containing independent cooking or kitchen facilities.

2) Hotel/Motel Density - the maximum allowable density for hotel/motel land use shall be 24 units per acre or 1/24 acre per unit.

e) Exceptions - Where a lot or parcel of land having a width of fifty feet and a depth of not more than one hundred feet was of record at the time of passage of the ordinance from which this chapter is derived, such lot may be occupied by one family; provided, that minimum side, front and rear yard requirements set out in sections 20-14 to 20-16 are complied with. (6-5-81 § 3.)

f) Lot Coverage - All land use in the Ocean Impact Residential District shall be limited to a maximum lot coverage of not more than 65% of the site west of the first line of stable vegetation.

g) All minimum lot size requirements and site measurements shall be based on the amount of useable land. Useable land is defined as the entire amount of land extending to each property line on the north, south, west and on the east to the rear lot line, which is the first line of vegetation west of the high water mark.

Section 20-10.4 YARDS - SIDES

The following regulations shall apply to side yards in the OIR-II Zone;

a) The minimum side yard setback requirement on a lot of fifty (50) feet or less in width shall be ten (10) feet from each side.

b) For all lots seventy-five (75) feet to ninety-nine (99) in width the minimum side yard widths shall be as follows:

1) Single level construction - 10 feet each side

2) Double or triple level construction - 12 feet on each side

c) For all lots 100 or greater feet in width the minimum side yard setback shall be as follows:

1) Single level construction - 10 feet on each side

2) Double level construction - 12.5 feet on each side

3) Triple level construction - 15 feet on each side

d) Side Yard Buffer - All multi-family dwellings in excess of a duplex and hotels and motels shall install and maintain a vegetative buffer of evergreen, salt tolerant species along the side yards of useable property in conjunction with multi-family development in this zone, and such may be located with-in the area of the required set-back lines.

e) Side Yard Parking Prohibited - The use of side yard setback areas for parking of vehicles is not permitted.

Section 20-10.6 YARDS - FRONT AND REAR

a) All oceanfront lots shall front on Highway 12 (Virginia Dare Trail) and all structures erected on these lots shall be set back from the front property line a minimum of 30 feet. Font yard parking shall be a permitted use provided all parking areas maintain a 30' setback from the front property line.

b) Lots that border the Atlantic Ocean shall be designated as having a rear yard on the Atlantic Ocean.

c) For each lot developed that has a rear yard on the Atlantic Ocean, the rear yard shall be determined by the setback multiplier established for ocean hazard areas of environmental concern (AEC) as administered by the local permit officer representing the N.C. Office of Coastal Management, (N.C.Coastal Area Management Act of 1974).

Section 20-10.7 CORNER LOTS

The following regulations shall apply to corner lots in the OIR-II Zone:

a) The side yard setback for corner lots on the OIR-II Zone shall be fifteen (15) feet, on those sides that abut a street.

Section 20-10.8 SIGNS (See Sec. 20-59)

Section 20-10.9 OFF STREET PARKING (See Sec. 20-73)

Section 20-10.10 EXISTING STRUCTURES

All structures and development projects officially in the planning process and submitted to the Planning Director's office and recorded as received prior to 12:00 p.m. o'clock on December 9, 1985 or under construction, or completed prior to December 9, 1985 at 12:00 p.m. o'clock shall be considered existing non-conforming uses and in the event that a natural disaster or accidental occurence leads to extensive damage or destruction of an existing, non-conforming use, that structure or use may be repaired or replaced to 100% of its status as of December 9, 1985 but no greater. Any proposed addition or alteration to a non-conforming use or structure must conform with existing guidelines at the date the expansion is proposed.

This Amendment to Chapter 20 - ZONING, ARTICLE IIA, OCEAN IMPACT RESIDENTIAL ZONE of the Kill Devil Hills Town Code shall take effect the 9th day of December 12:00 O'clock p.m. 1985. Adopted and passed by the Board of Commissioners of Kill Devil Hills at a regular Board meeting held the 9th day of December _____, 1985, by a vote of 5 in favor and 0 opposed.

Lowell M. Perry

Lowell M. Perry, Mayor

SEAL

Rollason moved
Drake seconded

ATTEST:

Mary E. Quidley

Mary E. Quidley
Clerk

APPROVED AS TO FORM:

_____

Wallace H. McCown
Town Attorney

The undersigned certifies that the foregoing official amendment designated AN ORDINANCE AMENDING THE KILL DEVIL HILLS TOWN CODE, CHAPTER 20 ZONING, ARTICLE IIA, was filed in the Kill Devil Hills Ordinance Book on the 17th day of December, 1985, at 1:45 o'clock p m.

Mary E. Quidley
Mary E. Quidley, Clerk

NORTH CAROLINA
DIVISION OF EMERGENCY MANAGEMENT

MODEL FLOOD DAMAGE PREVENTION ORDINANCE

ARTICLE 1. STATUTORY AUTHORIZATION, FINDINGS OF FACT, PURPOSE AND OBJECTIVES

SECTION A. STATUTORY AUTHORIZATION

The Legislature of the State of North Carolina has in Part 6, Article 21 of Chapter 143; Parts 3, 5, and 8 of Article 19 of Chapter 160A; and Article 8 of Chapter 160A of the N. C. General Statutes, delegated the responsibility to local governmental units to adopt regulations designed to promote the public health, safety, and general welfare of its citizenry. Therefore, the _____(governing body) of _____(local unit), North Carolina, does ordain as follows:

SECTION B. FINDINGS OF FACT

(1) The flood hazard areas of _____(local unit) are subject to periodic inundation which results in loss of life, property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures of flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

(2) These flood losses are caused by the cumulative effect of obstructions in flood plains causing increases in flood heights and velocities, and by the occupancy in flood hazard areas by uses vulnerable to floods or hazardous to other lands which are inadequately elevated, floodproofed, or otherwise unprotected from flood damages.

