SGR-88

January 1987

Prior Planning for Post-hurricane Reconstruction

SEA GRANT

Jack Salmon and Don Henningson

PRIOR PLANNING FOR POST-HURRICANE RECONSTRUCTION

By

Jack Salmon and Don Henningsen

Research Associates

Michael Brown, Steven Cook,
Thomas Dodds, Daniel Evans and Gregory Stone

Coastal Studies
Department of Political Science
University of West Florida
Pensacola, Florida 32504

Sea Grant Project Number R/C-P-10
Grant Number NA85AA-D-SG059

Report Number 88
Florida Sea Grant College
November 1986
Price $4.00

Acknowledgements

Florida Sea Grant provided the basic funding for this project. The University of West Florida assisted by providing funds for several graduate research assistants, thereby enriching their education and experience. We thank Buck Thackeray (National Park Service, Pensacola) and Buck Renfroe (Escambia County, Florida) for the use of their aerial photographs and for fruitful discussions on this project. The Graphics Department of the University of West Florida, with additional assistance by Heidi Carter, provided cartographic and other illustrations. Pat Davis labored mightily and without complaints on the word processor, and Debbie Hall helped with the accounting and other administrative work. Gregory Stone acknowledges receipt of an Advanced Science Scholarship from the Department of Higher Education of Northern Ireland, for study in the United States.

TABLE OF CONTENTS

CHAPTER 1

FLORIDA'S HURRICANE VULNERABILITY

Florida's unique position as a sub-tropical peninsula, the Caribbean sun porch of the United States, is the key to its role as a tourist mecca and the basis of a major portion of the economy and life style. But that broad geographic good fortune carries with it a cost: Florida extends into the tracks hurricanes usually follow and suffers more strikes than any other part of the United States. Hurricanes have changed the coastal areas of Florida by forming and removing islands and inlets, and have even changed history. The first European settlement in present-day America was at Pensacola, but a hurricane led to abandonment of the site and allows St. Augustine to claim the distinction of being the oldest continuously-inhabited American city.

The map of historical hurricane tracks in the United States shows that every part of Florida has been affected (Fig. 2-7). There is a statistical certainty that every part will be affected in the future. What we do not know are when a given area will be struck, or how powerful the hurricane will be. But we can, and increasingly do, plan and prepare to preserve life when the hurricane comes. Loss of life in hurricanes 50 years ago ran into the hundreds; today, 10 fatalities is high. With somewhat less success we have acted to protect property, both public and private, and Florida's natural resources.

Although we cannot yet do much about weakening or "steering" hurricanes, and may never be able to, much has been done to learn about and cope with these giant storms. The National Weather Service forecasts do not allow enough time for all local governments to evacuate their populations to safety. Scientists have built elaborate computer models capable of simulating the interaction of hurricane winds and waves with coastal lands and bays. The National Hurricane Center in Miami utilizes SLOSH (Sea, Lake and Overland Surge from Hurricanes) and SPLASH (Special Program to List Surge Amplitudes in Hurricanes) computer models for high risk areas. These models predict which locations can be expected to experience what degree of storm surge from the five categories of hurricanes approaching from five directions.

Federal programs coordinated through the Federal Emergency Management Agency, provide hurricane-relevant assistance to states, local governments and individuals. Florida's Division of Emergency Management is a source of technical assistance and funding for local government. Many regions and county governments now have hurricane evacuation plans and loss and contingency planning studies, some of them extremely detailed and based upon current information, kept up to date and exercised in practice alerts.

Preparedness programs are becoming increasingly important because of the "rush to the coast" in recent years. This virtual explosion of beachside homes, condominiums, motels, and businesses has moved not only larger numbers of people but a major portion of the State's economic structure into areas exposed to recurring hurricane impact. Some population centers are reaching practical limits of evacuation: there are too many people, too densely packed, to evacuate in the warning time capabilities of the National Weather Service. The people who live and work in these coastal high-hazard areas must be completely evacuated four to six hours before the eye reaches the coast: as many as 500,000 people may need to be notified, moved, and assisted in finding temporary shelter. Many hurricane refugees may need substantial assistance, economic and otherwise, when they return to damaged or destroyed homes and businesses. The total public and private investment on Florida's coast is enormous and still growing rapidly--which means that the potential economic impact of future hurricanes is also growing rapidly. When Hurricane Frederic made landfall (1979) near Gulf Shores, Alabama its swath of damage reached into Florida as far as Fort Walton Beach, some eighty miles to the east. Although the majority of the damage was in Alabama rather than Florida, the important point to note is that estimates of the total damage from this one hurricane is approximately $2.3 billion. Frederic was a powerful hurricane (category 3--see Chapter Two) but well within a "normal" range for hurricane strength, and struck an area which was, by the standards of much of Florida's coast, only moderately developed. It is not hard to imagine storm damage in a highly-developed Florida coastal area reaching a loss figure of $10 billion.

Federal Insurance Administration policies, plus coverage through various private insurance carriers, may help replace some of the private economic losses from storm damage. But we sometimes forget that when people and businesses rushed to the coast, government paced alongside. Construction of roads, utilities, street lighting, parks, bridges, boat launching areas and other public amenities in coastal areas has cost taxpayers hundreds of millions of dollars. Of the potential billions of dollars in storm damage, some large fraction will be to publicly-financed installations. City, county and state governments will face sudden, massive demands upon their financial resources as they attempt to restore services, assist citizens, and absorb short-term tax losses due to lowered values or business inactivity. It will be important for local governments to know both where to go and how to qualify for financial assistance, and perhaps to develop their own funding systems to partially self-insure against hurricane losses. Further, it makes excellent sense to do now those things which can reduce or minimize the risks and costs of future hurricanes, and hasten sensible recovery practices after the storm. This is generally referred to as mitigation planning.

MITIGATION PLANNING. Hurricane preparedness planning has typically focused upon two activities: first, evacuation of exposed populations to places of safety; second, short-term recovery measures after the storm has passed (e.g., emergency housing, food and water supply restoration, disaster loans and other financial assistance for quick rebuilding). But the National Governor's Association concluded in 1979 that "too much emphasis in practice, if not in legislative intent has been placed on the preparedness phase of emergency management" (NGA, 1979, pp. 11-12). Increasingly, the concept of mitigation is gaining acceptance as a more desirable approach to reduce hurricane emergency crisis management.

Mitigation is defined by the National Governor's Association as "any activities that actually eliminate or reduce the probability of occurrence of a disaster," including those "long-range activities designed to reduce the effects of unavoidable disaster" (NGA, 1979, p. 13). Because we can do little about eliminating or reducing the "unavoidable disaster" associated with a hurricane, we must focus upon things that can be done to reduce the damage levels and the risk and stress when the emergency arrives. The necessary conclusion is that we should do our mitigation planning in advance and implement mitigative measures as part of a comprehensive approach to risk-reduction.

Evacuation plans and relief for the immediate effects of a hurricane disaster continue to be essential elements of mitigation planning, but the trend is clearly toward development of a general planning scheme for dealing with hurricanes and integration of that program with area comprehensive plans. Much remains to be done, but at least some measures to prevent increase in risks are being emplaced.

However, such plans are still not universal and, when they exist, normally focus on preparing for and reducing damage from the next hurricane. They rarely consider more than one storm at a time -- that is, they do not consider using the post-storm recovery period as a time to actually improve their community and to take measures which will reduce exposure and risk in the next hurricane. Unfortunately, having had one hurricane does not mean that we may safely relax for a century -- the next one may come next year.

It is possible to discern a trend toward long-term planning for mitigating a sequence of hurricanes rather than just "the next one." Federal law now requires that a mitigation plan be filed within 180 days after a disaster, by the affected state for which Federal aid is extended. Federal and state hurricane guidance now usually uses concepts implying preparation for a sequence of storms. Presently, there is not a requirement that the mitigation plan be implemented, only that it be written. However, Congress has discussed legislation which would require implementation of mitigation plans as a condition of Federal aid.

It seems probable that such legislation will be in place soon, as a result of either or both federal and state legislation.

Recent Federal policy changes in the Flood Insurance Program (FIP) also make mitigation more important to local and state governments. Federal FIP aid for repair and reconstruction of public facilities was available for several years on the basis of a 90% Federal share. That has been changed to 75% Federal and a 25% state or local match. By policy, Florida will now cost-share on local government facilities up to 10%, leaving 15% to local government. If a hurricane damages $1 billion worth of public facilities, the State and local share will now run to $250 million, of which local governments would absorb some $150 million--enough to severely impact budgets.

Private citizens similarly have an interest in migitation. Flood insurance premiums are rising under Federal policy to reduce subsidies and make the FIP program self-financing. For taxpayers who live outside flood zones this may be good news, but anyone using the FIP may find mitigation increasingly cost-effective. Safety is also involved: poorly planned development may overload evacuation routes, exposing people in high hazard areas to increased risk and increasing public safety costs as government tries to cope with the problem. Poor construction or poorly-conceived infrastructure systems (sewers, water, gas and electric systems, roads) can be both dangerous and expensive. Inadequate construction may allow the hurricane to pick up a structure and use it as a battering ram to destroy neighboring buildings. Poorly-located streets or canals may funnel storm waves further inland and extend the area of maximum damage. Utilities and roads located in exposed areas may be destroyed, leading to both short-term health and safety problems and increased taxes to pay for restoration.

As we progress beyond basic evacuation and emergency response planning to more integrated approaches to dealing with the somewhat predictable hurricane emergency, mitigation becomes a key element in planning. Good mitigation can improve the efficiency and effectiveness of disaster aid, help reduce the probability of both personal injury and economic loss, shorten the "out of action" period of the local economy, and guide reconstruction in such a way that the next hurricane will have even less opportunity to injure and destroy.

But this has not been the "normal" reconstruction pattern following hurricane disasters. In the immediate post-hurricane period community and private resources of time and energy are strained to the limits. Officials are likely to be in "coping" mode, focusing on the most immediate and pressing problems of restoration of essential services, clean-up of the worst debris, and relief assistance to the homeless. Private citizens who are able to do so usually begin on their own as soon as possible to restore, repair and return to what they understand as normal:

the pattern of life before the storm. Everyone does as best they can, with little coordination or forethought. By the time things have quieted enough to allow time for thought and planning, the basic pattern of reconstruction is already literally set in concrete.

One possible outcome of such behavior is that the post-storm community will be reconstructed as a modified but obviously direct descendent of the pre-storm community. If that community was well-planned and rebuilding on the old pattern is desired, all may be well. But if destruction was severe it may be because the area's development had not heeded hurricane risks--and that pattern too may be repeated, simply resetting the stage for another disaster. A second possible outcome would involve relocation of businesses, housing and community installations, changes in transportation, land use and social structuring, with consequent important changes in community lifestyle. If this second outcome is not planned but "just happens" while no one has the time, the authority or the resources to assure that the new pattern is favorable, many people may regret their lack of forethought and prior planning.

It may seem strange to speak of a hurricane as an opportunity to improve, but a well-prepared community may find that to be the case. If a hurricane sweeps clean a stretch of beach, seriously damages existing utility services, washes out a coastal road or otherwise makes a sizable alteration in the pre-storm structure of land use and indeed in the land forms themselves, the local community and/or state may have a golden opportunity to actually improve the quality of life in the area. But such opportunities are usually limited in time: if they cannot be seized quickly, they vanish. A very significant value of prior planning for post-hurricane construction is that such windows of opportunity may be identified in advance and preparations made for action, so that when the next storm does hit and the opportunity arises it can be taken.

A community stuck in the 'coping mode,' trying to deal with short term problems on an ad hoc basis, cannot capitalize on this chance for improvement. When Hurricane Frederic destroyed the beach structures of Gulf Shores, Alabama there was widespread interest in improving building codes, zoning controls, public amenities and life quality in the area. Such actions could have also mitigated the impact of the next hurricane, when it comes. With Federal assistance, some opportunities were grasped, but it took a full two years to develop and put in place a new building code and zoning program, by which time vigorous coastal construction had already repeated many of the errors of the past. The opportunity was lost for this time. Perhaps, after the next hurricane, the improvements will be made.

It is important to recognize both the practical and the political significance of the concept of a "window of

opportunity." It is well-established that people's "disaster-consciousness" is highest during and for a short time following the disaster, after which it fades to "normal" levels of concern (Foster, 1980; Barton, 1969). It is during this "launch window" of a few weeks following the hurricane disaster that a community is most sensitive to the problems, and most willing to accept planning, property purchases, intervention, guidance, and change to mitigate future problems. In fact, scholars and practitioners of disaster management have come to recognize the existence of a "bitch phase," a period following the initial willingness to cooperate. During the "bitch phase" cooperative behavior drops off and is replaced by a search for someone to blame for mishaps. Often the blame will come to rest on the shoulders of local officials, who may serve as available symbols of "them"--the institutions, the rules, even the forces of nature (Petak, personal comm.). Good prior planning, and in particular good attention to the public participation element of the planning, may reduce public complaints. A well-prepared prior plan can be activated during the cooperative period, giving it an initial political boost which may be crucial to successful implementation over the long haul. Further, a local government may find itself "helped" by state and federal programs and officials in directions it would rather not go. A prepared mitigation plan can give the community leverage and a sense of direction during the vulnerable period.

THE POLITICS OF MITIGATION. Prior planning for the post-hurricane period requires careful attention to the political, social and economic aspects of planning. To a very great extent, hurricane mitigation is a variety of coastal planning and growth management. As such, it is likely to be quite controversial. State and local governments are becoming increasingly concerned about "growth management" and many are beginning to accept the considered opinion of the nation's leading coastal specialists: almost by definition, coastal "problems" arise due to ill-advised human action rather than natural forces (Leatherman, 1982; Pilkey, Pilkey, Pilkey and Neal, 1983). Attempts to "correct" natural forces are usually very expensive, often do not work, and may actually create new problems. Essentially, the ideal form of mitigation would be to keep all man-made structures well away from the beaches and flood zones. But business and residential property perversely seems to be more valuable in direct proportion to its likelihood of being damaged by hurricanes: the private home or resort hotel built right on the beach sells or rents for much more than does the home or hotel room 50 yards farther inland, and that home or room may be more valuable than a similar one located three or four blocks inland on higher ground. Such valuable properties are often owned by influential people able to make themselves heard politically. Nearly everyone objects to governmental or private actions which are perceived as likely to diminish their property values or control their plans for the future. Therefore, reconstruction planning may be opposed both on general principles and because of specific contents of the plan.

It is the position of this Report, and increasingly of federal and state officials, that prior planning for mitigation is advantageous for communities. But it is also correct to say that mitigative actions will cost money--both in actual outlay and in possible "tax expenditures"--and will probably have adverse impacts on property values or property rights of at least some individuals and businesses. Controversy must be accepted, but good planning can reduce and structure the controversy. As with any comprehensive planning effort, it is important to do the best possible job from the viewpoint of professional planning, which necessitates active public participation in the planning process. Often the problem with the "best-laid plans of mice and men" is not that they go astray, but that they are never used. In the aftermath of the hurricane a plan which has been prepared with wide public participation and has strong public support will have a much better chance to be implemented than would an even better "professional" plan little known to the constituency.

THE PLAN OF THIS REPORT. This report is intended to be of practical assistance to local government officials, planners and citizens in making the case for planning before the hurricane to take those post-storm actions which will restore and enhance the community. It is not exhaustive: much research information, many additional ideas or experiences, much more detailed treatments of specific points cannot be included here. References following each chapter will help those who need further information. Some local governments will already have in place some program elements we suggest, or effective alternatives. Few, if any, will have approached the problem as we suggest: as an integrated, long-term mitigation program. It is our purpose to provide basic, general information and experience to help get a planning effort underway. Each community must then tailor its own plan to meet its own needs and limitations.

The Report proceeds from this introductory chapter to consideration of the basic facts of land and sea which must be understood in order to construct a hurricane mitigation plan. Chapter Two treats basic facts about hurricanes, coastal barriers, and the interaction of the two to support the concept and practice of hazard mapping. Some illustrations of inadequate consideration of coastal hazards are provided.

Chapter Three considers "normal" post-hurricane reconstruction experience partly as negative examples but also to provide some opportunity to think about how to improve upon these expensive experiences. Chapter Four examines some constraints upon mitigation planning, considering both structural factors such as legal or institutional systems and more political-social factors such as hazard perception, allocation of costs and benefits and other less tangible constraints. However, this Report does not examine legal questions in detail. A related report, also available from Florida Sea Grant, will do so. An

insight into the relationship between short-term and long-term post-hurricane planning is discussed and how the short-term planning often loses sight of the long-term mitigation goals.

A considerable inventory of possible mitigation planning techniques and tools for action does exist. Chapter Five examines a number of these in the context of hurricane mitigation by prior planning, suggesting several adaptations of existing land use controls, financing techniques and land acquisition. In Chapter Six one of the most critical areas of mitigation is explored: use of public participation in preparing the mitigation plan and gaining public support for its adoption as policy and eventual implementation. It is becoming accepted by emergency management specialists that public participation and support are critical elements of a good disaster response, but there is no magic or scientific method known for gaining that support. Although this chapter should be helpful, it remains true that in this area political leadership is essential, and politics remains more an art than a science.

References

Barton, A. H., 1969. Communities in Disaster. New York: Doubleday.

Foster, H. D., 1980. Disaster Planning: The Preservation of Life and Property. New York: Springer Verlag.

National Governors Association, 1979. Comprehensive Emergency Management: A Governor's Guide. Washington, D.C.: N.G.A.

Leatherman, S. P., 1982. Barrier Island Handbook. College Park: University of Maryland.

Pilkey, O. H., Sr., W. D. Pilkey, O. H. Pilkey, Jr., and W. J. Neal, 1983. Coastal Design. New York: Van Nostrand-Reinhold.

U.S. Army Corps of Engineers, 1981. Hurricane Frederic Post Disaster Report. U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama, 250 pp.

CHAPTER 2

UNDERSTANDING HURRICANE IMPACTS

HURRICANE SEASON AND CHARACTERISTICS

Hurricanes are intense extra-tropical cyclones having their genesis near but not directly over the equator (Tannehill, 1938). The tropical cyclone is a consequence of loosely organized atmospheric disturbances or storms with weak winds developing in a circulatory fashion until they intensify to 39 miles per hour. At this speed the storm is classified as a tropical cyclone. Usually this intensification of wind speed continues and on reaching 75 miles per hour, the tropical cyclone becomes a fully fledged hurricane (CERC, 1977) with a well developed eye and low atmospheric pressure.

Hurricane winds in the northern hemisphere blow counter-clockwise around an area of low atmospheric pressure located in the storm center. However, in the southern hemisphere a clockwise trend prevails. Wind speeds increase towards the eye of the system. The strongest winds often occur approximately 8 to 30 miles from this center. Closer to the center, wind speeds decrease until only light winds occur in the eye of the storm. Hurricane Camille, which crossed the Gulf Coast at Mississippi in 1969, had measured peak gusts of 144 miles per hour (Dikkers, et al., 1971). Similarly, in 1979 peak gusts of 145 mph were recorded when Hurricane Frederic passed over the Alabama coast (U.S. Army Corps of Engineers, 1981).

The eye of the hurricane is the most interesting feature of the overall weather system. As the center of the eye approaches, dramatic reductions in wind speeds from high velocities to 15 mph or less occur. An example of this occurred in 1926 when a category 4 hurricane made landfall at Miami. As the eye passed over downtown Miami, the winds decreased to 10 mph. However, at the same time 80 mph winds were being reported at Miami Beach only 6 miles away (Dunn and Miller, 1960). The average diameter of the eye is approximately fourteen miles. Hurricane Frederic on making landfall had an eye diameter of 15 miles (U.S. Army Corps of Engineers, 1981), whereas Camille in 1969 had an estimated eye diameter of 10 miles (Dikkers, et al., 1971). Diameters as small as 4 miles (Dunn and Miler, 1960) and as large as 35 miles (Morgan, et al., 1958) have been recorded.

The distribution of wind velocities is usually asymmetrical with maximum strengths occurring on the right forward quadrant of the storm as it moves onshore in the northern hemisphere (Figure 2-1). This is due in part to the fact that the forward motion of the storm is added to the observed wind velocity (Dunn and Miller, 1960).