SECTION C. STATEMENT OF PURPOSE

It is the purpose of this ordinance to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

(1) Restrict or prohibit uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities;

(2) require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(3) control the alteration of natural flood plains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters;

(4) control filling, grading, dredging and other development which may increase erosion or flood damage; and,

(5) prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.,

SECTION D. OBJECTIVES

The objectives of this ordinance are:

(1) to protect human life and health;

(2) to minimize expenditure of public money for costly flood control projects;

(3) to minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) to minimize prolonged business interruptions;

(5) to minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in flood plains;

(6) to help maintain a stable tax base by providing for the sound use and development of flood prone areas in such a manner as to minimize flood blight areas; and,

(7) to insure that potential home buyers are notified that property is in a flood area.

ARTICLE 2. DEFINITIONS

Unless specifically defined below, words or phases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application.

"Appeal" means a request from a review of the local administrator's interpretation of any provision of this ordinance or a request for a variance.

Addition (to an existing building)" means any walled and roofed expansion to the perimeter of a building in which the addition is connected by a common load-bearing wall other than a fire wall. Any walled and roofed addition which is connected by a fire wall or is separated by independent perimeter load-bearing walls is new construction.

"Area of shallow flooding" means a designated AO or VO 2one on a community's Flood Insurance Rate Map (FIRM) with base flood depths from one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and indeterminate, and where velocity flow may be evident.

"Area of special flood hazard" is the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year.

"Base flood" means the flood having a one percent chance of being equaled or exceeded in any given year.

"Basement" means that lowest level or story which has its floor subgrade on all sides.

"Breakaway wall" means a wall that is not Part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces without causing damage to the elevated portion of the building or the supporting foundation system. A breakaway wall shall have a design safe loading resistance of not less than 10 and no more than 20 pounds per square foot. A wall with loading resistance of more than 20 pounds per square foot requires an architect or professional engineer's certificate.

"Building" means any structure built for support, shelter, or enclosure for any occupancy or storage.

"Coastal High Hazard Area" means the area subject to high velocity waters caused by, but not limited to, hurricane wave wash. The area is designated on a FIRM as Zone V1 -3, VE or V.

"Development" means any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations.

"Elevated building" means a non-basement building built to have the lowest floor elevated above the ground level by means of fill, solid foundation perimeter walls, pilings, columns (posts and piers), shear walls, or breakaway walls.

"Existing manufactured home park or manufactured home subdivision" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or safe for which the construction of facilities for servicing the lot on which the manufactured home is to be affixed (including at a minimum, the installation of utilities, either final site grading or the pouring of concrete pads, and the construction of streets) is completed before the effective date of this ordinance.

"Flood" or "flooding" means a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) the overflow of inland or tidal waters; and,

(2) the unusual and rapid accumulation of runoff of surface waters from any source.

"Flood Hazard Boundary Map (FHBM)" means an official map of a community, issued by the Federal Emergency Management Agency, where the boundaries of the areas of special flood hazard have been defined as Zone A.

"Flood Insurance Rate Map (FIRM)" means an official map of a community, on which the Federal Emergency Management Agency has delineated both the areas of special flood hazard and the risk premium zones applicable to the community.

"Flood Insurance Study" is the official report provided by the Federal Emergency Management Agency. The report contains flood profiles, as well as the Flood Boundary Floodway Map and the water surface elevation of the base flood.

"Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

"Floor" means the top surface of an enclosed area in a building (including basement), i.e., top of slab in concrete slab construction or top of wood flooring in wood frame construction. The term does not include the floor of a garage used solely for parking vehicles.

"Functionally dependent facility" means a facility which cannot be used for its intended purpose unless it is located or carried out in close proximity to water, such as a docking or port facility necessary for the loading and unloading of cargo or passengers, shipbuilding, ship repair, or seafood processing facilities. The term does not include long-term storage, manufacture, sales, or service facilities.

"Highest Adjacent Grade" means the highest natural elevation of the ground surface, prior to construction, next to the proposed walls of the structure.

"Levee" means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

"Levee System" means a flood protection system which consists of a levee or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

"Lowest Floor" means the lowest floor of the lowest enclosed area (including basement). An unfinished or floor resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this ordinance.

"Manufactured home" means a structure, transportable in one or more sections, which is built on a permanent chassis and designed to be used with or without a permanent foundation when connected to the required utilities. The term also includes park trailers, travel trailers, and similar transportable

structures placed on a site for 180 consecutive days or longer and intended to be improved property.

"Manufactured home park or subdivision" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

"Mean Sea Level" means the average height of the sea for all stages of the tide. It is used as a reference for establishing various elevations within the flood plain. For purposes of this ordinance, the term is synonymous with National Geodetic Vertical Datum (NGVD).

"National Geodetic Vertical Datum (NGVD)" as corrected in 1929, is a vertical control used as a reference for establishing varying elevations within the flood plain.