Hurricane size is determined by at least one of the following: (1) strength of the maximum sustained winds; (2) diameter of the hurricane winds (75 mph) and gale winds (40 mph); and (3) diameter of the outer closed isobar. Figure 2-1 illustrates an average diameter of hurricane winds of slightly

HURRICANE WIND GRADIENTS

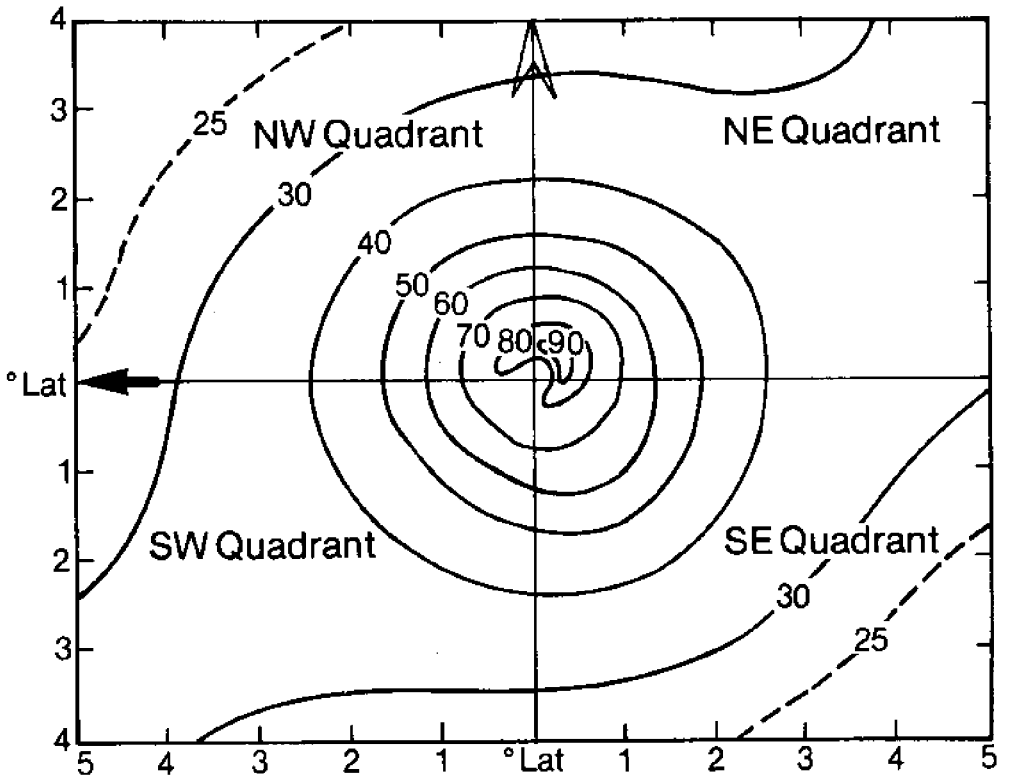


Fig. 2-1 Wind Speed (knots) distribution around a Tropical Cyclone. Note: arrow indicates direction of system movement (after Hughes, 1952). N.B. 1° lat = 60 nautical/69 statute miles.

greater than 100 miles and gales covering an area between 350 and 400 miles wide. These dimensions are representative of the average-sized hurricane.

The intensity of a hurricane is classified by the National Weather Service using the Saffir/Simpson Hurricane Scale. This scale categorizes hurricanes from 1 through 5 with category 5 being the most intense. As shown in Table 2-1, central barometric pressure, wind speed and surge heights are used in determining the degrees of damage. Surge heights do not include wave build-up on top of the surge. Wave build-up can be calculated by multiplying the surge figure by 0.55 and then adding to the surge height. Major hurricanes fall under categories 3, 4, and 5, while minor hurricanes fall under categories 1 and 2.

TABLE 2-1

SAFFIR/SIMPSON HURRICANE SCALE

Scale Number (Category)	Central Pressure Millibars	Inches	Winds	Surge	Damage
1	980	28.94	74-95	4-5	Minimal
2	965-979	28.50-28.91	96-110	6-8	Moderate
3	945-964	27.91-28.47	111-130	9-12	Extensive
4	920-944	27.17-27.88	131-154	13-18	Extreme
5	920	27.17	155	18	Catastrophic

HURRICANE SEASON

The hurricane season begins June 1 and ends November 30. This period is when water temperatures are warm providing the heat energy to the atmosphere for storm formation and intensification. High and low pressure systems over the Atlantic, Gulf of Mexico, and continental United States have a "steering" effect on the storm and hurricane system. Another weather factor either increasing or decreasing the formation of the hurricane system is the broad band of high altitude wind circling the equator. When this band is not moving it increases the chance of hurricane formation, when in motion it shears off the top of storms reducing the updraft forces. The development of a hurricane is suppressed. There are therefore, three key meteorological conditions which are ideal for hurricane formation, warm water, pressure gradients guiding storms into the Gulf or Atlantic warm water areas and the absence of high altitude winds over the warm water areas.

HURRICANE RELATED FEATURES AND POTENTIAL DESTRUCTIVE FORCES

Numerous weather phenomena related to the hurricane are swells, surges, rains and floods, tornadoes, lightning and thunderstorms. The destructive forces of tornadoes, waves, floods and winds cause the loss or damage to numerous structures, infrastructure and in some cases human lives.

Rain and Floods

Rains accompanying hurricanes occur in a series of bands or spirals expanding out from the hurricane eye. Their intensity is highly dependent on the hurricane's forward speed. The slower a hurricane passes over an area, the greater the amount of rainfall deposited on that area. Apparently, no correlation exists between storm intensity (wind strength) and rainfall intensity. It is not known what section, or quadrant of the hurricane, releases maximum rainfall intensity. Cline (1926) shows that for Gulf Coast hurricanes, maximum intensities occurred a distance of 60 to 80 miles in front of the storm system's center and to the right of the center line of advance. Work by Hughes (1952) and Schoner (1957) show similar tendencies and suggest maximum intensities occur in the front-right quadrant of the system. Color enhanced radar photography of the maximum rainfall quadrant supports this work.

The resulting floods are dependent upon the physical characteristics of the drainage area. For example, topography, soil type, saturation potential of the ground and vegetation all play an integral role. Similarly, the rate and total accumulation of precipitation and the river stage at the time of rainfall are of critical concern also. As Dunn and Miller (1960) point out, when heavy rains fall over relatively flat terrain the countryside may be submerged for a lengthy time period, causing damage to buildings, communication lines, and roads which creates considerable inconvenience, anxiety and discomfort to the populace. However, usually few to no fatalities occur. Intense rainfall in mountainous or hilly country can cause devastating floods which develop very rapidly, resulting in a higher potential for the loss of life.

For coastal areas in Florida, concern focuses on the highly destructive swells and surges, waves, and winds associated with hurricanes. The barrier islands, absence of dune systems, low coastal elevations, and extensive bay areas sets the stage for extensive hurricane losses.

Swells and Surges

Sea level is affected by hurricanes in several ways. The reduced atmospheric pressure in the center of the storm system serves to "suck up" the water beneath it forming a dome. Also, shear stresses occur as a consequence of the action exerted by

the wind on the water surface resulting in fluctuations in water levels. The resultant swell waves, or forerunners, arrive at a coastal location well in advance of the actual hurricane. The highest waves occur in concert with the highest winds, to the right of the hurricane center. Hoover (1957), on investigating a series of hurricane surge profiles, discovered that peak wave heights occurred on average between 10 and 20 miles to the right of the storm track. When the waves enter shallow water they begin to peak, eventually become unstable and break. In turn, this induces an overall increase in water level toward the coast. The configuration and slope of the offshore bottom affect the height of surge which establishes conditions for wave setup. Generally, if the water depth is shallow offshore, then the rise in sea level associated with an oncoming hurricane will be amplified. Similarly, the shape of the coastline will affect the surge height. For example, if a great mass of water is driven against a coastline, the area over which this quantity can spread will determine the height to which the water level will rise. The greatest increase occurs when water is funneled into bays and estuaries.

Daily or astronomical tide levels are of importance also particularly along coasts which experience significant tide ranges. Greater coastal inundation will result if the storm surge coincides with high tide rather than low tide.

Waves

To appreciate the tremendous forces of breaking waves under hurricane conditions, consider that a cubic yard of water weighs approximately three-fourths of a ton. A breaking wave containing a hundred cubic yards of water moving towards the shoreline at a speed of 60 mph will have a devastating effect on structures or physical features subject to stormwave inundation. From a structural standpoint, waves can damage coastal buildings in various ways. Structural collapse may result from direct horizontal and/or vertical wave attack. Buildings not constructed on pilings may be subject to foundation scouring as a consequence of plunging waves (Figure 2-2). Flooding often exacerbates the problem. Those structures constructed on pilings are often destroyed by vertical (lifting) wave forces of peaking waves (Figure 2-3). Both forces often result in overturning or lateral movement of the structures off their foundations. In addition, waves can also cause severe battering damage by tossing boats, piers, docks, and numerous other missiles at still-standing structures.

The environmental response of barrier islands and mainland coasts to hurricane generated waves is indeed dramatic. Dunes are often breached and overwashed, relic inlets are usually reopened, resulting in vast quantities of sand being transferred temporarily, from the beach dune and nearshore system. Each of these responses is determined not only by the nature of the

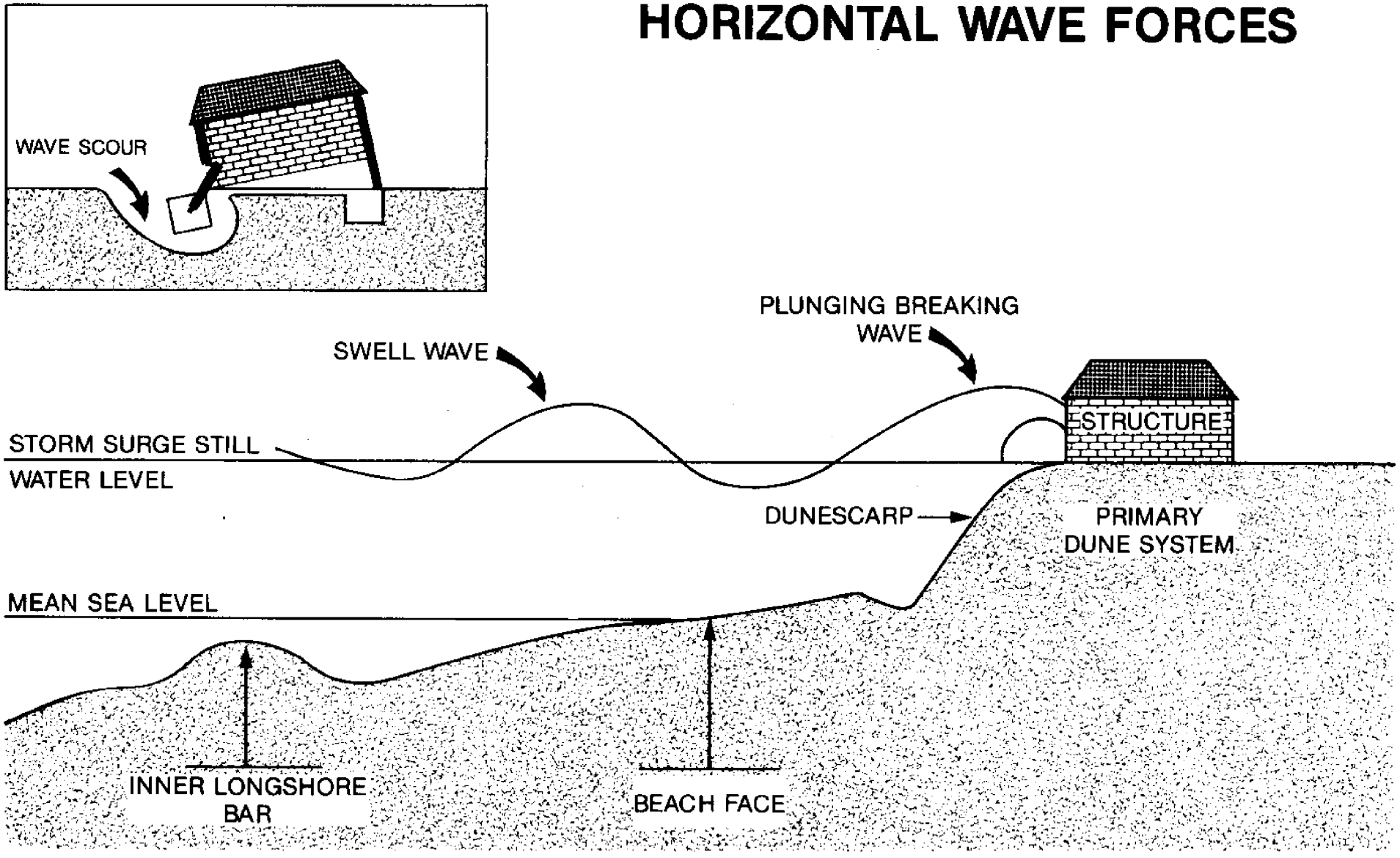


Fig. 2-2 Hurricane induced surge increase and resultant horizontal breaking wave forces exerted upon coastal structure. Inset: wave scour resulting in undermining of structure's foundation.

Vertical Wave Forces

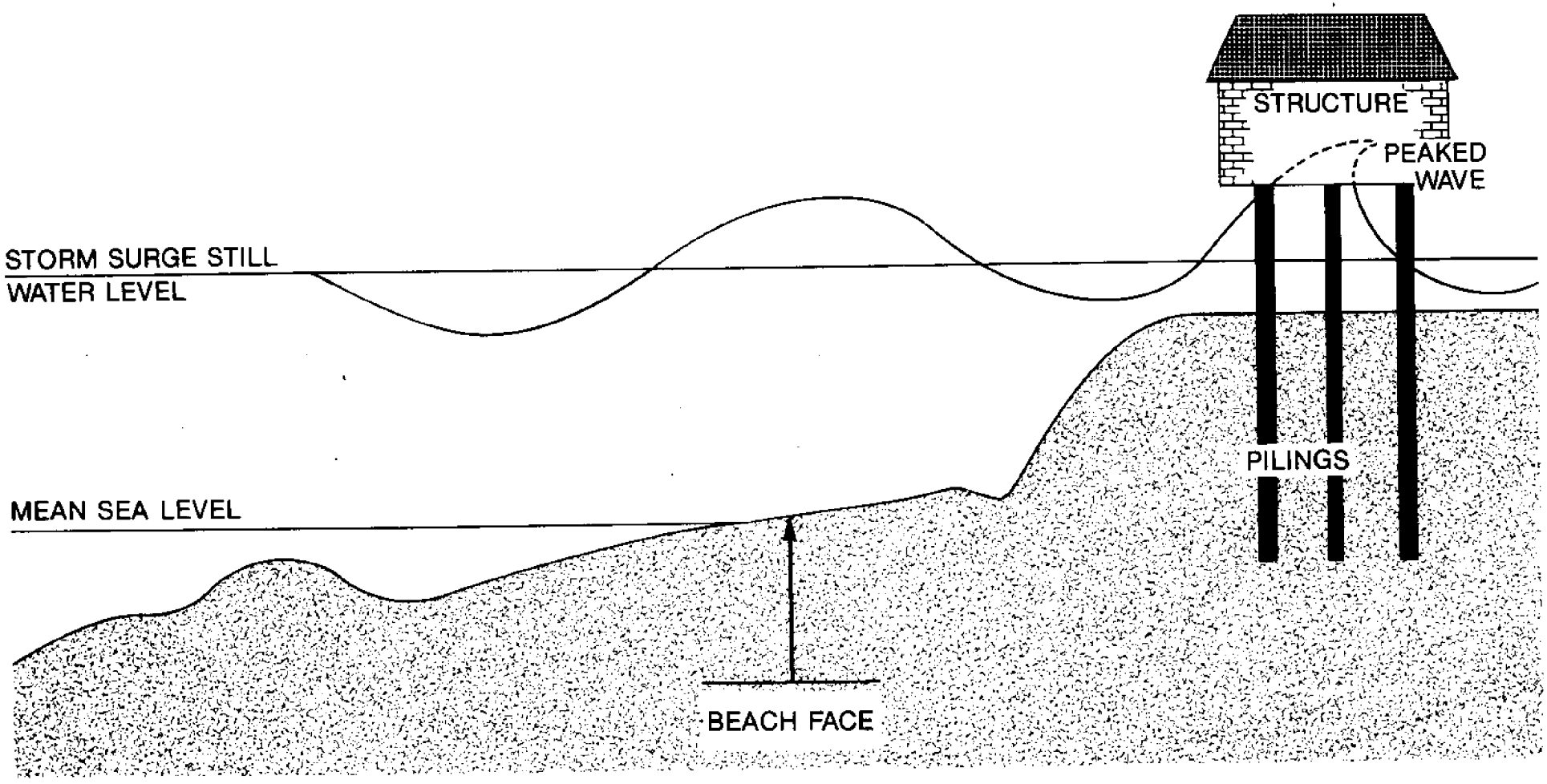


Fig. 2-3 Hurricane induced surge increase and resultant vertical wave forces caused by peaking waves.

hurricane (size, direction, forward speed, point of landfall), but also by the geomorphology of the coast. For example, low-profile barrier islands are more suspectible to overwash and other storm damage than are high-profile islands. Although Florida's coasts differ quite markedly, a general account of the geomorphology and the response to a hurricane will be presented later in this chapter.

Winds

Damage from hurricane winds is often ranked third behind sea-action and floods. Although the zone of destructive winds within the system is highly variable, on average it ranges between 50 to 100 miles in radius around the eye (Dunn and Miller, 1960). Generally, wind velocities increase as the pressure gradient decreases. Hurricane winds frequently attain average velocities of 100 to 135 mph. In more severe events such as the Labor Day (1935) hurricane on the Florida Keys, velocities between 135 and 160 mph are not uncommon. Peak gusts may reach speeds 50 percent higher than average. Unfortunately, wind data is often not very accurate or complete, primarily because of malfunctions or destruction of the measuring apparatus.

During storm conditions, buildings and structures are subject to uneven or pulsating pressures induced by wind gusts. Thus, all structural design within areas susceptible to hurricanes should allow for both strong sustained winds and gusts. A 100 mph wind, for example, may have an occasional peak gust to 150 mph. This is of critical importance because the force exerted on buildings and structures does not increase linearly with the velocity, but with the square of the velocity. Thus, if the velocity is doubled, the net result is an approximate quadrupling of the force. Pressure varies with wind speed, height above grade and roughness of terrain. The pressure may be calculated in pounds per square feet using the formula: $P = .00256\ (H/30)^{2/7}V^2$. P is the force exerted by the wind on the exposed surface, V is the wind velocity, and H is the height the wind speed is measured at. Work by Gentry (1955) provides a series of wind speeds and subsequent pressures (Table 2-2).

TABLE 2-2
TYPICAL WIND SPEEDS AND RESULTING PRESSURES
ON BUILDINGS AND STRUCTURES (After Gentry, 1955)

Wind Speed (mph)	K	Pressure per Square Foot
60	0.0040	14
80	0.0040	26
100	0.0045	45
120	0.0050	72
150	0.0050	112

A 60 mph wind will exert a pressure of 14 pounds per square foot whereas a 125 mph wind increases that pressure by a factor of five to 78 pounds per square foot.

Damage to small buildings by hurricane winds varies markedly and is dependent on the type of building and the degree of exposure. Often, structures with peaked roofs are subjected to entire or partial roof removal. Inappropriate anchoring is usually the primary cause. Improperly bonded or poorly maintained roof covering also results in damage. Falling walls, trees and structures, as well as windows broken by winds or projectiles cause significant damage.

HURRICANE PREDICTION AND WARNING

On September 8, 1900, a major hurricane struck Galveston, Texas. The hurricane had been under surveillance for ten days prior to landfall and had been tracked continuously from near its point of origin near the Windward Islands (off the northeast coast of South America). The coastal region of Texas was alerted to the possible landfall on September 7. However, the following day, 6,000 completely unprepared residents of Galveston lost their lives, the largest death toll from a natural disaster experienced in the United States.

With the advent of aircraft reconnaissance, coastal radar stations, and satellites, hurricane tracking and landfall prediction have become somewhat more accurate. Despite significant progress in understanding hurricane dynamics and movement predictions during the 1960's, few increases in capability have been made recently. Similarly, sudden increases in hurricane strength, witnessed for example during Hurricanes Celia (south Texas, 1970), Carmen (Louisiana, 1974), and Alicia (Galveston, 1983), as yet remain obscure even after extensive analyses. The inability of the National Weather Service to predict landfall within a 50-100 mile span prior to twelve hours decreases the evacuation time available. In some coastal areas evacuation cannot be completed with a twelve hour warning. Densely populated coastal areas such as southern Florida require 24-36 hours to evacuate. For example, Lee County, situated along Florida's southwest Gulf Coast, requires a maximum evacuation time of 27.1 hours in the event of a category 3 hurricane making landfall in their region (Southwest Florida Regional Planning Council, 1981). However, as shown in Table 2-3, specific hurricane warnings are generally not issued by the National Hurricane Center in Miami until approximately 24 hours prior to anticipated landfall. Unfortunately, potential errors in predicting hurricane landfall can be significant and the consequences can be critical when predicting the location of peak storm surges, highest winds and the identification of coastal areas from which residents must be evacuated. Figure 2-4 illustrates the significance of prediction errors. Simpson and Riehl (1981) provide an example where a hurricane was predicted

TABLE 2-3

HURRICANE WARNING SYSTEM EMPLOYED BY THE NATIONAL HURRICANE CENTER (FLORIDA)

Time	Procedure
72 hour advisory	Hurricane assigned category number on Saffir/Simpson Scale by National Hurricane Center.
48 hours prior to projected landfall	Local areas placed under hurricane alert by National Hurricane Center.
24 hours prior to projected landfall	Local areas placed under hurricane alert by National Hurricane Center.
12-24 hours prior to projected landfall	(1) Hurricane warning issued. Local area advised to evacuate by National Hurricane Center, advisory or Local National Weather Service office. (2) Governor advised by Division of Emergency Management to issue evacuation order for local area or chief elected official of local political jurisdiction advised by local disaster preparedness agency to issue evacuation order. (3) Evacuation order issued. (4) Dissemination to public by media and/or emergency response agencies.