"New Construction" means structures for which the "start of construction" commenced on or after the effective date of this ordinance.

"Remedy a Violation" means to bring the structure or other development into compliance with State or local flood plain management regulations, or, if this is not possible, to reduce the impacts of its noncompliance. Ways that impacts may be reduced include protecting the structure or other affected development from flood damages, implementing the enforcement provisions of the ordinance or otherwise deterring future similar violations, or reducing Federal financial exposure with regard to the structure or other development.

"Sand dunes" means naturally occurring accumulations of sand in ridges or mounds landward of the beach.

"Start of construction" (for other than new construction or substantial improvements under the Coastal Barrier Resources Act (16 U.S.C. §3501 et seq.), includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, or improvement was within 180 days of the permit date. The actual start means the first placement of permanent construction of a structure (including a manufactured home) on a site, such as the pouring of slabs or footings, installation of piles, construction of columns, or any work beyond the stage of excavation or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling: nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure.

"Structure" means a walled and roofed building that is principally above ground, a mobile home, a gas or liquid storage tank, or other man-made facilities or infrastructures.

"Substantial improvement" means any repair. reconstruction, or improvement of a structure, within any twelve month period, where the cost equals or exceeds fifty percent of the market value of the structure. either (1) before the improvement or repair is started, or (2) if the structure has been damaged and

is being restored, before the damage occurred. For the purposes of this definition, "substantial improvement" is considered to occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not, however, include either (1) any project for improvement of a structure to comply with existing state and local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions, or (2) any alteration of a structure listed on the National Register of Historic Places or a State Inventory of Historic Places.

"Variance" is a grant of relief to a person from the requirements of this ordinance which permits construction in a manner otherwise prohibited by this ordinance where specific enforcement would result in unnecessary hardship.

"Violation" means the failure of a structure or other development to be fully compliant with the community's flood plain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in Articles 4 and 5 is presumed to be in violation until such time as that documentation is provided.

ARTICLE 3. GENERAL PROVISIONS

SECTION A. LANDS TO WHICH THIS ORDINANCE APPLIES

This ordinance shall apply to all areas of special flood hazard within the jurisdiction of _____ (local unit).

SECTION B. BASIS FOR ESTABLISHING THE AREAS OF SPECIAL FLOOD HAZARD

The areas of special flood hazard identified by the Federal Emergency Management agency in its _____, dated _____, with accompanying maps and other supporting data, and any revision thereto are adopted by reference and declared to be a part of this ordinance.

SECTION C. ESTABLISHMENT OF DEVELOPMENT PERMIT

A Development Permit shall be required in conformance with the provisions of this ordinance prior to the commencement of any development activities.

SECTION D. COMPLIANCE

No structure or land shall hereafter be located, extended, converted or structurally altered without full compliance with the terms of this ordinance and other applicable regulations.

SECTION E. ABROGATION AND GREATER RESTRICTIONS

This ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this ordinance and another conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

SECTION F. INTERPRETATION

In the interpretation and application of this ordinance all provisions shall be: (1) considered as minimum requirements: (2) liberally construed in favor of the governing body, and; (3) deemed neither to limit nor repeal any other powers granted under state statutes.

SECTION G. WARNING AND DISCLAIMER OF LIABILITY

The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This ordinance does not imply that land outside the areas of special flood hazard or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of _____ (local unit) or by any officer or employee thereof for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.

SECTION H. PENALTIES FOR VIOLATION

Violation of the provisions of this ordinance or failure to comply with any of its requirements, including violation of conditions and safeguards established in connection with grants of variance or special exceptions, shall constitute a misdemeanor. Any person who violates this ordinance or fails to comply with any of its requirements shall, upon conviction thereof, be fined not more than $50.00 or imprisoned for not more than 90 days, or both. Each day such violation continues shall be considered a separate offense. Nothing herein contained shall prevent the _____ (local unit) from taking such other lawful action as is necessary to prevent or remedy any violation.

ARTICLE 4. ADMINISTRATION

SECTION A. DESIGNATION OF LOCAL ADMINISTRATOR

The _____ (local administrator) is hereby appointed to administer and implement the provisions of this ordinance.

SECTION B. DEVELOPMENT PERMIT AND CERTIFICATION REQUIREMENTS

Application for a Development Permit shall be made to the local administrator on forms furnished by him or her prior to any development activities. The Development Permit may include, but not be limited to plans in duplicate drawn to scale showing: the nature, location, dimensions, and elevations of the area in question: existing or proposed structures; and the location of fill, materials storage areas and drainage facilities. Specifically, the following information is required:

(1) Where base flood elevation data is provided in accordance with Article 4, Section C (10), the application for a development permit within the Zone A on the Flood Insurance Rate Map shall show:

(a) the elevation (in relation to mean sea level) of the lowest floor (including basement) of all new and substantially improved structures, and

(b) if the structure has been floodproofed in accordance with Article 5, Section B (2), the elevation (in relation to mean sea level) to which the structure was floodproofed.

(2) Where the base flood elevation data is not provided the application for a development permit must show construction of the lowest floor at least 2 feet above the highest adjacent grade.

(3) Where any watercourse will be altered or relocated as a result of proposed development, the application for a development permit shall include: a description of the extent of watercourse alteration or relocation; an engineering report on the effects of the proposed project on the flood-carrying capacity of the watercourse and the effects on properties located both upstream and downstream; and a map showing the location of the proposed watercourse alteration or relocation.