STORM TRACK SHIFT

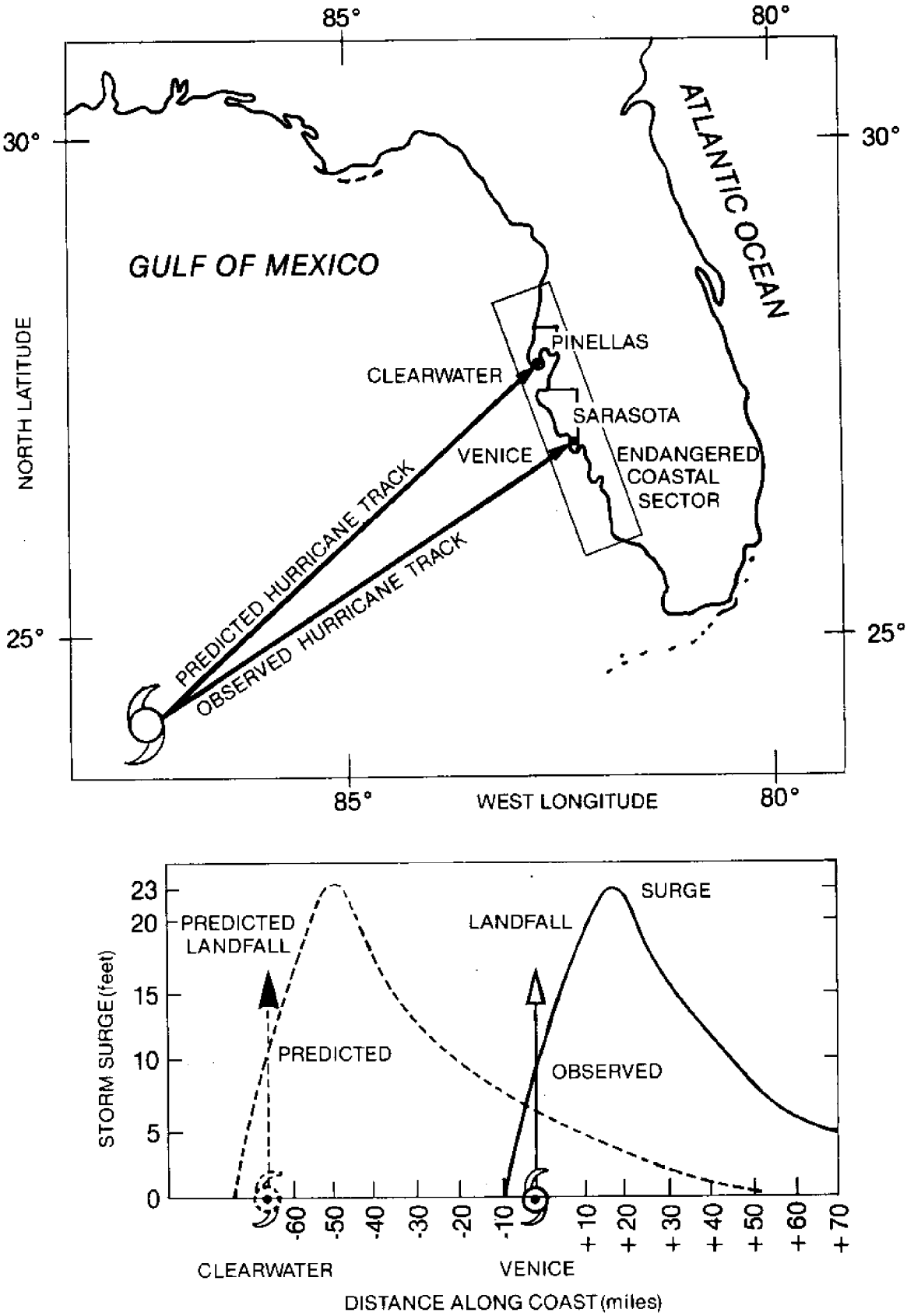


Fig. 2-4 Example of a shift in the endangered coastal sector: Top, the predicted hurricane track calculated 24 hours prior to landfall, differs by 10° from the observed track; bottom, consequent displacement of surge peak along the shoreline (after Simpson and Riehl, 1981).

24 hours in advance to make landfall at Clearwater. Because of a ten degree error in predicting hurricane movement--a reasonable expectation given a 24 hour forecast--the actual point of landfall was displaced by almost 70 miles to an area near Venice in Sarasota County, which requires an evacuation time of 17.4 hours. Figure 2-4 also shows how the problem is compounded by the fact that peak storm surges occur to the right of the point of landfall and therefore endangered coastal areas even farther south of Venice. In general, the average forecast error in the Gulf of Mexico increases from approximately 60 miles for the 12 hour forecast to about 425 miles for the 72 hour forecast (Carter, 1983). At present, tropical meterologists are pessimistic about any major advances in reducing these errors within at least the next decade.

A new approach to early warning occurred during 1983 when the National Hurricane Center in Miami introduced a hurricane probability rating system encompassing coastal reaches from Brownsville, Texas, to Eastport, Maine. In general, the system describes the probability of hurricane landfall within 44 coastal communities--17 of which are located in Florida--during a given hurricane (see Carter, 1983 for details). The probability system is used to supplement other data (current position, strength, movement, etc.) and is likewise susceptible to error resulting from incorrect track location and timing along the track.

MODELING HURRICANE MOVEMENT AND ENVIRONMENTAL RESPONSE

In general, three modeling techniques are used to predict hurricane movement: (1) kinematic analog models; (2) dynamic analog models; and, (3) pure dynamical models (Simpson and Riehl, 1981). Research in the mid 1960's resulted in the formulation of statistical analog models requiring inputs of position, direction and forward speed of the hurricane for the preceding 12 hours (Hope and Neumann, 1970). One such model, HURRAN, provides information on probabilities of hurricane movements for a 72-hour period based on the movement of historic hurricanes showing inherent similarities. In order to circumvent the shortcomings of these models, namely their limited usefulness during highly random movements, they were coupled with other analog devices (e.g., CLIPER) (Neumann, 1972), resulting in a procedure that accounts for substantial variance in hurricane movement and thereby enhancing predictability powers. The principal obstacle to the use of these models centers around initial-value inputs and the enormous amounts of computer time required for even the shortest prediction increment.

For supplemental review the texts of Dunn and Miller (1960), Simpson and Riehl (1981) as well as work by Miller, et al. (1972), Neumann (1972) and Hope and Neumann (1970), are suggested. At this point it is more useful to briefly discuss models which attempt to simulate hurricane conditions and subsequent environmental impact (response).

Although some of the statistical analogs discussed above attempted to simulate such environmental conditions as wind speed and rainfall distributions, primary emphasis in the past 10-15 years was placed upon storm surge modeling and shoreline response. Meterological and hydrographic data are inserted into computers which run the models to provide the degree of water surge and inland flooding at a coastline for a given hurricane. Most models contain two essential components: a storm model and a hydrodynamic model. The storm model uses meteorologic inputs (barometric pressure, forward speed and direction, etc.) in order to compute wind stresses and surface pressures, etc., and the hydrodynamic model uses the output of the storm model in order to calculate the time history of the coastal surge and inland flooding.

Numerous storm surge models are in operation around the coasts of the U.S. Examples include the FEMA (Federal Emergency Management Agency) storm surge model,. SLOSH (Sea, Lake and Overland Surges from Hurricanes), and SPLASH (Special Program to List Amplitudes of Surges from Hurricanes). Model SLOSH, continually undergoing a process of updating, provides simulated hurricane surge information along coastal sections of Florida. When compared with other models, SLOSH-generated information--wind speeds and surge heights for example--tend to be somewhat higher and perhaps more accurate. Data from Hurricane Alicia (Galveston, 1983), compared to SLOSH outputs for that area show a fairly good correlation at many points. The SLOSH, and FEMA models are considered to be state-of-the-art. (For more in-depth reading on storm surge modeling see Committee on Coastal Flooding From Hurricanes, 1983 and other references).

FLORIDA'S SUSCEPTIBILITY TO HURRICANES

Geographical Location

Of all the coastal states, Florida is the most prone to hurricane landfall. As Figure 2-5 illustrates, hurricanes approach the state from the Atlantic to the east, the Carribean to the south, and from the Gulf of Mexico to the west. The frequency and intensity of hurricanes in Florida are important planning considerations for all aspects of coastal development.

The review of previous hurricanes shows two well defined tracks: (1) west from the Antilles during August and September, and (2) north from the Carribean in September and October. The former affects southern Florida while the latter affects mostly southern and western sections of the Florida coast. Analysis of landfall probabilities at the county level (Figure 2-6) suggest that Monroe, Dade and Broward counties exhibit the highest potential. These three counties also show the highest probability of strikes by "great hurricanes" (wind speeds more than or equal to 125 mph) in any given year. Along the Panhandle, Bay County has the highest probability for landfall.

HURRICANE TRACKS

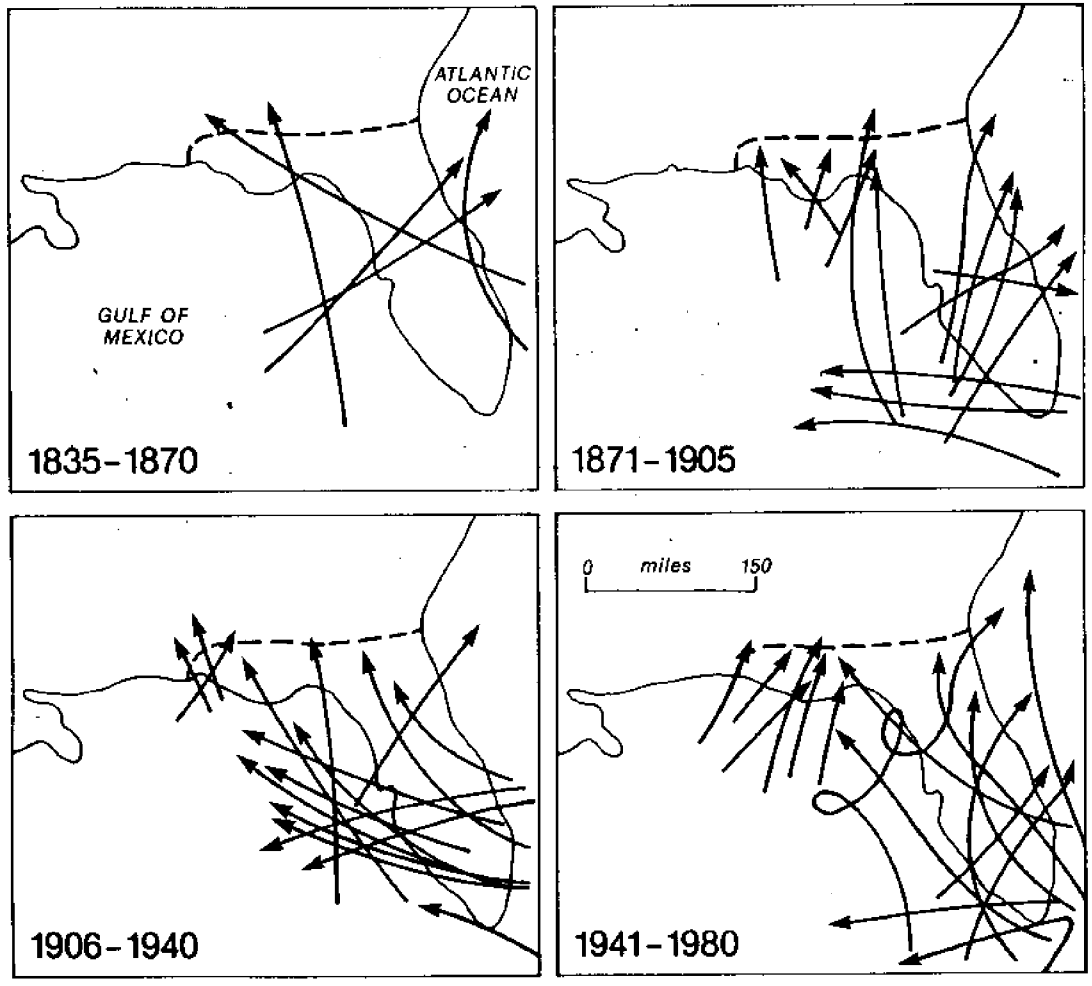


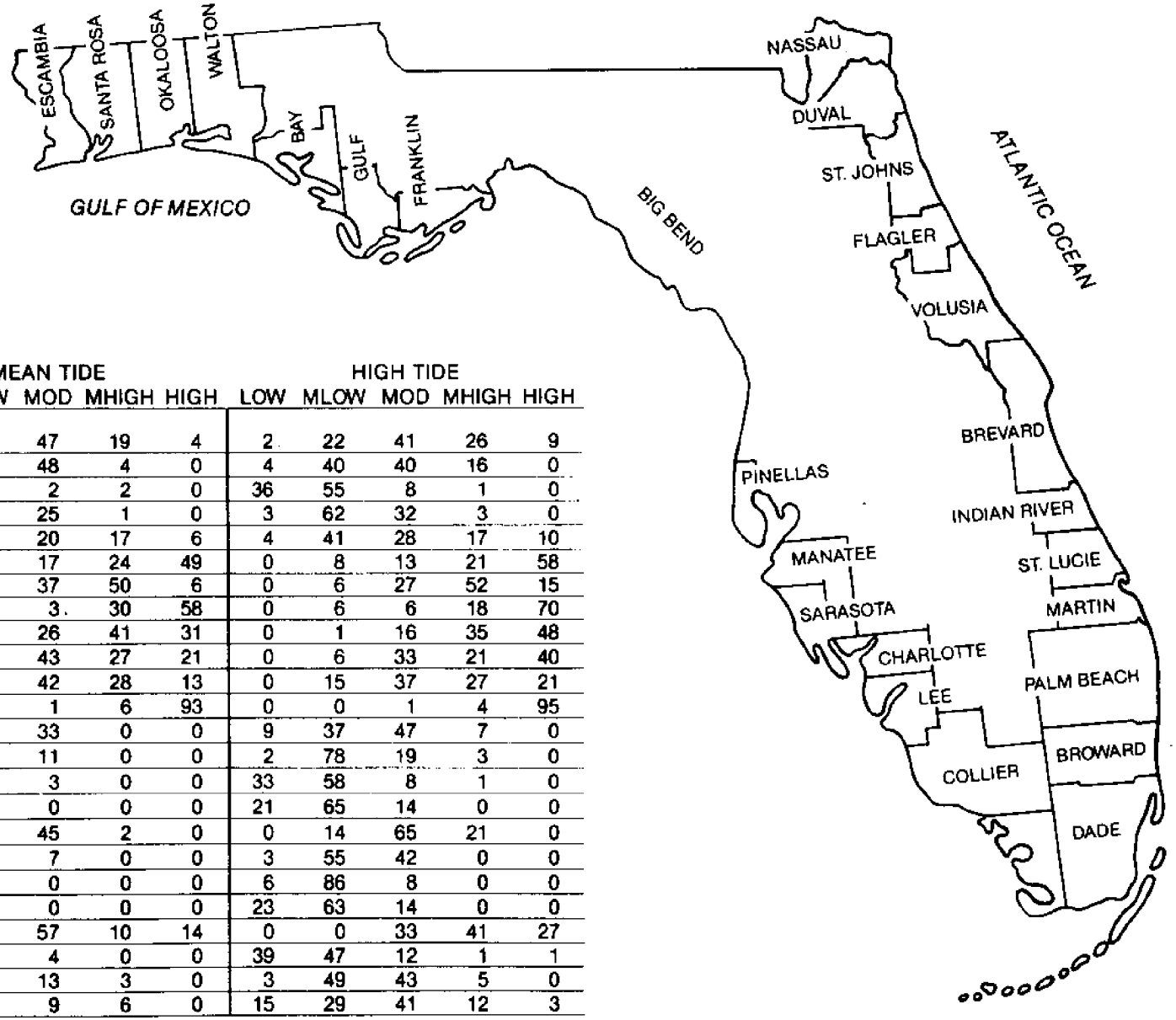
Fig. 2-5 The variability of hurricane tracks making landfall along Florida's coasts from 1835 to 1980 (after Carter and Oford, 1982).

In terms of "great hurricanes," the Panhandle shows a very low probability. This is also the case north of Indian River County on the east coast.

Coastal Topography

The geographical distribution of hurricane landfall points is of obvious importance and appears to follow a general trend (Figure 2-5). However, of equal or greater significance than the landfall site is the much larger area over which the hurricane system causes hazardous conditions to the population and destroys property. The most critical hazard area covers generally the nearshore-beach-dune system along the coast. This system varies substantially along Florida's coasts. Some areas are well protected behind large dunes, while other low-lying beach-dune systems are vulnerable to hurricane generated waves, riding on top of super-elevated water levels, battering structures and causing significant flood damage. However, it is noteworthy that the impact of a category 4 or 5 hurricane upon a coast is not determined by the character of the nearshore-beach-dune system over which the hurricane makes landfall, but more by the properties of the hurricane itself (e.g., wind, velocity, wave energy, barometric pressure differentials, forward speed and direction of approach).

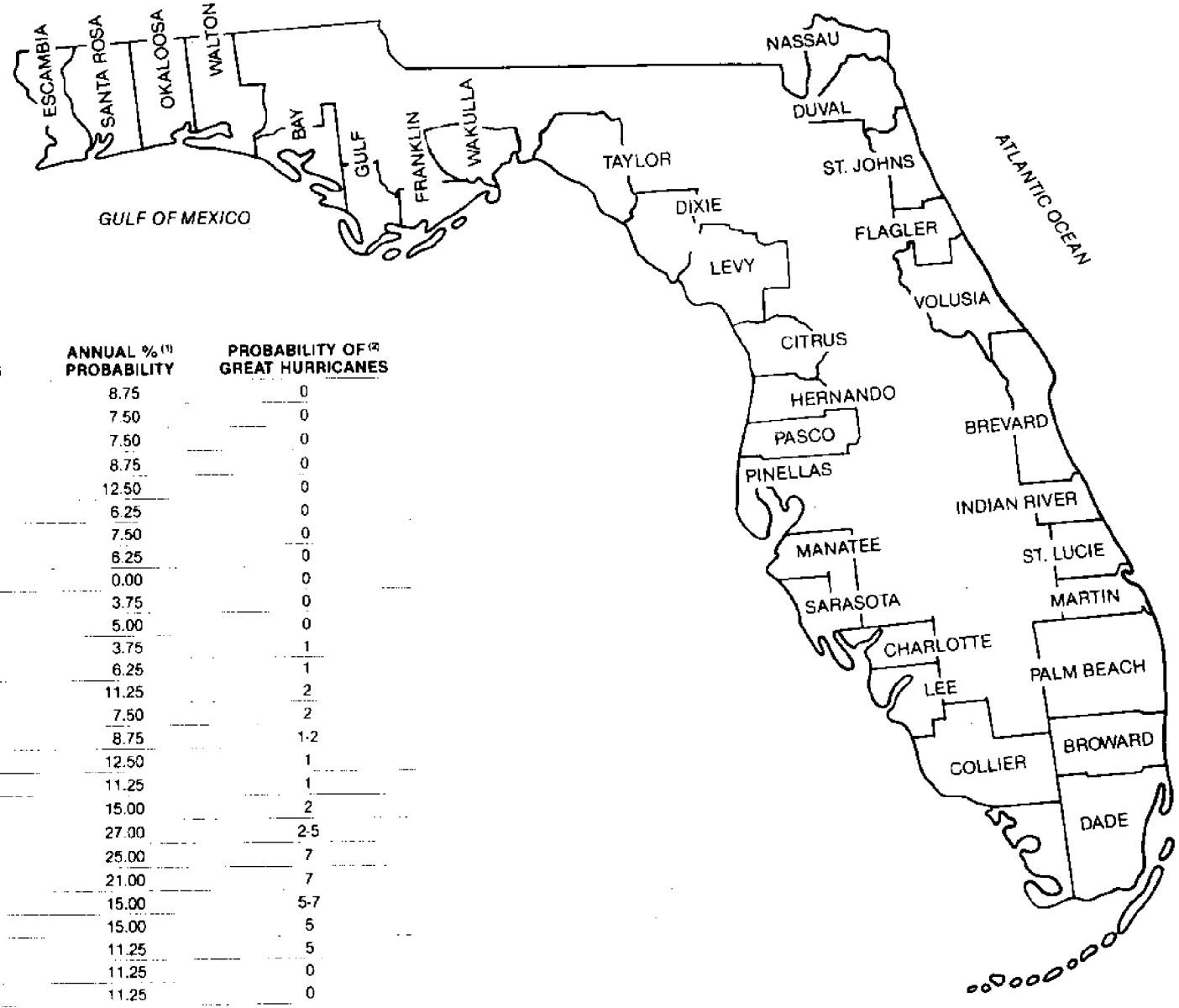
The importance of identifying coastal areas high in susceptibility to storm wave inundation has been recognized by Stone and Morgan (1983), Stone, et al. (1985), and Morgan and Stone (1983; 1985). Their work has resulted in the development of a computer model (STORMWAVE) which describes the susceptibility of open barrier and mainland coasts to storm wave inundation and damage. Model STORMWAVE has been applied to the entire Florida coast, with the exceptions of the Big Bend area and Monroe County. Figure 2-6 shows the average distribution of storm wave susceptibility categories per county around Florida's coasts. The most susceptible region lies along the western coast of the Florida peninsula from Collier to Pinellas County. It is interesting to note that in terms of annual probability of hurricane occurrence, this zone is among the highest throughout the entire state (Figure 2-7). Thus, from the standpoint of both incidence and topography, this sector of coastal zone is the most prone to hurricane wave inundation and damage throughout the entire state of Florida. Walton and St. Johns counties are the least susceptible and Franklin and Flagler counties the highest, along the Panhandle and east coasts respectively. As Figure 2-6 suggests, in general the east coast of Florida is less susceptible to storm wave inundation and damage than the west coast, while the northwest coast is somewhere in between. This variation is due primarily to the changes in morphology, i.e., high versus lower barrier profiles. Obviously, high-profile barriers, when compared with low-profile islands, possess a greater ability to absorb high wave energies in the event of a hurricane and thus reduce the geomorphological and structural