(4) When a structure is floodproofed, the applicant shall provide a certificate from a registered professional engineer or architect that the non-residential floodproofed structure meets the floodproofing criteria in Article 5, Section B (2).

(5) A floor elevation or floodproofing certification is required after the lowest floor is completed, or in instances where the structure is subject to the regulations applicable to Coastal High Hazard Areas, after placement of the horizontal structural members of the lowest floor. Within twenty-one (21) calendar days of establishment of the lowest floor

elevation, or floodproofing by whatever construction means, or upon placement of the horizontal structural members of the lowest floor, whichever is applicable, it shall be the duty of the permit holder to submit to the local administrator a certification of the elevation of the lowest floor, or floodproofed elevation, or the elevation of the bottom of the horizontal structural members of the lowest floor, whichever is applicable, as built, in relation to mean sea level. Said certification shall be prepared by or under the direct supervision of a registered land surveyor or professional engineer and certified by same. When floodproofing is utilized for a particular building, said certification shall be prepared by or under the direct supervision of a professional engineer or architect and certified by same. Any work done within the twenty-one (21) day calendar period and prior to submission of the certification shall be at the permit holder's risk. The local administrator shall review the floor elevation survey data submitted. Deficiencies detected by such review shall be corrected by the permit holder immediately and prior to further progressive work being permitted to proceed. Failure to submit the survey or failure to make said corrections required hereby shall be cause to issue a stop-work order for the project.

SECTION C. DUTIES AND RESPONSIBILITIES OF THE LOCAL ADMINISTRATOR

Duties of the _____ (local administrator) shall include, but not limited to:

(1) Review all development permits to assure that the permit requirements of this ordinance have been satisfied.

(2) Advise permittee that additional federal or state permits may be required, and if specific federal or state permits are known, require that copies of such permits be provided and maintained on file with the development permit.

(3) Notify adjacent communities and the N.C. Department of Crime Control and Public Safety, Division of Emergency Management, State Coordinator for the National Flood Insurance Program, prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Emergency Management Agency.

(4) Assure that maintenance is provided within the altered or relocated portion of said watercourse so that the flood-carrying capacity is not diminished.

(5) Prevent encroachments within floodways unless the certification and flood hazard reduction provisions of Article 5 are met.

(6) Verify and record the actual elevation (in relation to mean sea level) of the lowest floor (including basement) of all new or substantially improved structures, in accordance with Article 4, Section B (5).

(7) Verify and record the actual elevation (in relation to mean sea level) to which the new or substantially improved structures have been floodproofed, in accordance with Article 4, Section (5).

(8) In Coastal Hazard Areas, certification shall be obtained from a registered professional engineer or architect that the structure is securely anchored to adequately anchored pilings or columns in order to withstand velocity waters and hurricane wave wash.

(9) In Coastal High Hazard Area, the local administrator shall review plans for adequacy of breakaway walls in accordance with Article 5, Section B (5) (h).

(10) When floodproofing is utilized for a particular structure, the local administrator shall obtain certifications from a registered professional engineer or architect in accordance with Article 5, Section B (2).

(11) Where interpretation is needed as to the exact location of boundaries of the areas of special flood hazard (for example, where there appears to be a conflict between a mapped boundary and actual field conditions), the local administrator shall make the necessary interpretation. The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in this article.

(12) When base flood elevation data or floodway data has not been provided in accordance with Article 3, Section B, then the local administrator shall obtain, review and reasonably utilize any base flood elevation data and floodway data available from a federal, state or other source, including data developed pursuant to Article 5, Section D (4) in order to administer the provisions of this ordinance.

(13) All records pertaining to the provisions of this ordinance shall be maintained in the office of the local administrator and shall be open for public inspection.

SECTION D. ADMINISTRATIVE PROCEDURES

(1) Inspections of Work in Progress: As the work pursuant to a permit progresses, the local administrator shall make as many inspections of the work as may be necessary to ensure that the work is being done according to the provisions of the local ordinance and the terms of the permit. In exercising this power, the administrator has a right, upon presentation of proper credentials, to enter on any promises within the territorial jurisdiction at any reasonable hour for the purposes of inspection or other enforcement action.

(2) Stop Orders: Whenever a building or part thereof is being constructed, reconstructed, altered or repaired in violation of this ordinance, the administrator may order the work to be immediately stopped. The stop order shall be in writing and directed to the person doing the work. The stop order shall state the specific work to be stopped, the specific reasons for the stoppage, and the conditions under which the work may be resumed. Violation of a stop order constitutes a misdemeanor.

(3) Revocation of Permits: The local administrator may revoke and require the return of the development permit by notifying the permit holder in writing stating the reason for the revocation. Permits shall be revoked for any substantial departure from the approved application, plans, or specifications; for refusal or failure to comply with the requirements of state or local laws; or for false statements or misrepresentations made in securing the permit. Any permit mistakenly issued in violation of an applicable state or local law may also be revoked.

(4) Periodic Inspections: The local administrator and each member of his inspections department shall have a right, upon presentation of proper credentials, to enter on any premises within the territorial jurisdiction of the department at any reasonable hour for the purposes of inspection or other enforcement action.

(5) Violations to be Corrected: When the local administrator finds violations of applicable state and local laws, it shall be his duty to notify the owner of the building of the violation. The owner shall immediately remedy the violations of law.