COUNTY NAME	MEAN TIDE LOW	MLOW	MOD	MHIGH	HIGH	HIGH TIDE LOW	MLOW	MOD	MHIGH	HIGH
ESCAMBIA & SANTA ROSA	3	27	47	19	4	2	22	41	26	9
OKALOOSA	4	44	48	4	0	4	40	40	16	0
WALTON	41	56	2	2	0	36	55	8	1	0
BAY	11	64	25	1	0	3	62	32	3	0
GULF	4	53	20	17	6	4	41	28	17	10
FRANKLIN	0	10	17	24	49	0	8	13	21	58
PINELLAS	1	6	37	50	6	0	6	27	52	15
MANATEE	0	9	3	30	58	0	6	6	18	70
SARASOTA	0	2	26	41	31	0	1	16	35	48
CHARLOTTE	0	9	43	27	21	0	6	33	21	40
LEE	0	16	42	28	13	0	15	37	27	21
COLLIER	0	0	1	6	93	0	0	1	4	95
DADE	19	49	33	0	0	9	37	47	7	0
BROWARD	14	75	11	0	0	2	78	19	3	0
PALM BEACH	55	42	3	0	0	33	58	8	1	0
MARTIN	37	63	0	0	0	21	65	14	0	0
ST. LUCIE	0	53	45	2	0	0	14	65	21	0
INDIAN RIVER	10	83	7	0	0	3	55	42	0	0
BREVARD	25	75	0	0	0	6	86	8	0	0
VOLUSIA	44	56	0	0	0	23	63	14	0	0
FLAGLER	0	19	57	10	14	0	0	33	41	27
ST. JOHNS	60	36	4	0	0	39	47	12	1	1
DUVAL	10	74	13	3	0	3	49	43	5	0
NASSAU	20	65	9	6	0	15	29	41	12	3

STORM WAVE SUSCEPTIBILITY
CLASSIFICATION AS A % OF COUNTY COASTLINE

FIGURE 2-6



COUNTY NAME	NO. OF HURRICANES	ANNUAL %[1] PROBABILITY	PROBABILITY OF[2] GREAT HURRICANES
Escambia	7	8.75	0
Santa Rosa	6	7.50	0
Okaloosa	6	7.50	0
Walton	7	8.75	0
Bay	10	12.50	0
Gulf	5	6.25	0
Franklin	6	7.50	0
Wakulla	5	6.25	0
Taylor	0	0.00	0
Dixie	3	3.75	0
Levy	4	5.00	0
Citrus	3	3.75	1
Hernando	5	6.25	1
Pinellas	9	11.25	2
Manatee	6	7.50	2
Sarasota	7	8.75	1-2
Charlotte	10	12.50	1
Lee	9	11.25	1
Collier	12	15.00	2
Monroe	22	27.00	2-5
Dade	20	25.00	7
Broward	17	21.00	7
Palm Beach	12	15.00	5-7
Martin	12	15.00	5
St. Lucie	9	11.25	5
Indian River	9	11.25	0
Brevard	9	11.25	0
Volusia	5	6.25	0
Flagler	5	6.25	0
St. Johns	3	3.75	0
Duval	4	5.00	0
Nassau	3	3.75	0

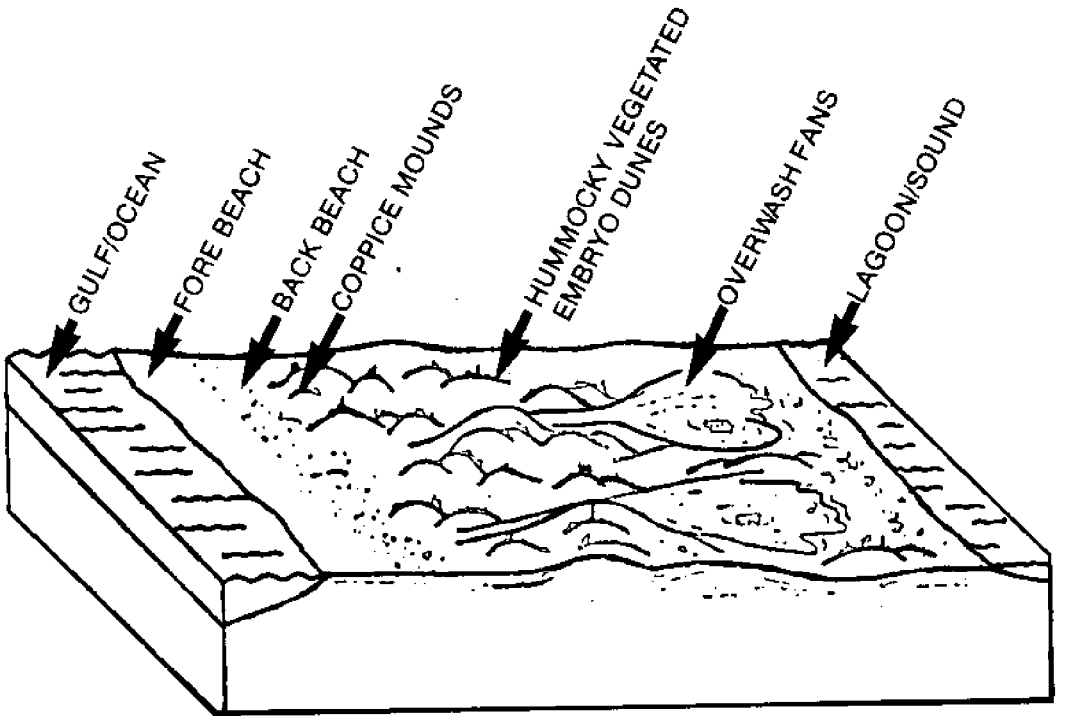
[1] Percent probability a hurricane will occur within a given year based on records from 1900-1980.

[2] Percent probability a great hurricane will occur (wind speeds ≥ 125 mph) in a given year.

PROBABILITY OF HURRICANE LANDFALL BY COUNTY

FIGURE 2–7

LOW PROFILE BARRIER ISLAND

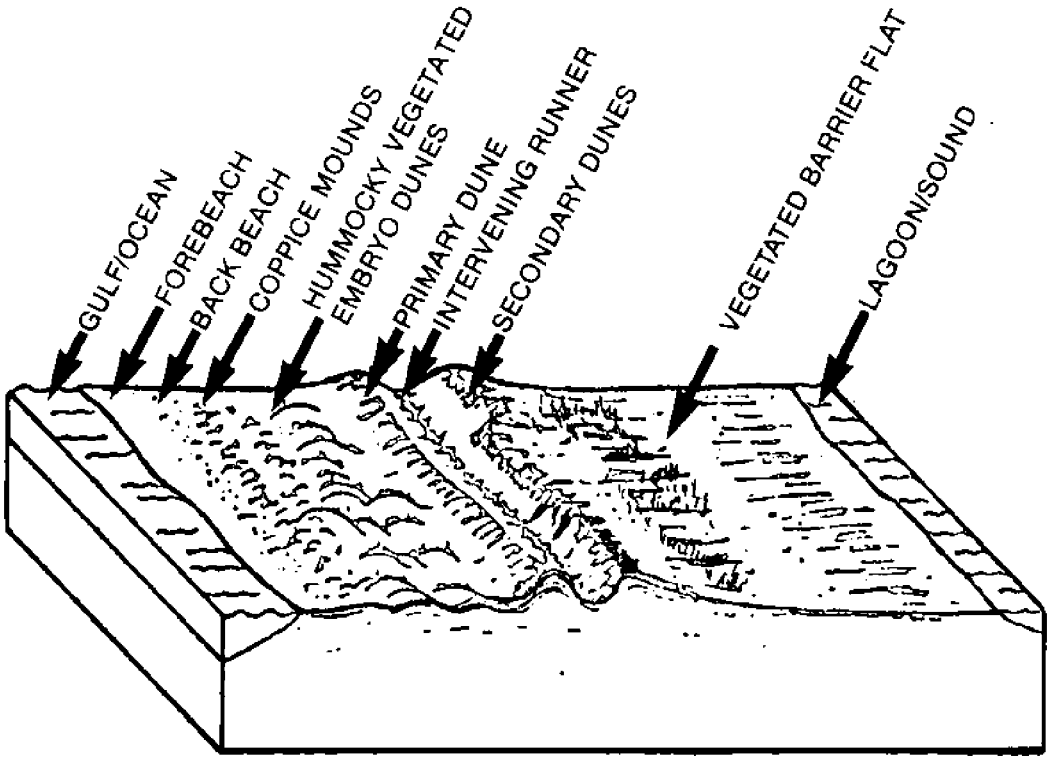


LOW BARRIER PROFILE RESPONSE TO HURRICANE LANDFALL

1. total submergence
2. partial submergence giving rise to:
   - —rock fragment, shell etc. deposition on beachface.
   - —primary dune erosion inducing broadening and flattening of beach profile.
   - —primary dune breaching permitting extensive overwash fan formation within wind tidal flats.
   - —extensive breaching in form of hurricane channels cutting through entire width of island.
   - —reopening of relic passes, inlets, etc., resulting in extensive deposition of sediment in lagoon/sound.
   - —dune blowouts created and/or increase in dimensions of pre-existing ones.
   - —closure of passes, inlets, etc., due to excessive littoral drift.
   - —wind damage sustained by roofs, trims, signs, fences, etc.
   - —street ends underminded resulting in pavement failures.
   - —roads, driveways, etc., built perpendicular to shoreline funnel storm surge.
   - —loss of dune walkover structures, decks, patios, porches, etc.
   - —power line utility damages, etc.
   - —undermining of structure foundations (bridges, buildings, piers, jetties, etc.).
   - —extensive road flooding and damage.

Fig. 2-8 Typical low profile barrier responses during and after hurricane landfall. (modified from Nummedal, 1982).

HIGH PROFILE BARRIER ISLAND



HIGH BARRIER PROFILE RESPONSE TO HURRICANE LANDFALL

— dune/scarp retreat.
— interdune washover fans occupying former blowouts/depressions.
— rock fragment, shell, etc., deposition on beach face.
— dune blowout formations and/or increase in dimensions of pre-existing ones.
— closure of passes, inlets, etc., due to excessive littoral drift.
— wind damage sustained by roofs, trim, signs, fences, etc.
— undermining of foundations (bridges, piers, jetties, etc.).

Fig. 2-9 Typical high profile barrier responses during and after hurricane landfall. (modified from Nummedal, 1982).

damage along the coast. Figure 2-8 and 2-9 provide a non-exhaustive list of typical barrier island responses (both physical and structural) to hurricane landfall. Although this list encompasses many of the common responses, obviously each response will depend on the storm magnitude and specific geomorphology of the landform.

COASTAL HAZARD MAPPING FOR HAZARD REDUCTION

Unequivocally, barrier islands when compared with other coastal landforms--mainlands and bay shorelines for example--afford little protection for people and structures in the event of hurricanes and storms. However, within the barrier system, certain areas are less prone to wave attack, washover, breaching, etc., than are others. Earlier, we described the higher level of protection afforded by high-profile barriers when compared with the lower-profile counterparts. Differing profile types often exist within the same barrier complex. If we can identify those areas less prone to damage, we have a basis for choosing safer zones for development. This planning tool will be of obvious use in any prior planning for post-hurricane, or storm, reconstruction.

Coastal areas, particularly barrier islands, are exceptionally fragile, and exhibit dynamic and complicated morphologic responses to processes that are not, as yet, totally understood. This fundamental limitation means that although prior planning for post-hurricane reconstruction can bring about a "reduction" of hazards associated with hurricanes, it cannot eliminate them.

A number of physical features of barriers can be used to depict potential hazard zones. Such indicators, considered collectively, permit location on a hazard map for the barrier under study. However, each barrier complex is geomorphologically unique and responds in its own way to natural forces. This uniqueness precludes construction of a single framework applicable to all barriers. We will highlight and discuss the more common physical features useful as hazard indicators, and in doing so formulate a tentative hazard reduction framework, but for best results we urge you to refine it and tailor it for your specific coastal reach.

Shoreline Change

Two types of shoreline change statistics should be considered, i.e., short and long term. Both data sets may be obtained through simple map and/or aerial photograph comparisons. However, this and other useful data already exist and are accessible through the Florida Department of Natural Resources, Division of Beaches and Shores. Understanding historical trends in shoreline changes allows one to surmise where the shoreline might be in the near future. Such data are of obvious use: for

example, it makes sense not to build or rebuild in an area undergoing extensive coastal erosion. This is of particular importance when "longer-life" utility construction is under consideration.

Barrier Island Geometry

As elevations increase along barrier complexes, potential for flooding and wave attack decreases. Predicted storm surge heights for a 100-year storm plays a major role in designating a "safe" elevation for construction of the lowest habitable floor. Topographical elevations have been determined around most of Florida's coasts by the Department of Natural Resources for the general primary-secondary dune zone. These data exist as raw numbers and are presented as diagram profiles measured in feet (above National Geodetic Vertical Datum) at 1000 foot intervals along the coast (see Morgan and Stone, 1985). Storm surge elevations have been calculated around Florida for construction of Federal Flood Insurance Rate Maps. Based on this computer simulation approach, FEMA calculates Base Flood Elevations (BFE) for various coastal areas. The BFE (measured in feet above mean sea level) pertains to a 100-year storm event which is roughly equivalent to a category 3 hurricane. We will discuss storm surge data in more detail later.

Barrier island width is a necessary measurement to help identify potentially hazardous zones. Ideally, structures should be built on an elevated point along the backside of a wide barrier. However, caution should be exercised here. While structures built within the back barrier zone are less susceptible to storm wave inundation and damage than those located along the Gulf or Atlantic shoreline, hazardous zones can occur along the soundside shoreline also. For example, along the northwest Florida barriers, soundside erosion--primarily a response to erosive waves driven by northerly winds--is a significant coastal management problem. One of the major destructive attributes of a hurricane is the funneling effects of water into sounds, bays, estuaries and lagoons during the storm surge. The release of the force that created the surge permits great quantities of water to leave these areas rapidly. Adjacent coastal reaches not adequately protected by dunes or beaches, will suffer significant flooding and damage as this reverse flow occurs. This funneling process is often exemplified within finger canals where water returning to the Gulf or Atlantic is trapped, forced to rise, inundating adjacent areas.

Barrier Island Physiography

Visual analyses of aerial photographs followed by field visits helps identify zones susceptible to breaching, overwash, scouring, and general storm wave penetration. Depressions located within the primary dune system (breached dunes, scour zones, etc.) are potentially hazardous and should not be considered sites for construction or reconstruction.

Inlets should be viewed as potentially hazardous sites for construction if the geomorphic history is not known. Most unstabilized inlets tend to "breathe" (i.e., widen and/or narrow). Others simply migrate in a random direction. The study of aerial photographs and maps over time usually permits insight as to future behavior and, therefore, allows one to identify potentially hazardous zones for new construction.

Barrier Island Response to Hurricanes

Without doubt, a succinct understanding of how each barrier complex responds to hurricane events would allow highly effective prior-planning for post-hurricane reconstruction. Unfortunately, there are many reasons why such an understanding is difficult, if not unattainable. For example, hurricane systems vary in strength, approach angle to the shoreline, point of landfall, etc. Each of these variations imparts differential effects on waves and surges which results in variable responses along adjacent coastal reaches. Computer simulations of hurricane conditions and the resultant shoreline responses have contributed significantly to our understanding of barrier morphodynamics during such extreme events. Long-term monitoring of barrier island recovery after hurricane landfall, as well as pre- and post- hurricane analyses, have provided valuable data and information. However, although barrier dynamics during hurricanes cannot be predicted accurately, it is often possible to identify dangerous areas, and sectors where the hazards would appear to be less critical.

Storm Surge

As was suggested earlier, storm surges are responsible for much of the damage witnessed along coastal areas from hurricanes. The degree of damage experienced by inland construction is primarily dependent upon surge elevation and penetration. Three main sources of information exist on inland coastal storm surges: Federal Flood Insurance Rate Maps (FIRM), U.S. Army Corps of Engineers' flood frequency curves, and the National Weather Service's SLOSH data. The U.S. Geological Survey has recently begun publishing maps on which they document storm surge elevations, wave runup, etc., at a scale of 1:24,000. The data, published as a series of atlases, are available usually several months after a hurricane makes landfall. These atlases are possibly the most useful data set in terms of assessing storm surge distribution along the coast. Where available, we recommend the atlas data because it is generated through field analysis soon after hurricane passage. Providing that good field techniques have been employed, this data set surpasses those derived via computational methods such as FIRM and SLOSH.

FOOTNOTE

It is of interest to note that on comparing preliminary revised (1984) FIRM data for Escambia County, Florida, with the USGS atlases for the same area--atlases of storm surge elevations during Hurricane Frederic, 1979--the two data sets showed poor agreement. The FIRM data tended to reduce the magnitude and spatial distribution of storm surge along, in particular, the barrier islands of Perdido Key and Santa Rosa Island. Based on field evidence and the USGS data, we are of the opinion that revised FIRM surge predictions for Escambia County, at least, are not representative of a class 3 hurricane (100-year storm). It is recommended that if FEMA does not revise these preliminary maps substantially, all potential users should use caution when using the data and utilize the USGS atlases already mentioned. If this problem occurs in your area, we suggest you utilize the field-generated USGS data. Local governments are required by the Federal Flood Insurance Program to set Base Flood Elevations at least as high as the FIRM maps, but counties can--and in this case should--set the BFE higher in their construction codes.

References

Carter, M. T., 1983. Probability of Hurricane/Tropical Storm Conditions: A User's Guide for Local Decision Makers. U.S. Department of Commerce, N.O.A.A., 25 pp.

Carter, R. W. G. and J. D. Orford, 1982. When Hurricanes Sweep Miami Beach. Geographical Magazine LIV, no. 8, pp. 442-448.

Cline, I. M., 1926. Tropical Cyclones. MacMillan Company, New York, 301 pp. Shore Protection Manual, 1977. Coastal Erosion Research Center, Dept. of the Army Corps of Engineers, Vol. III.

Dikkers, R. D., R. D. Marshall, and H. C. S. Thom. Hurricane Camille, August, 1969. National Bureau of Standards, U.S. Dept. of Commerce, Tech. Note 569, 71 pp.

Dunn, G. E. and B. I. Miller. Atlantic Hurricanes. Louisiana State University Press, 326 pp.

Committee on Coastal Flooding from Hurricanes, 1983. Evaluation of the FEMA Model for Estimating Potential Coastal Flooding From Hurricanes and Its Application to Lee County, Florida. National Academy Press, Washington, D.C., 154 pp.

Fischer, D. W., G. W. Stone, and D. Henningsen (in press). Integrated Multidisciplinary Information for Coastal Management, Florida. Journal of Coastal Research, Boca Raton, FL.

Gentry, R. C., 1955. Wind Velocities During Hurricanes. Paper Number 2731, Trans. Amer. Soc. of Civil Engineers, 120, 169 pp.

Hoover, R. A., 1957. Empirical Relationship of the Central Pressures in Hurricanes to the Maximum Surge and Storm Time. Monthly Weather Review, 85, pp. 167-174.

Hope, J. R. and C. J. Neuman, 1970. An Operational Technique for Relating the Movement of Existing Tropical Cyclones to Past Tracks. Monthly Weather Review, XCIII, pp. 925-933.

Hayes, M. O., 1967. Hurricanes as Geological Agents: Case Studies of Hurricanes Carla, 1961, and Cindy, 1963. Bureau of Economic Geology, University of Texas, Austin, Texas, 56 pp.

Hughes, L. A., 1952. On the Low-Level Wind Structure of Tropical Storms. Journal Meterology, 9, pp. 422-428.

Miller, B. I., P. O. Chase, and B. R. Jarvinen, 1972. Numerical Prediction of Tropical Weather Systems. Monthly Weather Review, C, pp. 825-835.

Morgan, J. P., L. G. Nichols, and M. Wright, 1958. Morphological Effects of Hurricane Audrey on the Louisiana Coast. Coastal Studies Institute, Louisiana State University, Baton Rouge, LA., No. 58-3, 53 pp.

Morgan, J. P. and G. W. Stone, 1983. A Geomorphic Evaluation of Florida's Sandy Beaches: Methodology. Proc. of the joint ASPA/FSBPA annual meeting, Boca Raton, Florida, p. 6-18.

Morgan, J. P. and G. W. Stone, 1985. A Technique for Quantifying the Coastal Geomorphology of Florida's Barrier Islands and Sandy Beaches. Shore and Beach, Volume 53, No. 1, pp. 19-26.

Neumann, C.J., 1972. An Alternate to the HURRAN Tropical Cyclone Forecast System. Dept. of Commerce, Tech. Memo. NWS SR-52.

Simpson, R. H. and H. Riehl. The Hurricane and Its Impact. LSU Press, Baton Rouge, LA., 398 pp.

Southwest Florida Regional Planning Council, 1981. Regional Hurricane Evacuation. Report prepared for Florida Sea Grant and Florida D.E.R., Office of Coastal Zone Management, 141 pp.

Stone, G. W. and J. P. Morgan, 1983. On the Concept of Storm Wave Susceptibility and Its Application to Four Florida Coastal Areas. Proc. American Shore and Beach/Florida Shore and Beach Preservation Assoc., Boca Raton, FL., pp. 19-36.

Stone, G. W., D. W. Fischer, and J. P. Morgan, 1985. Quantifying Florida's Coastal Storm Wave Susceptibility. Coastal Zone '85, Proceedings of the 4th Symposium on Coastal and Ocean Management, Baltimore, pp. 2374-2388.

Stone, G. W., D. W. Fischer, and J. P. Morgan, 1985. The Variability of Florida's Coasts to Storm Wave Susceptibility. Journal Shoreline Management 1, pp. 81-104.

Tannehill, T. R., 1938. Hurricanes, Their Nature and History. Princeton University Press, 257 pp.

United States Army Corps of Engineers, 1981. Hurricane Frederic Post Disaster Report, 30 August - 14 September 1979. U.S. Army Corps of Engineers, Mobile District, Mobile, Alabama, 250 pp.

CHAPTER 3

ISSUES IN HURRICANE RECOVERY PLANNING

INTRODUCTION

The impact of a hurricane "disaster" will vary considerably with the intensity of the storm, the location of a given community in relation to the eye of the storm, and the community's preparations for dealing with disasters. Some communities will find themselves fortunate enough to be on the edge of the storm and will require little more than some clean-up; others directly in the path of the hurricane may require extensive reconstruction. This report discusses chiefly middle- to high-ranges of storm destruction because minor damage is more amenable to "normal" handling.

Large-scale disasters are not particularly rare on our planet: hurricanes, earthquakes, tornado swarms, volcanic eruptions, or such man-caused disasters as chemical explosions or contamination are often read about in the daily headlines. Researchers have accumulated considerable information on the actual behavior of communities during these stressful periods, on the use and effects of different kinds of disaster relief, and on the post-disaster course of reconstruction. Some definite patterns have been described (Haas, Kates, Bowden, 1977) in a growing emergency management literature. This chapter will discuss some of these general patterns and their application to hurricane disaster response.

THE TIME SEQUENCE OF DISASTER RECOVERY

If we begin the time sequence with the disaster incident itself, we can first distinguish an emergency response period. This period lasts for several days or weeks, depending on the severity of the disaster and the resilience of both the affected community and its larger social context (scale and effectiveness of state and federal aid). During this period the focus of action is on relieving immediate life-threatening conditions and restoring basic services. Officials are in a "coping mode," doing the best they can to deal with immediate and pressing problems. Citizens are likewise coping as best they can, sometimes by putting political pressures on officials. This is not a good time to do planning. It is an important time to have a plan, to preclude ad hoc decision-making which could lead to unfortunate outcomes.

Restoration is the next phase. During restoration the emphasis shifts from temporary, emergency responses to salvage and rebuilding. Debris removal and demolition of unsalvagable buildings and facilities, reopening of transit services, repair of utilities and residential and commercial buildings and the resettlement of the homeless into permanent or longer-term

temporary housing become the primary efforts of the region. By the end of the restoration period these functions will have been accomplished. This phase emerges from the emergency response stage without a clear demarcation line, and as vaguely slides into the next phase, that of replacement reconstruction.

Restoration typically .lasts for several weeks to a few months, but the replacement reconstruction phase may last for several years. Disaster studies (Foster, 1980) define this phase as completed when the pre-disaster population level is reached and losses in jobs, residences and capital stocks have been rebuilt. Except for a possible "commemorative, betterment and developmental" period (Foster, 1980; Kates and Pijawka, 1977), in which the community moves on to longer-term community improvement and development beyond the level achieved before the disaster, replacement reconstruction signals the community's recovery and completion of the disaster experience.

It is important not to do too many things wrong during the emergency response period, but it is in the restoration and replacement reconstruction stages that mitigation planning becomes most important. In the midst of disaster it is difficult for public officials to be "hard-nosed" about reconstruction on a case-by-case basis. "These difficult times" call for compassion, leniency, let's-all-pull-together behavior rather than seemingly arbitrary permit denials and "toe-the-line" rulebooks. Ad hoc decision making will run toward the pattern most familiar to the population and officials, the pre-disaster pattern of community life. If the community "returns to normal" without a plan it is likely that many of the problems of the pre-disaster period will be recreated. But this will not be entirely correct: again, disaster studies indicate certain kinds of deviation from the pre-disaster pattern which are themselves "normal" and should be expected.

If a community desires to improve itself, to recover with optimum speed and effectiveness, and to make its own decisions on how to do these things, it is important to plan in advance for the critical restoration and replacement reconstruction periods. We therefore will examine some of the "normal" patterns of restoration and reconstruction in order to identify patterns which a community may desire to allow, encourage, discourage or prevent in order to achieve its post-disaster goals. In addition to potentially resulting in an improved community, preparation and use of a post-disaster plan can ease what has been identified as probably the greatest single impediment to swift and efficient recovery--uncertainty. People and organizations--including government--may engage in wasteful, expensive, temporizing behavior, and miss valuable opportunities.

POST-DISASTER SOCIAL AND ECONOMIC STABILITY AND CHANGE

"Reconstruction following disaster compresses in time, exaggerates in process, but does not basically change the growth and evolution of cities," according to Haas, Trainer, Bowden and Bolin (Haas, Kates and Bowden, 1977). Their useful study of "reconstruction issues in perspective" is the source of much of the information in this section.

Given that the above conclusion is correct, it follows that 1) the basic pattern of community reconstruction is reasonably predictable, in that it will largely replicate the past and continue existing trends; 2) any important changes from the pre-disaster pattern will probably be due to conscious choice, by governmental authorities or private organizations. Reconstruction plans should therefore determine what patterns should be encouraged to continue, and what changes to encourage or prevent. Both governmental and private decisions can be critical to the reshaping of the community. Most of this report deals with governmental actions useful and necessary in post-disaster reconstruction, but those actions will occur against the background of private decisions and the operation of the marketplace. Since these private sector influences may condition governmental action, they are important to understand.

Characteristic of heavy damage is the need for those who own property or businesses, who live and work in the area, to decide whether and how to rebuild, or whether and where to relocate. Government actions can influence and even control some of these decisions, but not all of them. Further, governments are usually slower than the decision-making of private individuals and the marketplace. In fact, a major reason for prior-planning is to allow government to obtain the freedom of action necessary soon enough to use it effectively.

Some private decision-makers during the period of uncertainty may be paralyzed, others may leap to capitalize on an opportunity. Haas et al. (1977) report a fairly clear pattern of response, characterized by superior speed, scale and effectiveness of action as one goes up the scale of socioeconomic power. Thus financial institutions with access to capital and larger businesses with capital and/or insurance payments may move quickly to buy up desirable new locations, if they want to relocate, and to begin rebuilding or to reopen for business. Next come department stores and general merchandisers, followed by service segments--hotels, theatres, medical services, etc. Among residential decision-makers, those in the upper socioeconomic categories are most likely to have the capital and adequate insurance which allow them freedom of decision.

The result of these private actions may be significant redesign of the community, both the heavily damaged areas and those less damaged. Government attention typically focuses upon the more heavily damaged areas, but businesses or individuals who decide to relocate may move to new areas. One observed result of

post-disaster reconstruction is the expansion of urban areas: rebuilding consumes new space. Some may move from less damaged areas into those more heavily damaged, taking advantage of reduced property prices and the owners' desire or need to sell. Others may move in the opposite direction, leaving heavily damaged areas as "bombed out" sections. Changes in business and residential patterns increase new demands for services, altered routes for transportation, new business centers and residential sections. There is one clear point here: a full-blown reconstruction plan should recognize that impacts will occur well beyond the borders of heavily damaged areas, and may well require coordination with neighboring communities.

The market mechanism works in favor of the interests of those best able to operate in the market: better capitalized businesses and well-to-do residents. By contrast, businesses and individuals or families lower in the socioeconomic scale are less able to resist or recover from the impact of the disaster. Scarce housing will rent or sell at higher prices, increasing the probability that lower-income people may relocate to other areas. Marginal businesses may be slower to reenter the market, or be unable to do so. Although there may be a surge of employment during the recovery period as debris is cleared and initial repairs made, this may be followed by an increase in unemployment, particularly among the lower income segments of the society, as the economy slowly recovers.

One element of a recovery and reconstruction plan should deal with the special needs of local lower income or ethnic minority groups. Low income people are likely to require more governmental assistance in coping with their post-disaster problems, and ethnic minority groups may have special problems of language, employment, food or other needs. Given the pattern described above, in which the socially-strong have the ability to act in furtherance of their own interests, important questions of social fairness may arise.

Local government must attempt to anticipate these impacts and decide what, if anything, it can and will do to deal with these possible developments. It is probable that government, businesses, and citizens will agree entirely on one point: the sooner the community completes the restoration stage and is well launched on replacement reconstruction, the better. Foster (1980, p. 239) states flatly that "A significant factor that influences their speed of recovery appears to be uncertainty, the removal of which as rapidly as possible must be a major aim of local government." He then declares that "the simplest and most desirable way of achieving this end is through the preplanning of reconstruction." Citizen participation in preparation of such a plan, which should increase confidence in and awareness of its provisions, may reduce the period of uncertainty.

Cooperation in development of a reconstruction plan should benefit government, citizens, and business. Communities operate as interacting systems; when one element lags or leads the others there is a cost to be paid in "friction" of wasted resources.

ISSUES IN RECONSTRUCTION

Haas, Trainer, Bowden and Bolin (1981) specifically identify seven issues of importance in reconstruction. These issues arise against a background of social cooperativeness and a desire to avoid actions that may re-create the disaster conditions, an attitude which is strongest in the early weeks of the response and recovery periods. But as the disasterous event fades into the past and present needs are focused on, the desire to return to normalcy becomes stronger and may conflict with slow-moving "do it right this time" planners. Time pressure thus forces some issues, in the absence of prior planning, and governmental decision makers find that their choices among options begin to disappear as private decisions narrow the range of choice. The situation is worsened by the fact that the issues/decisions frequently are interactive: a decision on land use rules or changes, for example, will affect such other issue areas as building codes, compensation, and revised revenue systems. The community simply cannot afford to wait during a post-disaster process of methodical planning, community discussion and consensus building, but neither does it benefit by hasty, disjointed decisions.

Of the issues defined by Haas et al. as significant, the logically prior question for government is that of how decisions are to be made: by "normal" processes or by extraordinary means? Because the community is seriously damaged, the scope and impact of decisions is likely to be far larger than usual: whole areas of a city reclassified for land use purposes, or major traffic arteries changed, or basic revenue measures introduced. Should decisions under conditions of grave community disruption, involving possible massive changes in "normal" life, be made by procedures used in less trying circumstances? Is there time for those procedures? Will those procedures give too much, or not enough, representation to various groups in the community?

Decisions made even under "normal" procedures may be subject to new kinds of influence, yielding unusual results. Groups or interests previously nonexistent (e.g., those with heavily-damaged property located in flood areas) may reshape community influence patterns. If there are proposals for major changes such as may well be needed for valuable mitigation measures, the usual procedures may be quite inadequate to deal with the emotions generated and the interests involved and may take so long the point becomes moot. But if extraordinary procedures are to be used, what are they to be? Is there legal authority for them? In fact, deciding whether to use the normal or new extraordinary procedures is itself a fundamental decision likely to create disruptive controversy.

A second issue is quite obvious in hurricane planning: what, if any, land use changes should be made? This issue is of great economic significance to at least some landowners, affects the overall "efficiency" of the community, and may be important to the revenue base of the local government as well. Often decisions on relocation, like where to move people, cannot be made until the land use question is settled, which places heavy time pressure on this decision. There is probably no other decision so critical to the future shape of the community as land use: it will affect all types of utilities, transportation patterns, residential sectors, housing inventories, tax rates, revenues, and many other issues.

If uncertainty is the key factor inhibiting reconstruction, land use decisions are a key element in creating uncertainty. In hurricane planning, more than in some other disasters, advance identification of high risk zones is usually possible by means of hazard analysis: in principle, uncertainty can be reduced.

These first two issues, how to make decisions and what land use rules will apply, are strategic: their resolution conditions all else. If done well, recovery may be swift and efficient; if done poorly or not at all, the cost may be high. Further, both issues are susceptible to advance planning generally and sometimes in specific terms as well. Decisions on whether and how to use special citizen task forces, expert panels, or other special "input" channels can be made in advance. Legal authority for use of special measures and powers can be created in advance. Criteria for the "rebuild or relocate" decision can be developed. Hazard analysis can be applied to spot those geographic areas in which that decision may have to be made, and possible relocation sites identified. Because these things can be done in advance, they can also be done through established channels with suitable citizen participation, adding popular support and spreading the information widely to further reduce confusion.

Additional issues identified by Haas et al. include the following:

--should the building code be changed?
--should there be an effort to improve the community, making it more efficient and attractive?
--should there be compensation or special financial assistance for private property losses?
--how shall personal and family problems be handled in the disaster recovery period? and,
--how should the community pay for increased public expenditures?

All of these issues can be the subject of advanced planning. Some will be important factors in shortening the period of uncertainty, such as agreed changes in building code requirements applicable to reconstruction in high-hazard areas. Others may

improve the community's feeling about itself, an important factor in recovery and future development.

The last issue, how to pay for increased public expenditures occasioned by the disaster, deserves additional discussion. The problem is made worse because the disaster will almost certainly reduce community tax revenues temporarily due to property destruction, unemployment, reduced sales taxes, etc. Federal or state aid can be of great value in this situation but there are very important conditions attached to that aid. For example, some or all of Federal aid may be conditioned upon local agreement to make certain changes in land use policies, or particular provisions for eligibility for assistance (e.g., Sec. 1362 of Federal Flood Insurance Act). The community must decide whether it wants to meet these conditions, and then must take the necessary legal steps. Further, aid is usually in the form of reimbursement for expenses rather than paid in advance or at the time of expenditure, and the time required for reimbursement can run into many months. For at least the short term and perhaps for an intermediate term, the community must make financial plans different from the routine. Again, these decisions can be made in advance and standby authority created.

Financial questions are part and parcel of the other issues. If compensation is to be given to private persons, if land in hazard zones is to be purchased by condemnation or otherwise, or if significant "community betterment" projects are to be undertaken during the "window of opportunity" created by the storm's destruction, additional financial burdens will be created.

As Kates (in Haas, Kates, Bowden, 1977) underscores:

> The central issues and decisions are value choices that give varying emphasis to the easy return to normalcy, to the reduction of future vulnerability, or to opportunities for improved efficiency, equity, or amenity.

But these value choices need not be considered in a vacuum. Kates calls the reconstruction process "ordered, knowable, and predictable." In general it is possible to describe the probable areas of damage, types of damage, and emergency response needs. These things are in fact being done around the state in a series of hurricane evacuation plans and loss estimates, sponsored through the State's Division of Emergency Management. When these basic data are available it can be applied to the known patterns of post-storm disaster response and issue areas described above. In some cases only general principles and other legal authorities can be agreed upon in advance--but these can be of vital importance in shortening the period of uncertainty and speeding the community's recovery. Where it can be done, more detailed planning for contingencies and opportunities could help significantly in reducing the practical impact of the disaster.

References

A. H. Barton. 1969. Communities in Disaster. New York: Doubleday.

R. Dynes. 1970. Organized Behavior in Disaster. Lexington, MA: Heath Lexington.

Federal Emergency Management Agency. 1982. Local Government Emergency Planning. Washington, DC: FEMA.

H. D. Foster. 1980. Disaster Planning: The Preservation of Life and Property. New York: Springer Verlag.

J. E. Hass, R. W. Kates, M. J. Bowden, eds. 1977. Reconstruction Following Disaster. Cambridge, MA: MIT Press.

The above edited work contains the following cited chapters:

J. E Haas, P. B. Trainer, M. J. Bowden, R. Bolin. 1977. Reconstruction Issues in Perspective.

R. W. Kates. 1977. Major Insights.

R. W. Kates, D. Pijawka. 1977. From Rubble to Monument: the Pace of Reconstruction.

R. E. Herman. 1982. Disaster Planning for Local Government. New York: Universe Books.

S. P. Leatherman. 1982. Barrier Island Handbook. College Park, MD: University of Maryland Press..

National Governor's Association. 1979. Comprehensive Emergency Management: A Governor's Guide. Washington, DC: NGA.

O. H. Pilkey, Sr., W. D. Pilkey, O. H. Pilkey, Jr., W. J. Neal. 1983. Coastal Design. New York: Van Nostrand Reinhold.

E. L. Quarantelli, ed. 1978. Disasters: Theory and Research. Beverly Hills, CA: Sage.

CHAPTER 4

PLANNING
SHORT TERM - LONG TERM

INTRODUCTION

Short term goals, in regard to hurricane mitigation efforts, can be considered to span one month to six months. Long-term planning extends beyond six months and may encompass up to a ten to twenty year time-frame. Both the short-term and long-term planning should focus on the hurricane season which is June 1 to November 30. During this six month period the major threat of hurricane landfall or paralleling the coastline occurs mainly during the August through October period. This vulnerability period should drive planning actions prior to, during, and after, whether a hurricane has affected the community or not. A sound mitigation program must be designed around long-term goals, with intermediate and short-term action programs coordinated and structured to advance, not conflict with, those goals.

Coastal plans are not static documents. As property use changes or beach conditions change in the short-term, the community coastal plan may change as well for that specific location. However, long-range goals should change very little on a year to year basis. Intermediate range plans serve as a vital link between short and long term, to maintain consistency between long-range goals and short-term actions. Individuals can observe and participate in the evolution, promoting public consensus and sound investment decisions. Any significant changes in post-hurricane plans should be publicly announced, with encouragement of citizen participation and public hearings.

An intermediate range plan should support the established long-term goals the community hopes to achieve. Generally these long term coastline goals fall into one of the following categories:

1. to preserve and protect the dune system;
2. to reduce beach erosion and promote natural accretion;
3. prohibit artificial structures that inhibit the natural littoral process;
4. maintain aesthetically pleasing beach environments;
5. promote public beach access;
6. prohibit the changing of natural sand texture, quality or color;
7. protect development landward of the designated coastal construction control line; and

8. protect health and safety of coastal residents and visitors.

PHASES OF GOVERNMENT ACTIVITY

Successful public policy requires that purpose be understood before procedure is established. Thus, at the outset, the city or county mitigation specialist has to know what it is he is trying to accomplish. All local government officials are interested in protecting the public health, safety, and general welfare. The mitigation official is concerned specifically with the long-range protection of life and property. During the phases of mitigation and recovery, he emphasizes and publicizes local goals concerning public health and safety when confronted with a hurricane disaster. To this end, the act of disaster planning actually involves four interrelated phases of government activities. Figure 4-1 depicts these government functions (McElyea, et. al., 1982, p. 3-1).