(6) Actions in Event of Failure to take Corrective Action: If the owner of a building or property shall fail to take prompt corrective action, the administrator shall give him written notice, by certified or registered mail to his last known address or by personal service:

(a) That the building or property is in violation of the Flood Damage Prevention Ordinance;

(b) That a hearing will be held before the local administrator at a designated place and time, not later than 10 days after the date of the notice, at which time the owner shall be entitled to be heard in person or by counsel and to present arguments and evidence pertaining to the matter: and,

(c) That following the hearing, the local administrator may issue such order to alter, vacate, or demolish the building; or to remove fill as appears appropriate.

(7) Order to take Corrective Action: If, upon a hearing held pursuant to the notice prescribed above, the administrator shall find that the building or development is in violation of the Flood Damage Prevention Ordinance, he shall make an order in writing to the owner, requiring the owner to remedy the violation, within such period, not less than 60 days, as the administrator may prescribe; provided, that where the administrator finds that there is imminent danger to life or to other property, he may order that corrective action be taken in such lesser period as may be feasible.

(8) Appeal: Any owner who has received an order to take corrective action may appeal from the order to the local elected governing body by giving notice of appeal in writing to the administrator and the clerk within 10 days following issuance of the final order. In the absence of an appeal, the order of the administrator shall be final. The local governing body

shall hear an appeal within a reasonable time and may affirm, modify and affirm, or revoke the order.

(9) Failure to Comply with Order: If the owner of a building or property fails to comply with an order to take corrective action from which no appeal has been taken, or fails to comply with an order of the governing body following an appeal, he shall be guilty of a misdemeanor and shall be punished in the discretion of the court.

SECTION E. VARIANCE PROCEDURES

(1) The _____ (appeal board) as established by _____ (local unit) shall hear and decide appeals and requests for variances from the requirements of this ordinance.

(2) Any person aggrieved by the decision of the _____ (appeal board) or any taxpayer may appeal such decision to the Court, as provided in Chapter 7A of the N. C. General Statutes.

(3) Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places without regard to the procedures set forth in the remainder of this section.

(4) In passing upon such applications, the _____ (appeal board) shall consider all technical evaluations, all relevant factors, all standards specified in other sections of this ordinance, and:

(a) the danger that materials may be swept onto other lands to the injury of others;

(b) the danger to life and property due to flooding or erosion damage;

(c) the susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

(d) the importance of the services provided by the proposed facility to the community;

(e) the necessity to the facility of a waterfront location, where applicable;

(f) the availability of alternative locations, not subject to flooding or erosion damage, for the proposed use;

(g) the compatibility of the proposed use with existing and anticipated development;

(h) the relationship of the proposed use to the comprehensive plan and flood plain management program for that area;

(i) the safety of access to the property in times of flood for ordinary and emergency vehicles;

(j) the expected heights, velocity, duration, rate of rise and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site; and,

(k) the costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, and water systems, and streets and bridges.

(5) Upon consideration of the factors listed above and the purposes of this ordinance, the _____ (appeal board) may attach such conditions to the granting of variances as it deems necessary to further the purposes of this ordinance.

(6) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

(7) Conditions for Variances:

(a) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

(b) Variances shall only be issued upon (i) a showing of good and sufficient cause, (ii) a determination that failure to grant the variance would result in exceptional hardship, and; (iii) a determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisance, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

(c) Any applicant to whom a variance is granted shall be given written notice specifying the difference between the base flood elevation and the elevation to which the structure is to be built and a written statement that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation. Such notification shall be maintained with a record of all variance actions.

(d) The local administrator shall maintain the records of all appeal actions and report any variances to the Federal Emergency Management Agency upon request.

ARTICLE 5. PROVISIONS FOR FLOOD HAZARD REDUCTION

SECTION A. GENERAL STANDARDS

In all areas of special flood hazard the following provisions are required:

(1) All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure;

(2) Manufactured homes shall be anchored to prevent flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This standard shall be in addition to and consistent with applicable state requirements for resisting wind forces;

(3) All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage;

(4) All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damages;

(5) Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

(6) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

(7) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters;

(8) On-site waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding; and,

(9) Any alteration, repair, reconstruction of improvements to a structure which is in compliance with the provisions of this ordinance, shall meet the requirements of "new construction" as contained in this ordinance.

SECTION B. SPECIFIC STANDARDS

In all areas of special flood hazard where base flood elevation data has been provided, as set forth in Article 3, Section B, or Article 4, Section C (10), the following provisions are required:

(1) Residential Construction. New construction or substantial improvement of any residential structure shall have the lowest floor, including basement, elevated no lower than (_____ feet) above the base flood elevation. Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate the unimpeded movements of flood waters shall be provided.

(2) Non-Residential Construction. New construction or substantial improvement of any commercial, industrial, or non-residential structure shall have the lowest floor, including basement, elevated no lower than (____ feet) above the level of the base flood elevation. Structures located in A-zones may be floodproofed in lieu of elevation provided that

all areas of the structure below the required elevation are water tight with walls substantially impermeable to the passage of water, using structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. A registered professional engineer or architect shall certify that the standards of this subsection are satisfied. Such certification shall be provided to the official as set forth in Article 4, Section B (5).

(3) Elevated Buildings. New construction or substantial improvements of elevated buildings that include fully enclosed areas formed by foundation and other exterior walls below the base flood elevation shall be designed to preclude finished living space and designed to allow for the entry and exit of floodwaters to automatically equalize hydrostatic flood forces on exterior walls.