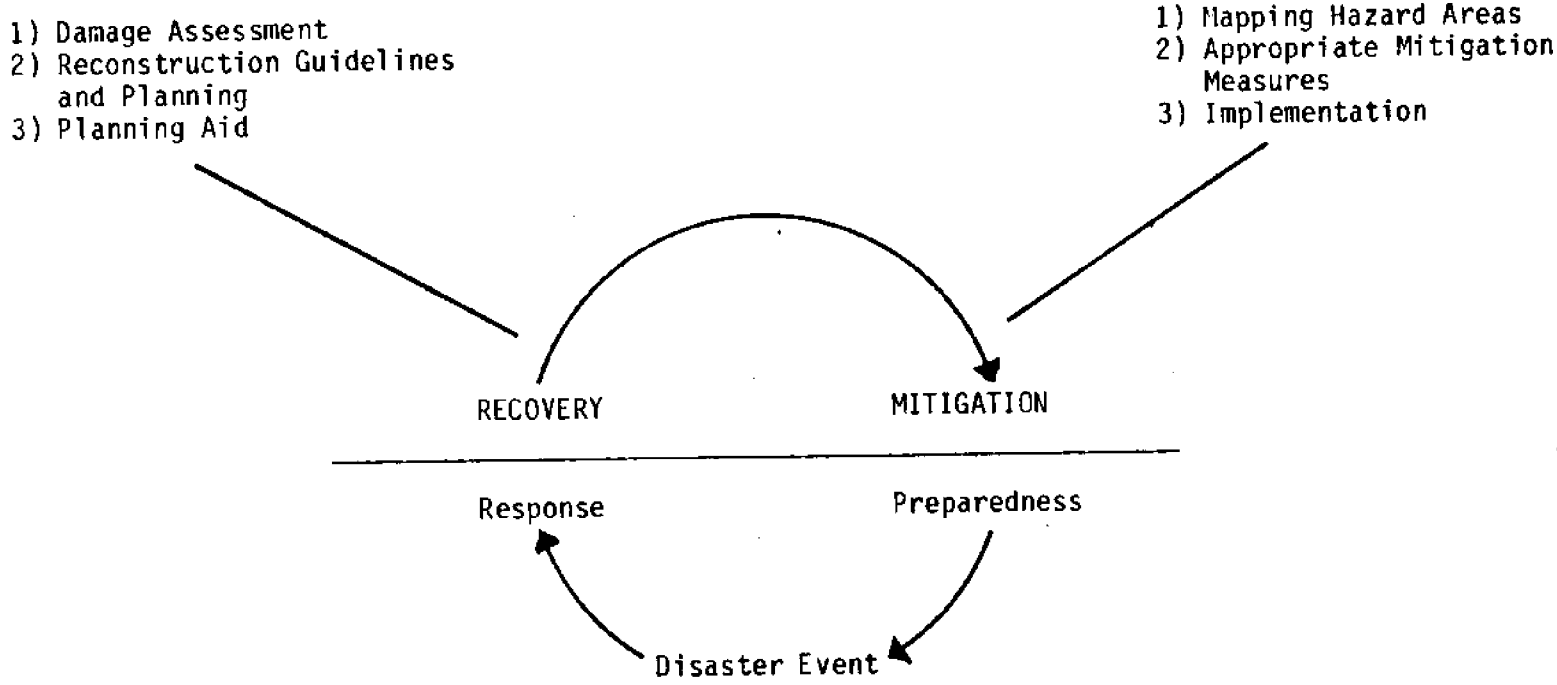
For disaster management planners there are two distinct phases--development management and emergency management. Two planning phases comprise development management: mitigation planning and recovery planning. Mitigation planning refers to improvement of conditions by providing a set of guidelines for pre-disaster development, part of a long-term planning process used to minimize the possibility of life and property loss due to hurricane forces, with an ultimate goal of avoiding a disaster. Local government planning for the recovery phase aims to reconstruct the community swiftly and well. As with the mitigation phase, recovery should follow guidelines adopted by local government to enhance the safety of the community in preparation for the next hurricane.

The emergency management phases of preparedness and response immediately precede and follow a storm, and have long been the major focus of disaster planning. These activities need to be coordinated with development management. This report concentrates on the neglected phases of development management rather than the more glamorous and familiar emergency management.

Figure 4-1 also depicts the planning strategies inherent in the mitigation and recovery phases. The local planner has various legal tools available at each strategy step of the two phases. For the mitigation phase the legal means for identifying the community's vulnerability to storm forces is discussed. Also discussed are the tools for defining specific mitigation measures and for implementing them. Legal tools of the recovery activities of damage assessment, reconstruction permitting, and relief procurement are covered. This discussion should provide the reader with an understanding of what it is that mitigation planning seeks to accomplish. It should be obvious that there is no sharp dividing line between the mitigation and recovery phases. Recovery activities are often an opportunity to put into practice the aims of a mitigation plan.

Figure 4-1

PHASES OF GOVERNMENT DISASTER MANAGEMENT



McElyea, et al., 1982

SHORT TERM PLANNING

Hurricanes are unpredictable in many aspects--when, where, duration, severity, direction of approach, amount of rainfall, possible accompanying tornadoes, and precise extent of tidal surges. These various hurricane conditions cannot be forecasted by the National Hurricane Center with any degree of certainty until 6-12 hours prior to landfall; by which time affected communities should already be executing their hurricane evacuation and preparation plans.

Community decisions affecting the welfare and safety of residents and tourists are made in a confusing and complex political arena with information that is often conflicting and fragmented. Imbedded in many officials' minds are fears of taking emergency action prematurely, and then having to face public criticism should the hurricane veer away from its forecasted landfall. For a major coastal resort community which depends on the tourist season for its economic vitality, the mayor's decision process usually considers the economic impact on the community if he orders an unnecessary evacuation. But if he does not order an evacuation and the hurricane hits, he may be held responsible for not fulfilling the responsibilities of the office--and could be sued by vacationers and residents suffering losses including loss of life. Officials having to make decisions regarding hurricane preparedness and evacuation require firm written guidelines, for reasons of both legal liability and timely decision-making. The guidelines should be codified and widely disseminated, seeking to make them thoroughly understood by all residents; however, tourists present another problem. One thing must be clear: There is no alternative to evacuation of all citizens in hurricane hazard areas. If people remain in the high hazard areas they may not survive, and if injured, may not be rescued or receive medical attention for many hours.

The state of evacuation and short-term emergency response planning is generally good, and improving rapidly with state and federal prodding and financial assistance. Leading examples are noted in the reference section of this chapter. Here we will summarize key elements of these hurricane response programs.

For local and state mitigation planners, safety of the population must be the primary factor. There is a limited warning time available. Egress from hazardous areas takes a specific amount of time, and the amount of time is a function of the number of people to be moved over a known set of evacuation routes. If the number of people exposed to risk is allowed to exceed the known evacuation capabilities, those who make that decision are creating the potential for a major disaster. No action should be taken if it will increase the disaster potential; all mitigation actions should be directed toward reducing that potential. Despite political, social and economic pressure to increase the allowable number of people resident in hurricane hazard areas, to do so is to act irresponsibly.

The incorporation of hazard mitigation into the overall planning scheme is actually an attitude or mindset: expanded planning. It is a recognition that coastal zone planning is only effective when the interrelatedness of resources is addressed via coordinated programs (Hershman, 1981, p. 35). Legal tools are available for successful inclusion of hazard mitigation in the planning process if local leaders can overcome the constraints on planning posed by the political process. A major step in the planning process is the inclusion of hazard mitigation in the Local Government Comprehensive Plan as a part of all the elements in the Plan.

The hurricane evacuation chapter in the comprehensive plan should address seasonal fluctuation of both tourists and second home owners. Included should be a section covering transient residers at marinas who live on the boats. Fortunately the winter tourist season in south Florida does not correspond with the June-November hurricane season; however, in the northwest and northeast sectors of Florida the tourist season and hurricane season overlap. We stress again that there is no substitute for evacuation, and that failure to establish, implement and maintain a realistic population limit in hazardous areas we may be encouraging disaster.

Storm hazard mitigation is only one of the many goals sought in planning. The comprehensive plan provides a mechanism for addressing and balancing various local development objectives. Local government has the decision-making role in the short-term response to a hurricane disaster. Local officials must initiate the municipality response, set priorities for repair work, and designate legal channels that must be followed. Regulatory powers often conveyed to a mayor or city manager when an emergency is declared should be understood by the elected officials granting the emergency power, by the populace and by the recipient of that power. Equally important, major agency managers need to know what responsibilities and authority may be conveyed to their agency and what limitations go with the declared emergency response.

Major agency managers who will be directly involved in helping the municipality recover should have a pool of manpower that can be used until the city begins to function normally. Labor intensive efforts such as debris clearance can use unskilled labor to remove trees and limbs from city streets. For most managers directing a post-hurricane effort, having listed and notified individuals who will automatically respond alleviates the possible lack of telephone capability. As the hurricane approaches preliminary notification of these individuals or businesses is accomplished. Municipalities may contract with people who will respond with chain saws, trucks, tractors and cleaning equipment to perform specific task requirements within sectors. The agency manager responsible for debris clearance should have a current status of equipment,

sector coverage, and individuals qualified to do the work. Within a sector those facilities or services critical to the safety, health and welfare of the population must be quickly placed in service. Therefore, the initial clearing and repairs should be made to open streets to these services. Electric and phone companies should have a prioritized listing of where repairs should be completed quickly.

When municipalities cannot cope with the amount and severity of destruction, county assistance should be quickly integrated into the on-going efforts. Officials at both the municipal and county levels can request specific assistance from the state. This may involve mobile field hospitals, highway repair teams, and hazardous waste mitigation teams and equipment. Mutual aid intergovernmental memoranda are advisable, and should be updated before every hurricane season and included in the local government comprehensive plan.

Local Government Comprehensive Planning Act

Section 163.3161 of Chapter 163 gives the intent and purposes of the Local Government Comprehensive Planning Act. All Florida communities have drawn up comprehensive plans as mandated by the State, with the intent of guiding and controlling future development. Of the eight elements which comprise a plan, those relevant to our discussion are the Coastal Zone Protection, Recreation and Open Space, Future Land Use, Drainage and Utility, and Conservation.

The Coastal Zone Protection Element focuses on ecological planning principles. Development cannot destroy the integrity of the coastal ecosystem by altering the "optimum populations of all species of wildlife." The element requires formulation of management and regulatory techniques to implement ecologically based planning. Particular emphasis is placed on surveys of existing vegetation types to be preserved for natural control of dune erosion. This obviously enhances mitigation since dunes act as natural seawalls against water surge. The Conservation Element amplifies the Coastal Zone Element.

The Recreation and Open Space Element can be coordinated with the Coastal Zone Protection Element. Land too dangerous to develop can be set aside as part of mandated passive recreation sites.

The Future Land Use Element is the heart of the comprehensive planning process (DCA #1, 1980, p. 48). It is here that "standards to be followed in the control and distribution of population densities" are established. Hurricane mitigation practices certainly fall under the category of "standards."

The Drainage Element is intimately tied to future land use. It is included as a means of addressing the technical provision

of services (the others being sanitary sewer, solid waste disposal, and water) envisioned during future growth. It is particularly important to integrate this element with the Conservation and Coastal Zone Protection Elements. If care is not taken, placement of infrastructures can shape development in such a way as to destroy the intent of the other elements.

The legislation by its very nature is policy oriented and establishes only the basic criteria for comprehensive plans. Implementation is left to local governing bodies. Without specific areawide standards such as zoning, the comprehensive plan will be ineffectual.

Local governments interested in improving mitigation aspects of their comprehensive plans may amend those plans. Sections 163.3187 and 163.3184 detail the means of accomplishing changes. Amendment of the future land use element, or portion thereof which involves less than five percent of the total land area of the governmental unit, requires public hearings on the proposal. Affected property owners are notified and given 30 days notice of the hearing date. It is likely that more than one public meeting will be necessary. Upon conclusion of all hearings, a majority vote of the local governing body will decide the matter. Procedure for amendment of other elements is the same as the original adoption of the comprehensive plan. The future land use element in the plan should guide and regulate growth which should reduce and channel confrontations. This plan must trigger zoning and other regulations so that goals are established for land use promoting consistency, reducing the number of zoning variances, and increasing predictability of how neighborhoods will develop. A coastal community should establish a total build-out number of structures/people and estimate when that date should be reached.

Hurricane Evacuation and Mitigation Elements

Comprehensive plans for coastal counties and municipalities should have a section which covers hurricane evacuation and mitigation. The plan should consider growth and identify the maximum population at which evacuation can no longer be safely conducted under existing circumstances. This hurricane evacuation element of the comprehensive plan should require region, county and state approval prior to allocation of any funds which promote coastal growth either directly or indirectly. No bridge, road, airport or marine improvements or major developments (DRI) should be approved until the community issues a maximum population number for safe evacuation, and a plan to do so. For example, regional airport development may be important when looking at what may happen on a barrier island or Key West as a hurricane approaches.

As a scenario, assume that two charter jumbo jets of tourists fly in from some distance away for a two week vacation. Five days later a hurricane develops and is 16-20 hours away,

landfall location still uncertain. The two jumbo jets, now in London, Frankfurt or Chicago are booked up and in any case decline the flight due to the severe weather forecast. The municipality or county now has 800 tourists with round trip tickets but no aircraft. With an unused air ticket and more than a week to go in the expensive two week vacation, many are reluctant to leave by other modes of transportation. Most of these tourists will be staying in hotels, motels, and condominiums on the beach. Not only are the tourists reluctant to evacuate but the owners and managers of these businesses do not want them to leave and will resist suggestions to evacuate until it is declared the hurricane is going to make landfall near their location. By the time emergency transportation is arranged for the tourists, evacuation may be too late, with flooded roads and tree blow-down already occuring. This scenario shows how even airport expansion or construction, not normally considered relevant to hurricane mitigation, must be analyzed carefully in long-range comprehensive plans.

There are three general principles of policy analysis that should be borne in mind when employing Table 4-1 for cost benefit analysis (CBA) (Starling, 1979, p. 285). The first principle is that all possible major outcomes of a decision should be identified. This means that the outcomes (costs and benefits) of a decision not to proceed with migitation planning should be compared to the benefits and costs of the "yes" decision. Only then can the local official get a contextual view of the package of outcomes of the "yes" (proceed with mitigation) and "no" (status quo) decisions.

The second principle states that all assumptions and uncertainties that are used to predict outcomes should be explicitly stated. This relates to the advantages of using numerical data. A factually based description of an outcome contains more information than a nonfactual statement: it clarifies the actual choices and consequences. "Our coastal location is hit by a category 3 hurricane every 22 years on the average" is more useful than the observation that "we took a hit by a hurricane when I was a boy."

The third principle states that net outcomes rarely occur in isolation, so outcomes should be stated in context. It is not enough to list probable outcomes. What are the interrelationships among the consequences of decisions? How will the decision to proceed or not with nonstructural planning measures affect other parts of the comprehensive plan? How will recreation needs, housing elements, water quality provisions, and tax revenues be impacted? While policy analysis is still very much an art it becomes more of a science if these principles are used. It gives the local official a means for putting public interest and vested interest in a comprehensive framework.

TABLE 4-1

Sample Cost/Benefit Matrix (after Starling) for Hurricane Hazard Mitigation

		BENEFITS	COSTS
DIRECT	TANGIBLE	lower insurance premiums; reduced post-hurricane property damage; lowered emergency rescue costs; lowered infrastructure replacement costs;	purchase of flood-prone land; movement of structures out of zones; maintenance of land
	INTANGIBLE	savings of lives; community confidence; clarification of goals and values	"interference" with property rights; social change
INDIRECT	TANGIBLE	enhanced recreational opportunities; improved water quality; improved habitat	value decrease in high-density-related property; traffic pattern changes
	INTANGIBLE	aesthetic improvements; heritage preservation	loss of private control; community impacts
PECUNIARY		individual windfall property value increases; commercial revenue growth	property value decreases; commercial revenue decreases

POLITICAL PRIORITY GIVEN NATURAL HAZARDS BY STATE AND COMMUNITY ELITES

Hazard mitigation policy will need the support of political influentials, as well as the general public. A survey conducted by Rossi, et. al., reveals that, for the most part, political decision makers in most state and local communities do not see environmental hazards as a very serious problem. Not unexpectedly, in questioning respondents about the perceived seriousness to their community or state of eighteen potential state and local problems, five natural disasters were consistently listed as less serious than such problems as inflation, welfare, and crime. Hurricanes ranked 15 out of 18.

POLICY MAKING FOR NATURAL HAZARDS MITIGATION

Nonstructural means of hazard protection require planning. Traditionally, in this country, planning has referred to that function of local governments concerned with the use of physical space. The degree to which planning affects the design of a community is, of course, a matter of policy. It is important that an outline listing the possible damage to the community and short-term, intermediate-term and long-term actions the government might consider be developed for review and consideration (Figure 4-2).

As with any discipline, planning has developed its own body of technical expertise, and accepted methods of problem solving. For instance, the "comprehensive" plan has been touted as an example of the planner's unique ability to act as the neutral arbiter of the public interest. Planning thus becomes the perspective from which the community is viewed, according to Vasu, as an "organic whole with a public interest that is, metaphorically, larger than the sum of the individual interests of the body politic" (Vasu, 1979). The inference is that both the acceptability of a given land use, and conflict between differing land users, can be resolved in a technical and rational fashion. While the relevancy of factual information and expertise in a planning scheme cannot be denied, it must be recognized that the planning process is inherently political.

Politics has been defined by Lasswell as the exercise of power leading to the determination of who gets what, when, and how. Because planning decisions have enduring social consequences, they should be made with reference to agreed upon goals. The policy maker and planner choose to value land uses using non-market values as well as more rational factors. This is an exercise of a political nature, likely to raise issues important to the public during planning hearings. Chapter Six details some methods and a rationale for public participation. Policy success dictates that the planner be aware of both articulated and unarticulated political performance standards before any contingency plan is readied or any project undertaken.

Preplanning for Short, Intermediate and Long Term Actions

Event	Short Term (Day 1 to 30)	Intermediate Term (Month 1 to 12)	Long Term (Year 1 to 10)
Tidal Surge Destruction of Homes	Moratorium	Rebuild Move Landward	Building Code Criteria Modify CCCL
Flash Flood Destruction	Moratorium	Rebuild Relocate	Building Code Criteria Move Structures From Flood Plain
Slow Rise Flood Damage	Repair	Channel Water Better Drainage	Federal Flood Control State/Municipality Program
Wind Destruction	Repair	Construction Guidance Building Code	Wind Resistant Materials Improved Materials/Techniques
Beach Erosion	Follow State/ County/Municipal Guidance	Qualifies for Nourishment Not Qualified for Nourishment	DNR/County/Local Funding Beach Conservation Measures
Road Cuts	Temporary Repairs	Permanent Repairs Improve Temporary Repairs	Increase Dune Height Relocate Bids
Bridge Destruction	Moratorium	Rebuild Relocate Not Rebuild	Change Design Change Location Establish Access Mode
RR Track Destruction	Repair	Alternate Routes Protective Structures	Rebuild Construct
Airport Damage	Repair	Construct	Improved Materials/Techniques
Ship/Dock Damage	Repair	Clear Channels Rebuild Docks	Dredge Breakwaters
Power Failure	Repair	Undergound Back-Up Systems	Storm Proof Conduits Generators Built-In
Water Supply Failure	Emergency Repair	Rebuild Relocate/Reroute	Structural Improvements Move Landward
Sewerage System Failure	Emergency Repair	Rebuild Relocate/Reroute	Structural Improvements Move Landward
Fire	Respond	Reduce Threat Rebuild With Modifications	Control Flammable Materials Retention Systems/Sprinklers
Communications Failures	Emergency Repair	Plan Change New Development Install New Systems	Telephone Lines Undergound Hurricane Resistant
Dispersal of Hazardous Materials	Respond	Secure Hazardous Materials Modify Structures	Relocate From Water Source Reinforced/Elevated Buildings
Crop Destruction	Assist/Advise	Crop Replanting Drainage/Erosion Control	Financing & Seed Source Water Management System
Fuel Shortages	Replenish	Modify Storage Structures Alternate Supply/Sources	Reinforce/Relocate Reinforce/Relocate

FIGURE 4–2

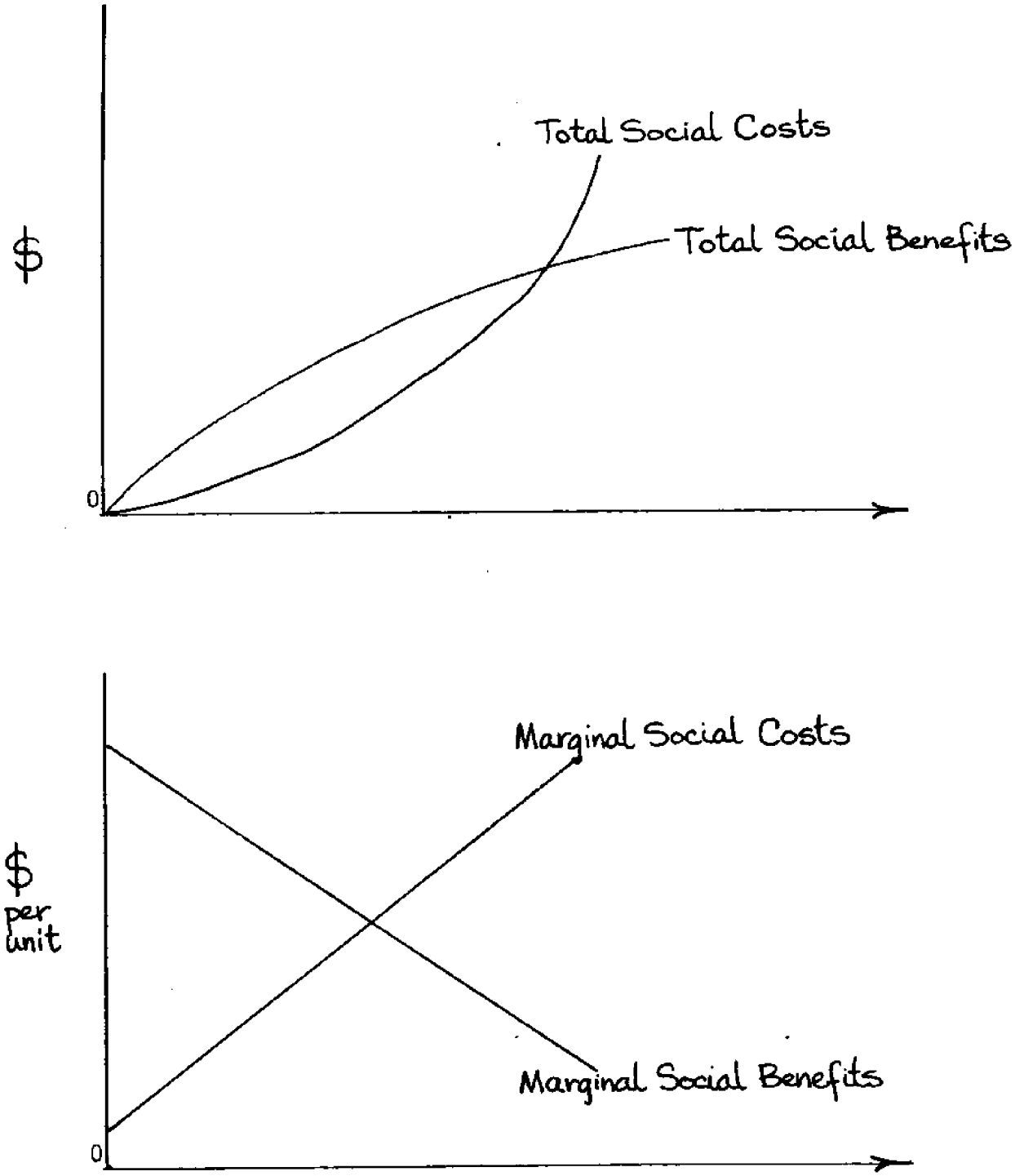
Hazard mitigation planning embodies the use of political and social power to control allocations, for ends that would not otherwise be achieved. Such decisions may well be in conflict with other legitimate values. For instance, development along the coast is important to builders and residents. Many of them may believe that public interest would best be served by allowing the free market to determine the pattern of land usage. The marketplace is seen as a "self correcting movement" which reflects changes in supply, demand, and preference (Vasu, 1979, p. 180). Thus, the planner's desire (or requirement) for a comprehensive plan to serve larger social interests will often run contrary to those interests which want to see the popular will expressed via a marketplace permitted to achieve economic equilibrium. There are no easy solutions to the problems posed by "vested interests," nor will any two communities adopt the same solutions to these problems.

Cost Benefit Analysis

The local official should, wherever possible, conduct a cost/benefit analysis (CBA) for hurricane mitigation planning. This will help insure that costs incurred in mitigation planning (such as regulations on construction) will contribute to the maximum social gain. Since government action to foster public goods is not exempt from the principles of efficiency, the planner needs to ask himself whether government is producing the right things in the right quantities (Starling, 1979). CBA allows a mathematical and graphical depiction of the interaction of total social costs and total social benefits. The theory assumes that the marginal social benefit (MSB), the extra benefit added by each last extra "unit" of mitigation activity, will be growing at a decreasing rate. Conversely, marginal social costs (MSC) will be increasing per unit of output as total expenditures grow. The point on the graph where MSB and MSC cross is the optimum amount of hurricane mitigation because to produce more benefits would produce costs out of proportion to benefits. Figure 4-3 represents these concepts.

Implicit in the justification of CBA is the notion that it is better to use numerical probabilities in making judgments about uncertainities than to use subjective probabilities which are subject to influence by vested interests or personal values. The attempt to reduce costs and benefits to mathematics can help planners assemble and process large and confusing amounts of information, and may clarify relationships between variables that are not immediately obvious. This is true for assessing both the risk posed by a hazard and the desirability of consequences of alternative decisions. The "Perceived Risk" section elsewhere in this chapter covers factors surrounding hazard assessment. Unfortunately, determination of the costs and benefits of various outcomes is harder to figure.

FIGURE 4-3



(After Starling, 1979, p. 293)

The policy maker must consider all benefits and costs when comparing different courses of action. This is where the "science" of cost/benefit analysis becomes the "art" of cost/benefit analysis. The local official has to decide which benefits and costs are relevant and how they should be valued. In addition, the policy makers must compute the present value of future benefits and costs. Only benefits that increase the community's welfare or lower the resources necessary to provide for the common good are to be considered. These real benefits are contrasted with pecuniary effects which represent a gain for one group of people at the expense of another group. In that case, there is no net contribution to the maximum social gain (Starling, 1979, p. 251). The only exception to excluding these effects occurs in cases of a policy aimed at social redistribution. It is crucial that the policy maker have a clear view of the goals of a mitigation project so that ambiguous benefits can be weeded out.

Benefits and costs must be divided into direct and indirect categories. Direct benefits and costs are those directly related to the main objective of a program. Indirect or secondary benefits and costs are by-products. As with pecuniary benefits, the analyst needs to look at the interest of given legislation or policy directives to determine the cost/benefit categorization. This is certainly true in the mitigation arena, where different locales will combine different goals (e.g., mitigation, recreation, environmental maintenance) in their planning schemes. Considerable time should be spent in analyzing the potential indirect social effects over time.

Not all costs/benefits can be captured with a dollar amount measurement. Such factors are termed intangibles. Aesthetic and leisure experiences are often given as examples of intangibles. The largest intangible of all and the prime motive behind hurricane mitigation is, of course, the value of a human life. Policymakers implicitly put a price on lives whenever they make decisions about health or safety matters. The CBA, by putting a number to it, merely helps an official analyze a lot of information in a form that clarifies perspective. No case is made for the CBA eliminating judgment on the part of the decision maker.

NATIONAL FLOOD INSURANCE PROGRAM

The federal government has instituted typical single-purpose legislation and agencies for coastal hurricane hazard mitigation. These management programs stand alongside other coastal programs stemming from the following federal interests: commerce, defense, federal ownership of lands, international relations, environmental quality, fisheries, energy and others (Hershmann, 1981, p. 17).

In essence, the federal flood insurance program dangles the carrots of planning funds, subsidized insurance, and post-disaster relief funds in front of local communities. To obtain the carrot, communities must enact sensible coastal land-use planning, based on recognition that certain uses are most compatible with the character of certain resources. For hurricane mitigation, development is not advisable in areas subject to severe storm impact. This truth has not been self-evident, judging by past policy decisions and legislation. Nor is improper coastal development a problem in Florida alone: much of the following section is based on work done in North Carolina by McElyea, Brower and Godschalk (1982).

The federal government increased its payments for flood losses significantly in recent decades, particularly in coastal regions. In response to this rising outlay of "disaster aid" and to the inability of citizens to obtain private flood insurance, Congress established the National Flood Insurance Program. The Federal Insurance Agency (FIA) provides insurance to property owners in designated flood areas. These areas are defined as including all property which would be inundated by a 100-year flood. Local and state governments must enact and enforce floodplain management to receive the subsidized insurance. Land use controls and construction standards are typical management techniques. Clearly, the intent of the program is to remove developed property from flood exposure.

The aims of the NFIP necessarily take years to implement and are accomplished in two stages. In the Emergency Phase, limited subsidized insurance is offered to those portions of a community at flood risk (up to $35,000 for single-family house and up to $100,000 for all other structures). The FIA gives the community a "flood hazard boundary map" based on the best available data. The local authorities are required to issue permits for all proposed construction in hazard areas and must review permits to ensure that development is reasonably safe from flooding. Special anchoring and flood resistant construction methods are mandated in the hazard area. Additionally, new subdivisions must be properly drained and new utility systems must be designed and located to prevent flood loss. The Emergency Phase thus clarifies the need for extended planning and puts in place some hurried mitigation measures. Local government officials can expedite their community entry into this stage while moving toward inclusion in the Regular Phase.

The Regular Phase features more detail in both hazard mapping and floodplain management regulations. The Federal Insurance Administration contracts with an engineering firm to accurately determine the community's base flood elevations (BFEs). The community must enact regulations which will protect new construction in the designated flood hazard areas from inundation by the base or "100-year flood." A new "flood insurance rate map" (FIRM) is derived and the community is

provided higher levels of insurance coverage for new and existing residential and non-residential structures (McElyea, 1982, p. 418).

The community must enact and enforce the minimum requirements of the NFIP to be eligible for Regular Phase admittance. These requirements are presented in Table 4-4. The regulations must be legally enforceable and take precedence over any less restrictive local regulations. They apply in addition to those regulations already adopted under the Emergency Phase. New construction is obviously covered under the regulations, as are substantial improvements. "Substantial improvements" refers to any repair, reconstruction, or addition for which the cost equals or exceeds fifty (50) percent of the structure's market value before the damage occurred or the improvement is started. The "substantial improvements" requirement may be key elements of mitigation planning.

The National Flood Insurance Program encourages local officials to adopt more rigorous criteria than those used for minimum standard setting. This is the perfect opportunity for those intimate with an area, the local long-term residents and experts, to contribute their information. Similarly, local input is required to interpret the NFIP conditions under which a community can issue variances from management regulations (McElyea, 1982, p. 4-20). Typically, only lots of one-half acre or less are considered for variance and adjacent lots should have structures located below the base flood level. Then, the three-fold test for variance is as follows:

(1) showing of good and sufficient cause;

(2) failure to issue the variance would lead to exceptional hardship;

(3) variance will not increase the threat to public safety or lead to extraordinary expense.

Because these three factors are subject to interpretation and are judgment calls, local officials will need to act intelligently so as to protect the integrity of their management plan. The balancing of private versus public interests will not likely be accomplished solely in the technical sphere.

Table 4-2 divides the floodplain management regulations into two categories. The fact that a V-zone has all the regulations of the A-zone plus additional ones indicates that the zones involve different types of hazards. Structures in the A-zone are subject to "static" flooding during a 100-year storm. They may be inundated by rising waters, but they do not feel the impact of wave action. Property lying within the Coastal High Hazard or V-zone, however, will experience direct wave action during a hurricane event. FIRM's for each county of Florida predict the

TABLE 4—2: Minimum Federal Flood Insurance Requirements for Regular Phase Communities

Flood Hazard Zone	
A-zone (base flood determined)	-Residential structures must be elevated to the base flood level (includes mobile homes outside of existing parks or subdivisions). -Non-residential structures must be elevated or floodproofed to base flood level (registered engineer or architect must certify adequacy of floodproofing methods). -Mobile homes must be elevated to the base flood level in mobile home parks or mobile home subdivisions that are new or have been substantially improved (repair, reconstruction, or expansion exceeding 50 percent of the value of existing streets, utilities, and pads). -Mobile homes must be anchored by over-the-top and frame ties to resist flotation, collapse, and lateral movement. -Evacuation plans for mobile home parks and mobile home subdivisions must be filed with appropriate disaster preparedness authorities. -No new construction or substantial improvement may cause the base flood level to increase by more than one foot at any point in the community. -The community must maintain an accurate and up-to-date record of elevation and floodproofing heights for all new and substantially improved structures.
V-zone	All of the above apply, plus the following: -All structures must be landward of the mean high tide line. -All structures must be elevated to the base flood level on pilings or columns. A registered engineer or architect must certify that anchorages between the pilings and the floor of the structure are adequate to withstand velocity waters and hurricane wave wash. -Fill may not be used for structural support. -The space below the base flood elevation must be free of obstruction or constructed with "breakaway walls." -Mobile homes may only be placed in existing mobile home parks or mobile home subdivisions. -Man-made alterations of sand dunes are prohibited if they will increase potential flood damage.

Source: McElyea, Brower, Godschalk. 1982. Before the Storm: Managing Development to Reduce Hurricane Damages. University of North Carolina. p. 4-19.

100-year storm surge and 100-year wave crest elevations atop the surge. Recent additions of the wave crest elevation computations means that previously-established BFE's will be elevated. This adjustment then requires updating construction regulations and local insurance premium schedules.

The Federal government has established regulations to back local government action to prevent rebuilding of damaged structures in areas likely to be struck again by hurricanes. Funds are available to move damaged structures, subject to prior agreement between the property owner and the local government. The constructive total loss approach allows FIA to pay the limits of a policy even though actual damages do not equal the total covered by the policy. The community then receives title to the damaged property and must add it to open space use. The owner benefits by receiving funds to rebuild outside the flood zone.

Section 1362 of the National Flood Insurance Act is used to buy and move or demolish larger amounts of flood damaged properties, and to transfer the land as open space to the relevant state or local agency. FIA gains by eliminating further insurance disbursements. The FIA uses community selection factors for determining priorities in fund allocations. Among other items, a community will need to show that permanent removal will contribute to existing, on-going programs and that acquisition will boost multiple community development goals. Communities will be evaluated on the management plan they submit. How will the acquired property mesh with existing land use plans and what new ordinances will be required to implement the plan? Advance planning before a hurricane hits can help the community assess its hazardous areas and target sources of post-disaster funding such as section 1362.

FEDERAL DISASTER ASSISTANCE PROGRAM

The federal government has spent billions of dollars over the years in rebuilding disaster ravaged communities. In most cases, the cities and towns were made no safer than they were before the hurricane. While the largess will undoubtedly continue, the funds are now increasingly conditioned. Money is tied to mitigation work done by local and state governments, and may be contingent on land use, relocation, public acquisition and floodproofing measures.

Federal relief packages come in so many forms and address so many post-disaster problems that integration of programs to obtain mitigation has been difficult. Creation of the Federal Emergency Management Agency in 1978 improved coordination of federal efforts by assigning one agency lead responsibility. Further unification of disparate programs to achieve hazard mitigation goals was accomplished when the primary federal agencies dealing with recovery funds signed an "Interagency Agreement on Nonstructural Damage Reduction Measures as Applied

to Common Flood Disaster Planning and Post-Flood Recovery Practices." Twelve agencies are now involved. The Interagency Agreement recognizes the value of reducing storm damage via nonstructural approaches and the necessity of planning ahead for actions to reduce future damages. Emphasis is put on special opportunities presented in the hurricane's aftermath for making the community safer the next time.

Interagency Hazard Mitigation Teams exist for each of the ten federal regions to coordinate federal response to the needs of a community and to recommend specific mitigation measures for the impacted area. Upon Presidential delcaration of a disaster, the teams join with state and local agents to conduct an on-site survey of the extent and severity of damage. Their report is due within 15 days of the Presidential declaration and must include observations of mitigation opportunities. It also will outline how the assistance available from each agency should be coordinated. The report is purposely issued quickly to provide guidance to federal agencies disbursing funds before long-term recovery decisions are made. A follow-up report is released in 90 days to assess whether or not agencies have followed the prescribed suggestions. The Mitigation Team occupies an advisory role. The Mitigation Report is designed to complement the required long-term Hazard Mitigation Plan of Section 406 of the Federal Disaster Relief Act of 1974.

Section 406 Hazard Mitigation Plan contains regulations (44 CFR 205, M) detailing the cooperative efforts of federal, state, and local governments in evaluating community hazards and in selecting mitigation measures to protect against future hurricanes. Section 406 uses disaster assistance funds to state and local governments to encourage appropriate mitigation action. There is a 180 day time frame after the Presidential declaration for development of a Hazard Mitigation Plan. The Plan, which is submitted to FEMA's Regional Director, has three primary goals:

1) To follow up, in detail, recommendations of the federal/state/local survey and planning teams and the aforementioned Interagency Regional Hazard Mitigation Team;

2) To establish both immediate and long-term planning frameworks for implementation of hazard mitigation efforts; and

3) To recommend hazard mitigation alternatives for local, state and federal agencies.

The joint federal/state/local survey team, like the Interagency Hazard Mitigation Team before it, identifies hazards and recommends specific hazard mitigation measures. The survey team submits recommendations to the FEMA Regional Director and to the Governor's Authorized Representative. The report is also included in an analysis of state and local hazard mitigation plans and programs by the joint federal/state/local planning

team. Like the survey team, the planning team is appointed by the FEMA Regional Director, the Governor's Representative and local officials. The planning team actually writes the Section 406 Hazard Mitigation Plan. FEMA can then enforce mitigation measures by prescribing land use regulations, construction standards, or outright denial of reconstruction funds.

The community which has already devised mitigation strategies has more control over its recovery process than the community which must simply accept the dictates of state and FEMA officials. By preparing a plan in advance, local officials can be certain that they have a thorough response to the mitigation problem in their city. Further, they may be able to leave other goals of the Comprehensive Plan intact, even while responding to the need for hurricane mitigation. By tackling the mitigation issue during a non-crisis period, the community has time to overcome the almost certain political objections to land redevelopment.

Federal Disaster Assistance Program

The Federal Disaster Assistance Program was initially established by the Disaster Relief Act (1974). The Disaster Assistance Program outlines the policies of FEMA and discusses the procedures for requesting FEMA grants. Also covered is administration of disaster grants when awarded. Disaster grants may be awarded to state and local governments and certain private nonprofit organizations. Updated program reports should be obtained from FEMA annually.

After the Governor of the state has declared a disaster area or an emergency and requested federal aid, the President can direct FEMA to administer Federal disaster assistance. The magnitude and severity of the destruction must warrant Federal assistance.

The type of help offered to individuals or families usually falls under one or more of the following:

(1) temporary housing;

(2) disaster loans;

(3) Federal income tax assistance in claiming casualty losses;

(4) legal services;

(5) consumer aid;

(6) disaster unemployment benefits;

(7) crisis counseling; and

(8) individual and family grants.

If payments have been received from insurance coverage that person or organization is not eligible for Federal Government assistance.

FEMA guidelines provide that assistance can be given for immediate emergency assistance in debris removal, and for measures immediately necessary to save lives, protect public health and safety, or to protect property. Short term local government planning should include guidelines to cope with the following issues which arise during and immediately following the hurricane alert and are eligible for FEMA assistance:

-- search and rescue;

-- reduce public hazards;

-- emergency communications;

-- emergency transportation;

-- emergency shelter, feeding and medical assistance;

-- temporary housing; and

-- emergency repairs to water, sewer, electric, gas and debris collection.

If the President declares the area a major disaster, longer-term assistance to storm victims becomes available, and usually includes:

-- those whose homes are uninhabitable may be located in temporary housing;

-- essential repairs to homes so occupants can return;

-- temporary assistance with mortgage or rental payments for persons faced with loss of their residences because of disaster-caused financial hardship;

-- unemployment assistance;

-- up to $5,000 to pay for necessary expenses or serious needs for those unable to pay expenses not covered by other programs or means;

-- legal services for low-income families and individuals;

-- crisis counseling;

-- loans to individuals, businesses, and farmers for repair, rehabilitation or replacement of damaged real and personal property;

-- agricultural assistance;

-- social security assistance;

-- veteran's assistance -- adjustments;

-- tax relief/casualty losses from IRS; and

-- waiver of penalty for early withdrawal of funds from certain time deposits.

(Program Guide, Disaster Assistance Programs. DR&R-18, FEMA, May 1983).

FEMA Assistance to State and Local Governments

Federal agencies that can provide disaster assistance coordinated through FEMA oversight once the President has declared a major disaster, are:

1. Small Business Administration (SBAB), business loans;

2. Small Business Administration (SBAH), home loans;

3. Farmers Home Administration (FMHA), Department of Agriculture, emergency loans;

4. Emergency Conservation Program (ECP) -- Farmland cleared of fallen trees and damaged fences replaced to rehabilitate cropland to productive use. Agricultural Stabilization and Conservation Service can cost share in this effort;

5. Disaster Unemployment Assistance (DUA);

6. Emergency Food Stamps (EFS), Department of Agriculture;

7. Federal Insurance Administration (FIA), flood insurance;

8. Individual Family grants (IFG), pensions and security; and

9. Corps of Engineers (COE).

Regional Directors will accept applications for assistance within 90 days of a major disaster or 30 days of an emergency. Applications for assistance may propose:

-- clearance of debris, when in the public interest, on public or private land;

-- emergency protective measures for the preservation of life and property;

-- repair or replacement of roads, streets, bridges;

-- repair or replacement of water control facilities (dikes, levees, irrigation works, and drainage facilities);

-- repair or replacement of public buildings and related equipment;

-- repair or replacement of public utilities;

-- repair or restoration of public facilities damaged while under construction;

-- repair or restoration of recreational facilities and parks; and

-- repair or replacement of private nonprofit educational, utility, emergency, medical, and custodial care facilities.