(a) Designs for complying with this requirement must either be certified by a professional engineer or architect or meet the following minimum criteria:

(i) Provide a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding;

(ii) The bottom of all openings shall be no higher than one foot above grade; and,

(iii) Openings may be equipped with screens, louvers, valves or other coverings or devices provided they permit the automatic flow of floodwaters in both directions.

(b) Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

(c) Access to the enclosed area shall be the minimum necessary to allow for parking of vehicles (garage door) or limited storage of maintenance equipment used in connection with the premises (standard exterior door) or entry to the living area (stairway or elevator).

(d) The interior portion of such enclosed area shall not be partitioned or finished into separate rooms, except to enclose storage areas.

(4) Floodways. Located within areas of special flood hazard established in Article 3, Section B, are areas designated as floodways. The floodway is an extremely hazardous area due to the velocity of flood waters which carry debris and potential projectiles, and has erosion potential. The following provisions shall apply within such areas:

(a) No encroachments, including fill, new construction, substantial improvements and other developments shall be permitted unless certification (with supporting technical data) by a registered professional engineer is provided demonstrating that encroachments

shall not result in any increase in flood levels during occurrence of the base flood discharge.

(b) If Article 5, Section B(4)(a) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of Article 5.

(c) No manufactured homes shall be permitted except in an existing manufactured home park or subdivision. A replacement manufactured home may be placed on a lot in an existing manufactured home park or subdivision provided the anchoring standards of Article 5, Section A(2), and the elevation standards of Article 5, Section B(1) are met.

(5) Coastal High Hazard Areas (V Zones). Located within the areas of special flood hazard established in Article 3, Section B, are areas designated as coastal high hazard areas. These areas have special flood hazards associated with wave wash. The following provisions shall apply within such areas:

(a) All buildings or structures shall be located (_____feet) landward to the reach of the mean high tide.

(b) All buildings or structures shall be elevated so that the bottom of the lowest supporting horizontal member (excluding pilings or columns) is located no lower than (_____feet) above the base flood elevation level, with all space below the lowest supporting member open so as not to impede the flow of water. Open lattice work or decorative screening may be permitted for aesthetic purposes only and must be designed to wash away in the event of abnormal wave action and in accordance with Article 5, Section B (5)(h).

(c) All buildings or structures shall be securely anchored on pilings or columns.

(d) All pilings or columns and the attached structures shall be anchored to resist flotation, collapse, and lateral movement due to the effect of wind and water loads acting simultaneously on all building components. The anchoring and support system shall be designed with wind and water loading values which equal or exceed the 100 year mean recurrence interval (one percent annual chance flood).

(e) A registered professional engineer or architect shall certify that the design, specifications, and plans for construction are in compliance with the provisions contained in Article 5, Sections B (5)(b), (c), and (d) of this ordinance.

(f) There shall be no fill used as structural support. Non-compacted fill s-may be used around the perimeter of a building for landscaping/aesthetic purposes provided the fill will wash out from storm surge (thereby rendering the building free of obstruction) prior to generating excessive loading forces, ramping effects, or wave deflection. The local administrator shall approve design plans

for landscaping/aesthetic fill only after the applicant has provided an analysis by an engineer, architect, and/or soil scientist, which demonstrates that the following factors have been fully considered:

(i) Particle composition of fill material does not have a tendency for excessive natural compaction;

(ii) Volume and distribution of fill will not cause wave deflection to adjacent properties; and

(iii) Slope of fill will not cause wave run-up or ramping.

(g) There shall be no alteration of sand dunes or mangrove stands which would increase potential flood damage.

(h) Lattice work or decorative screening shall be allowed below the base flood elevation provided they are not part of the structural support of the building and are designed so as to break away, under abnormally high tides or wave action, without damage to the structural integrity of the building on which they are to be used and provided the following design specifications are met:

(i) No solid walls shall be allowed.

(ii) Material shall consist of wood or mesh screening only.

(iii) Design safe loading resistance of each wall shall be not less than 10 nor more than 20 pounds per square foot; or

(iv) If more than 20 pounds per square foot, a registered professional engineer or architect shall certify that the design wall collapse would result from a water load less than that which would occur during the base flood event, and the elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components during the base flood event. Maximum wind and water loading values to be used in this determination shall each have one percent chance of being equalled or exceeded in any given year (100-year mean recurrence interval).

(i) If aesthetic lattice work on screening is utilized, such enclosed space shall not be designed to be used for human habitation, but shall be designed to be used only for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises.

(j) Prior to construction, plans for any structures that will have lattice work or decorative screening must be submitted to the local administrator for approval.

(k) Any alteration, repair reconstruction or improvement to a structure shall not enclose the space below the lowest floor except with

lattice work or decorative screening, as provided for in Article 5, Sections B (5)(h) and (i).

(1) No manufactured homes shall be permitted except in an existing manufactured homes park or subdivision. A replacement manufactured home may be placed on a lot in an existing manufactured home park or subdivision provided the anchoring standards of Article 5, Section A (2), and the elevation standards of Article 5, Section B (1) are met.

SECTION C. STANDARDS FOR STREAMS WITHOUT ESTABLISHED BASE FLOOD ELEVATIONS AND/OR FLOODWAYS

Located within the areas of special flood hazard established in Article 3, section B, are small streams where the Federal Emergency Management Agency has not provided base flood data and where no floodways have been identified. The following provisions shall apply within such areas:

(1) No encroachments, including fill, new construction, substantial improvements, or new development shall be permitted within a distance from the stream bank equal to _____ times the width of the stream at the top of bank or twenty feet each side from top of bank, whichever is greater, unless certification by a registered professional engineer is provided demonstrating that such encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

(2) If Article 5, Section C (1) is satisfied and base flood elevation data is available from other sources, all new construction and substantial improvements within such areas shall comply with all applicable flood hazard ordinance provisions of Article 5 and shall be elevated or floodproofed in accordance with elevations established in accordance with Article 4, Section C (10). When base flood elevation data is not available from a federal, state or other source, the lowest floor, including basement, shall be elevated, at least two (2) feet above the highest adjacent grade.

SECTION D. STANDARDS FOR SUBDIVISION PROPOSALS

(1) All subdivision proposals shall be consistent with the need to minimize flood damage;

(2) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage;

(3) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood hazards; and,

(4) Base flood elevation data shall be provided for subdivision proposals and other proposed development which is greater than the lesser of fifty lots or five acres.

SECTION E. STANDARDS FOR AREAS OF SHALLOW FLOODING (AO ZONES)

Located within the areas of special flood hazard established in Article 3, Section B, are areas designated as shallow flooding. These areas have special flood hazards associated with base flood depths of one to three feet (1'-3') where a clearly defined channel does not exist and where the path of flooding is unpredictable and indeterminate. The following provisions shall apply within such areas:

(1) All new construction and substantial improvements of residential structures shall have the lowest floor, including basement, elevated to the depth number specified on the Flood Insurance Rate Map, in feet, above the highest adjacent grade. If no depth number is specified, the lowest floor, including basement, shall be elevated, at least two (2) feet above the highest adjacent grade.

(2) All new construction and substantial improvements of nonresidential structures shall:
   (a) have the lowest floor, including basement, elevated to the depth number specified on the Flood Insurance Rate Map, in feet, above the highest adjacent grade. If no depth number is specified, the lowest floor, including basement shall be elevated, at least two (2) feet above the highest adjacent grade; or,

   (b) be completely floodproofed together with attendant utility and sanitary facilities to or above that level so that any space below that level is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy.

Adopted on _____

BY: _____
_____
_____
_____
_____
(Signature of Governing Board)

Certified by: _____

Date: _____

MODEL AMENDMENTS TO DEM FLOOD DAMAGE PREVENTION ORDINANCE

I. Zoning

a) Density

Residential density shall not exceed five dwelling units per acre in Areas of Special Flood Hazard and three dwelling units per acre in Coastal High Hazard Areas.

b) Density Bonus

Any owner of a single or contiguous parcels which are partly within and partly without the Hazard Area boundaries may receive a density bonus. For each acre in an Area of Special Flood Hazard, one acre outside the Hazard Area may be rezoned to allow for a density or floor area ratio (at the election of the landowner) one-and-one-quarter times greater, or a minimum lot size one-and- one-quarter times smaller, that provided by the existing zoning provisions. For each acre in Coastal High Hazard Areas, the density bonus for each acre outside the Hazard Area shall be one-and-one-half times the existing provisions.[1]

c) Nonconforming Uses

Any use or structure which exists at the time of enactment of this ordinance may be continued, without expansion or substantial alteration,

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[1]The density bonus provision is intended to be a form of compensation for the restrictions of the Hazard Area ordinance. It balances the restrictions on development in the Hazard overlay zone by allowing more intense development elsewhere, thus creating a means to accommodate market pressures, alleviate any perceived unfairness of hazard mitigation restrictions, and discourage takings suits. By eliminating the requirement that the restrictions and the bonus be applied to the same or contiguous parcels, this provision could be extended and developed into a Transferable Development Rights scheme.

unless: the use or structure is abandoned or discontinued for a period of one year; or the structure is damaged or destroyed by flooding, wave action, wind action, beach erosion, or other result of a hurricane or coastal hazard, to the extent of 50% or greater of its market value as determined by the _____ tax assessor.[2] All damaged, destroyed, or substantially altered structures must be rebuilt in conformance with this ordinance.

II. Subdivision Requirements

a) Lot Configuration

Lots must be at least one-and-one-half times as long as they are wide, and the long side shall be perpendicular to the shoreline.[3] The minimum lot size for a single family residential structure shall be 20,000 square feet in Areas of Special Flood Hazard, and 30,000 square feet in Coastal High Hazard Areas.[4]

b) Site Preparation

Any natural vegetation which is damaged or destroyed in construction, except that occupying the building footprint and driveway, shall be replaced. No sand may be removed from the site, and dune systems are to be undisturbed. Construction may not decrease the elevation of the site, and the site is to be

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[2]By allowing the rebuilding of uses damaged or destroyed by non-coastal-hazard-related causes (i.e., fire), this provision softens the impact of hazard-related development restrictions which may create large numbers of nonconforming uses.

[3]This is to allow an "escape lot" or sufficient room to relocate structures if erosion or storms moves back the shoreline and/or the CAMA setback line.

[4]Minimum lot sizes will be proportional for other uses.

returned to its original contours to the maximum extent possible. Impervious surface coverage shall not exceed twenty-five percent of the lot area.

c) Hazard Disclosure

All subdivision proposals shall provide, and show on the final plat as recorded in the _____ County land records, base flood elevations and the boundaries of Areas of Special Flood Hazard and Coastal High Hazard Areas.

Model Post-Storm Moratorium Ordinance

1. Statutory Authority and Statement of Purpose

Under the general police power authority of N.C.G.S. §160A-174 et seq. (153A-121 for counties), _____ hereby enacts a Post-Storm Reconstruction Moratorium. Because _____ is a coastal community and subject to the destructive forces of hurricanes, storms, and other natural hazards, careful planning is necessary to ensure a level and pattern of development which will not unreasonably endanger life and property. The post-disaster period offers an opportunity to implement comprehensive, planned reconstruction measures such as the _____ Hazard Mitigation Plan, but the confusion and community anxiety which often accompany the aftermath of a disaster can impede these efforts. A moratorium on development activities can provide a necessary breathing space, limited in scope and duration, during which the _____ government can better assess the damage situation, attempt to coordinate the relief efforts of state and federal agencies, and promote reconstruction in conformity with the _____ Hazard Mitigation Plan.

2. Declaration of the Moratorium

A Post-Storm Reconstruction Moratorium shall exist upon the occurrence of one or more of the following events: _____ is struck by a hurricane of force equal or greater than 3 on the Saffir-Simpson scale, as determined by the National Weather Service; _____ is declared a disaster area either by the Governor of North Carolina or the President of the United States; or twenty percent or more of the structures in _____, or any zoning district thereof,

as determined by the Building Inspector, are destroyed or substantially damaged by a hurricane or other coastal storm hazard.[5]

3. Effect of Moratorium

The Moratorium shall be declared by the Mayor (Chief Executive) as head of the Reconstruction Task Force, and shall remain in effect until revoked according to the triage provisions in Section 4(b) of this ordinance. In no case shall the Moratorium be of less duration than thirty days. While the Moratorium is in effect, no development permits or variances of any kind shall be issued, no rezonings or zoning changes shall be approved, and no construction or reconstruction activity may be undertaken, excepting only minor interior repairs and emergency repairs necessary to prevent injury or loss of life or imminent collapse or other substantial damage to structures.

4. Triage Provisions

a) Task Force Responsibilities

Upon declaration of the Moratorium, the Reconstruction Task Force shall be activated. The Task Force shall consist of:_____[6] The Task Force shall immediately survey all affected areas and prepare a report, dividing (the jurisdiction) into the following three categories:

1. Undamaged or Slightly Damaged Areas;
   Areas in which buildings, structures, or other improvements have been damaged up to 25% of their assessed market value, as determined by the Building Inspector and/or Tax Assessor;

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[5]The moratorium may also be made to apply only in one or more of the triage-classified areas.

[6]Composition of the Post-storm reconstruction Task Force should be specified according to the jurisdiction's Hazard Mitigation Plan. Several members of the Task Force should also be members of FEMA federal/state/local post-disaster teams, so as to coordinate relief and reconstruction efforts. For further discussion, see Chapter 6, Part II.

2. Damaged Areas:
   Areas in which buildings, structures, or other improvements have been damaged to the extent of greater than 25% but less than 50% of their assessed market value, as determined by the Building Inspector and/or Tax Assessor;
3. Severely Damaged Areas:
   Areas in which buildings, structures, or other improvements have been damaged to the extent of 50% or more of their assessed market value, as determined by the Building Inspector and/or Tax Assessor.

Within each category, the Task Force shall recommend any changes in zoning, subdivision regulations, setback, density, or elevation requirements, or any other ordinances which it deems necessary or advisable to prevent a recurrence of coastal hazard damage.

The Task Force shall also identify any parcels or locations suitable for acquisition by (the jurisdiction) or by (the jurisdiction) in conjunction with state or federal agencies or private conservation organizations.[7]

b) Substantive Provisions

1. Undamaged or Slightly Damaged Areas

   Within Undamaged or Slightly Damaged Areas, the Moratorium shall be lifted as soon as possible after 30 days have elapsed. Reconstruction, subject to applicable ordinances and regulations, may commence as soon as roads, water, sewer, electric, telephone, and other essential public services are restored.

2. Damaged Areas

   Within Damaged Areas, the Moratorium shall not be lifted until the (Town Council/County Commissioners) have made a final disposition of the Task Force's recommendations as to whether any additional

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[7]The locality could consider acquisition through negotiated purchase, condemnation, the NFIP §1362 program, state beach access programs, or purchase of development rights. For further discussion see Chapter 5.

development restrictions should be enacted in the Area or whether any property rights in the Area should be purchased.

3. Severely Damaged Areas

Within Severely Damaged Areas, no reconstruction shall occur except under the following conditions: residential densities shall be one-half the underlying requirement, and minimum lot sizes in the Area shall be twice the underlying requirement. All uses permitted under the underlying zoning, except single-family residential and accessory uses, shall be conditional uses. Alternatively, reconstruction shall comply with the provisions applicable to Coastal High Hazard Areas, whichever is more stringent.[8]

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[8]The types of density reduction listed are illustrative only; they are examples of imposing an automatic, predetermined development restriction in the most severely damaged areas. Given the circumstances of the hurricane aftermath, this area will have been substantially overdeveloped, and an automatic downzoning or density reduction offers the chance for reconstruction to proceed from a clean slate at a lower, more appropriate level.

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