Reimbursement of hurricane disaster costs by FEMA to local governments must be carefully documented with contracts and detailed billings from businesses providing the services. The municipal agent responsible for disbursing local funds for hurricane disaster work must be familiar with FEMA requirements and use approved FEMA forms for recording expenditures.

Temporary Housing Program

One of the major problems which will confront local communities is the housing of people whose homes are destroyed or badly damaged. FEMA programs to cope with this problem are:

1. transient accommodations;

2. government owned housing;

3. private rental; and

4. mobile homes.

If the first three options cannot accommodate those requiring housing the fourth option is to truck-in mobile homes from prepositioned sites under FEMA administration. FEMA will also assist homeowner repairs under their Limited Home Repair Program. Local government officials must cooperate with FEMA by designating sites for temporary housing, providing services, and generally fitting the program into the community. (See Scenario on following page.)

Emergency Housing Planning -- A Scenario

In preparing the post-hurricane plan, the County planning staff considered the problem of temporary housing for those driven from their homes by water or wind damage. Using hazard mapping data previously developed, the staff arrived at an estimate of the minimum and maximum numbers of people requiring housing and an estimate of the number likely to require subsidized housing or replacement housing.

Coordination with local real estate groups resulted in a memorandum exchange in which the real estate board agreed to prepare as quickly as possible after any hurricane a list of local apartment units with vacancies. The County would display or issue this list to all applicants for housing assistance. Using normal vacancy rates and some assumptions about ability to pay, the staff then refined its estimate of the number of people and family units still requiring housing.

Temporary housing is one of the standard forms of assistance offered by FEMA, when a Presidential Declaration is issued under PL 93-288. However, the local community must supply the site(s) and the necessary services (utilities, roads, etc.) on site. This has caused problems in the past. Wichita Falls, Texas, had an ordinance which prohibited mobile homes in the city. When one of the worst "tornado swarms" in U.S. history devastated a large part of the city FEMA could not bring in its housing because of the ordinance. The city rushed through a change in the ordinance--with the result that mobile homes were allowed virtually anywhere in the city and have considerably altered the character of many areas. In other cases, various emergency infrastructure measures have been expensive and often unsatisfactory.

After examining County land use plans and resources, the staff identified several potential sites and prepared brief estimates of fiscal and other effects for each site. The County Commission decided that one particular site best fit the staff's estimates, the County's budget and land use plan, and FEMA's requirements and recommendations. This preferred site was in an area designated for light and medium industrial development, County land intended as an industrial park. Infrastructure for the mobile home site could be added to planned development at minimal incremental cost. Further, location of a potential labor pool close to an intended industrial site made sense in terms of transportation as well. The Commission decided to designate and prepare this large single site and to place remaining sites on a special inventory list, in case of need. A work plan was developed by staff, including assignment of responsibility for site survey and preparation in the immediate post-storm period. The entire package was then reduced to a form suitable for public presentation as part of the overall mitigation plan.

Damage Survey Reports (DSR's)

This responsibility usually is delegated to the Corps of Engineers and state officials who are experienced in damage estimations of public buildings and facilities. These estimations are used to determine the funds required by governments to repair or rebuild damaged structures, and are essential in applying for Federal and State aid.

Hurricane Frederic figures (Hurricane Frederic: Post-Disaster Report, 1980) show the following types of damage survey reports filed and amounts funded just for Alabama:

DSR	Number Approved	Amount (dollars)
(1) debris clearance	566	$15,600,000
(2) protective measures	276	3,200,000
(3) road systems	117	2,800,000
(4) water control facilities	6	35,000
(5) public buildings & equipment	676	14,400,000
(6) public utilities	191	3,800,000
(7) facilities under construction	6	71,000
(8) private, non-profit facilities	73	3,800,000
(9) other	243	5,100,000
	2154	49,114,000

Preparation of hurricane loss contingency studies and annual updates would shorten the time required for the survey and give local government some assurance that local concerns are not overlooked. The loss studies will also give government an idea of the fiscal impact possible from a hurricane and allow realistic fiscal planning for that contingency. A loss study requires several months to perform and must be done before a hurricane. The basic outline of such a study is outlined in the following six steps.

The first step of a hurricane loss/mitigation study is to review FEMA maps, SPLASH or SLOSH maps, and other data to locate property in hazardous areas. In addition, Coastal Construction Control Line photographs and USGS maps 1:24,000 should be viewed to provide a complete analysis of coastal areas that may be subjected to hurricane surge and flooding.

The second step is to overlay the hazardous areas onto a local area map with streets and property identified by house number. As part of this effort property is identified as residential, industrial, commercial, local government, state or federal jurisdiction. Other categories of land use which should be identified are agricultural, conservation/recreation, vacant and public utilities and easements.

The third step is to place a value on the property in the hazardous areas. The most current prices for structure replacement and grading should be used. FEMA has predicted water heights for category 1-5 hurricanes. Water damage to residential structures can be estimated based on water depth. The "depth-damage curve" (West Florida Hurricane Loss and Contingency Planning Study, 1985) indicates percentage of total value lost per each foot of water rise. This figure when multiplied with the total value of the structure yields the loss in dollars. In addition to the water level loss curves, water battering curves have been fomulated as well as wind damage curves (see above).

The fourth step is to estimate the extent and duration of unemployment, to provide estimates of potential unemployment support required and social services that may be needed.

The fifth step is to calculate how many temporary housing units will be required and for how long a period of time. Location of the temporary housing should be carefully programmed and situated to facilitate family and individual recovery from their losses.

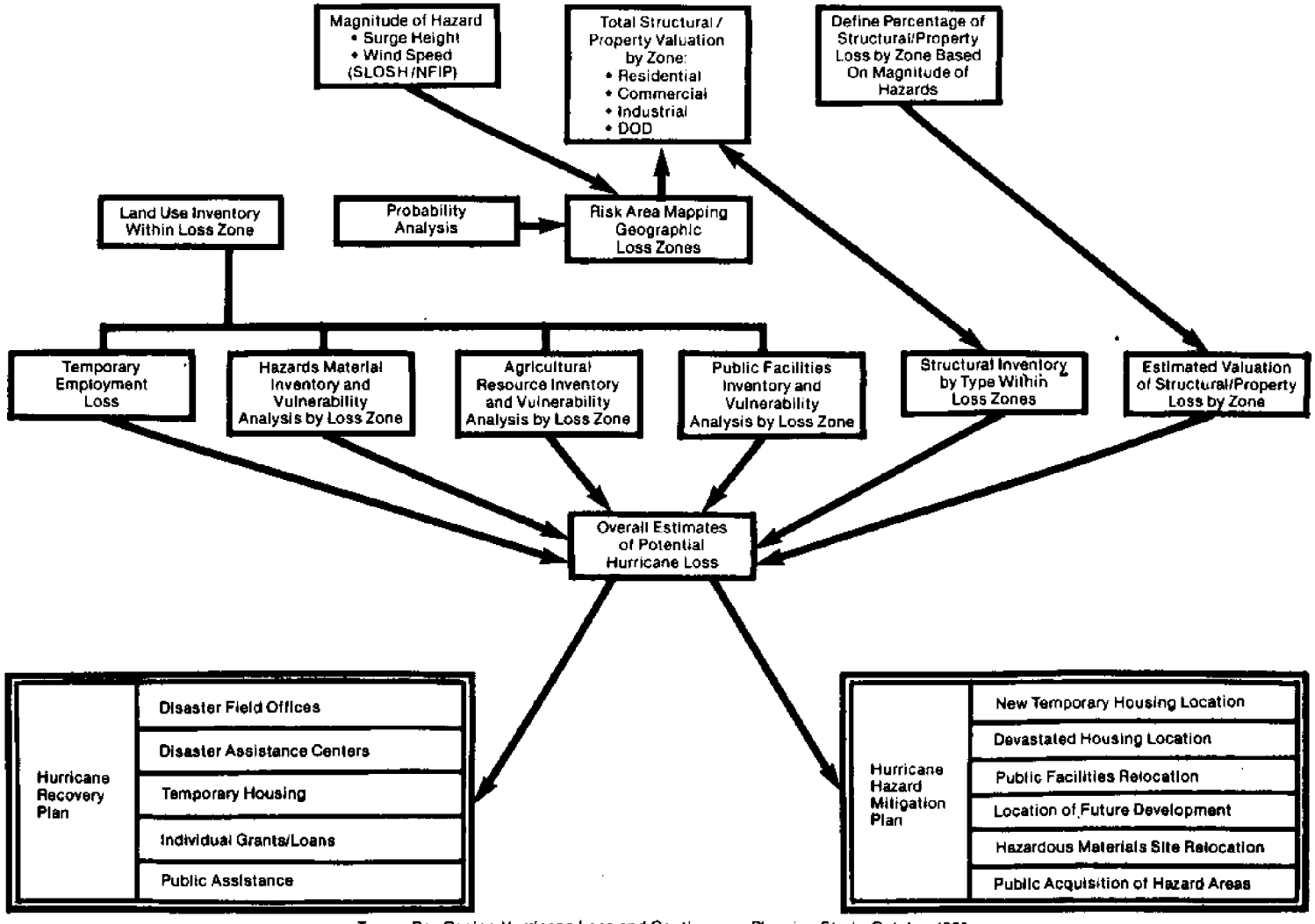
The sixth step is to estimate farm crop loss and financial assistance that may be required. Crop harvest times are correlated with the forecasted hurricane vulnerability period. A crop that is planted yearly is a serious loss but not when compared to mature orchards which may take 6-8 years to replace and produce yields.

The six steps listed can be used to produce an overall loss estimation for a potential hurricane. Florida's Division of Emergency Management has recently sponsored a series of regional hurricane loss studies for the State. Information from these studies can be utilized, if available, by local governments. (Figure 4-4).

Public Facilities and Infrastructure

The most obvious planning action, for implementation even before a hurricane strikes, would be to not invest public funds in construction or rehabilitation of any public facility in these susceptible areas. Schools, administrative buildings, police and fire facilities in hazard areas should not be improved but permitted to function in a gradually diminishing role, as facilities in safer locations are phased in. The one to two year changes in budgeting funds for the new location can be considered intermediate planning. Another important planning factor is the decision not to re-pave roads, build sidewalks, install new or upgraded water and sewer lines which traverse or support hazardous sites. Funds that would have been invested can be diverted to more secure locations not easily damaged or destroyed by hurricanes.

Preplanning for Post-Hurricane Reconstruction



Tampa Bay Region Hurricane Loss and Contingency Planning Study, October 1983.

FIGURE 4–4

Once such decisions are in the planning stage it is imperative to give public notification, hold a public hearing to explain the reasoning for the change. This signals an official planning policy to place both new buyers and those in residence on notice that the municipality views the area as susceptible to hurricane damage, and therefore is a bad investment of tax dollars. The odds that the public investment would be completely destroyed, and the extra cost for reconstruction, makes initial or additional investment questionable at best. Should several hurricanes strike the area over a three to four year period, replacement costs could deplete municipal funds at the expense of sensible and necessary investments elsewhere.

County and state governments should have specific policies restricting expenditure of public funds in areas that are in hurricane water surge zones. Florida state agencies have begun to revise their rules toward this end. Permanent repair or reconstruction of public facilities within this zone should not be undertaken; however, money for temporary repair to protect the safety, health and welfare of the inhabitants would be appropriate. An exception should be made for areas serving to provide public beach access, but here construction should be low cost and easy replacement. County policy for reconstruction in unincorporated areas should be carefully detailed. This means designating buildings which will not be reconstructed, specific roads that will revert to shell fill-in rather than asphalt and public utilities that can be rerouted to safer easements. County and state governments stimulate these actions on the part of local governments by cost sharing, assisting in solution of legal problems and providing benefits to utilities and special districts to begin intermediate/long range planning.

One of the more difficult decisions governmental agencies must grapple with is whether to budget money for a disaster event such as a hurricane. Since the short-term probability appears so low to many citizens and community leaders, money may never be funded for disaster events. However, should a hurricane destroy many public facilities and services there is no ready source of funds to draw on until outside funding assistance can be processed and approved, a period ranging from weeks to months, through cost sharing with State and Federal sources of disaster funds. If a community should suffer a ten million dollar loss it would probably have to raise up to $2.5 million dollars locally in order to receive matching Federal or State money. Can that much be scavenged from the community's current budget--while remembering that local tax revenue will probably drop for a time? If an account exists for post-hurricane use it might not have all that is needed buy any existing funds can be used immediately to start matching state and federal funds into the area. Declaration of an emergency by a designated key official could be an automatic legal trigger for release of these funds for recovery efforts.

FEMA will provide help to eligible governmental and non-profit applicants to repair, restore, reconstruct or replace facilities as they existed prior to the hurricane and in conformance with local building codes and coastal plans. The following list identifies types of permanent work that qualify:

(1) public utilities

(2) water control facilities

(3) facilities under construction

(4) public building and equipment

(5) road or street facilities

(6) private nonprofit facilities

(7) other

Federal grants under FEMA are of two types: categorical grants, which pay for work described in the application, and flexible funding grants, which pay a percentage of the estimated loss for permanent work and allow flexibility in the expenditure. Under federal funding, construction must comply with floodplain management, hazard mitigation, protection of wetlands, environmental assessment and insurance requirements. There are a number of conditions and restrictions on federal funds. For example, FEMA may help buy brooms (considered consumable items) but not shovels (permanent equipment) for debris clean-up. Local governments should probably not try to fathom such complexities, but could enlist the aid of experienced state staff for review of local funding plans. This could help reduce false expectations, avoid delays in plan implementation, and hold down on intergovernmental friction during a tension-ridden time.

Acquiring Coastal Property

A complex and often controversial issue is the value of property after the hurricane. Coastal property valued at $300,000 for a lot 200' x 200' but reduced to 200' by 75' by erosion might be reappraised at a far lower figure. Setback lines or control lines designated by the state or county landward of the mean high water mark, plus street-side restrictions due to right-of-way setbacks, may constrict the buildable zone to a very narrow segment or preclude building entirely. What can be done when the hurricane destroys the structure and the narrow width of the eroded lot will not permit a new structure to be built?

The municipality may acquire the property through various means. In order to buy the damaged property (at a reduced price), the municipality needs a funded account to complete the purchase transaction in a timely manner. This may help to

convince the homeowner to sell by providing "up front" money to relocate, perhaps as a down payment on a new home. Simplifying the homeowner's financial position in a time of great anxiety and frustration can be a convincing factor in the decision to sell or not to sell. This decision should be further eased if the homeowner knows in advance that the municipality might buy his property if the home is destroyed or erosion decreases the property, precluding rebuilding.

Coastal Barriers--Executive Order 81-105

Of all coastal areas, it is coastal barriers that are exposed to hurricane surge impact, and most important, act as "shock absorbers" for the land behind them. They are also most attractive to development. The Governor's Executive Order 81-105 focuses on coastal barriers and their vulnerability to hurricane damage while directing Florida's three major agencies to review growth development, mitigation, and evacuation issues. Further definition of the executive order and mapping efforts are being developed. The main issue is growth management on barrier islands. Growth is perhaps acceptable provided that:

* The area has excessive infrastructure capacity (i.e., roads, sewer, water);

* It will not increase evacuation times of threatened coastal regions beyond the 12-hour warning period (provided by the National Hurricane Center) for a worst-probable hurricane;

* Development can occur if the risk is minimal, understood as "absence of a reasonable need to evacuate during the approach of a worst-probable hurricane and the ability of the public property to withstand damage by a 100-year storm event;" and

* Development should be consistent with hazard mitigation standards--should not increase evacuation times beyond the 12-hour warning threshold or increase unreasonably the potential property loss that would be inflicted by a 100-year storm.

The Governor's Executive Order, in part, is reproduced below:

WHEREAS, it is the policy of the State of Florida to protect and manage Florida's extensive, fragile coastal resources, in order to enhance the recreational, scientific, economic and natural resource values, for both present and future Floridians; and

WHEREAS, these coastal barriers serve to reduce Florida's extensive vulnerability to natural hazards, particularly hurricanes, thereby reducing the ever-present threat to human life, private and public property, and other resources in the coastal areas; and

WHEREAS, these coastal barriers are vulnerable to hurricanes, other storm damage and geologic composition, and are continuously altered by wave, tidal, and wind actions; and

WHEREAS, these coastal barriers are a source of beauty and enjoyment, in addition to contributing billions of dollars to the State's economy annually; and

WHEREAS, past utilization of coastal barriers often has not taken place in a manner consistent with public safety and economic welfare; and

WHEREAS, certain State actions, programs, and funding policies have historically subsidized and encouraged development on coastal barriers resulting in a loss of barrier resources, increased vulnerability of human life, health, and property and the recurring obligation of tax dollars; and

WHEREAS, the Florida Legislature, the Governor, the Cabinet, and various state agencies have recognized the importance of protecting these critical coastal areas and sought to manage these resources in a manner consistent with the principles of public safety, economic development, and resource management.

In order to implement the Governor's Executive Order state agencies--DER, DNR, DCA--are directed to develop long range plans which:

1. Give coastal barriers, which include barrier islands, beaches and related lands, high consideration in existing state land acquisition programs and priority in the development of future acquisition programs.

2. Direct state funds and federal grants for coastal barrier projects only in those coastal areas which can accommodate growth, where there is need and desire for economic development, or where potential danger to human life and property from natural hazards is minimal. Such funds shall not be used to subsidize growth or post disaster redevelopment in hazardous coastal barrier areas. Specific consideration shall be given to the impacts of proposed development or redevelopment with respect to hazard mitigation.

3. Encourage, in cooperation with local governments, appropriate growth management so that population and property in coastal barrier areas are consistent with evacuation capabilities and hazard mitigation standards.

State Government

Hurricane hazard mitigation for coastal states usually is focused on three main goals. As stated in the Florida Peacetime Emergency Plan, they are:

1. protection of life and property through the reduction or avoidance of unnecessary and uneconomical uses of hazardous areas;

2. preservation and enhancement of beneficial uses of hazard-prone areas; and

3. protection of natural systems that serve a hazard moderating or mitigation function.

Chapter 252, F.S., authorizes the State of Florida to cope with natural disasters such as hurricanes. The primary state agency charged with the responsibility of developing programs focused on hazard mitigation is the Division of Emergency Management in the Department of Community Affairs. The long-range goals of other state agencies are reviewed in regard to guiding development away from hurricane hazardous areas and insuring they are consistent with existing policies. The Division, working with the Interagency Management Committee (IMC), coordinates hazard mitigation policy. The IMC has representatives from the major state agencies whose jurisdiction covers the coastal areas or activities within the area. Inputs from local, regional and county agencies are received through the Interagency Advisory Committee to the IMC. The IMC views hazard mitigation from three perspectives: (1) issues and policy development, (2) on-going hazard mitigation activities, and (3) site-specific hazard mitigation studies (State of Florida, Peacetime Emergency Plan, Annex B-xxvi-5).

There is a similar sharing of power between state and local governments in Florida. A portion of Florida's approved coastal zone program is represented by the Local Government Comprehensive Planning Act (Chapter 163), which requires every coastal community to have a coastal zone element in its comprehensive plan (163.3177 s6). This gives local governments direct influence over federal activities, since the local comprehensive plan becomes part of the state's coastal management plan. Hurricane mitigation plans, as part of the comprehensive plan, thus affect federal licensing, permitting and assistance activities.

The State of Florida has passed legislation dealing with land use and growth management. Some of these laws address the matter of hurricane mitigation directly while others have the effect of assuring prudent development in hurricane hazard areas. The legal tools are available to the community or county governments which anticipate problems to plan mitigation and recovery strategies. Strong leadership is necessary to formulate a plan that will be supported in the private sector. The following sections provide thumbnail sketches of relevant Florida Statutes.

State Emergency Management Act (Chapter 252)

This title addresses emergency mitigation directly. The act was passed "in order to insure that preparations of this state will be adequate to deal with, reduce vulnerability to, and recover from...natural disasters." The state's emergency management agency is known as the Division of Emergency Management. The division works in conjunction with other "appropriate state agencies...to keep land use and construction of structures and other facilities under continuing study and identify areas which are particularly susceptible to... flood or other catastrophic occurrence..." Additionally, if the division subsequently feels that building standards and land use controls are inadequate in a given area, it will recommend changes to the governor. The governor reviews the suggestions and can, after accepting public input, recommend changes be implemented by the proper jurisdictional agency.

Local officials obviously need not wait for state officials to invoke Chapter 252. It is locals who can most readily identify potential hazards in their area. The provisions of the Emergency Management Act allow local administrators to gain assistance from allies in state executive agencies. Open dialogue with relevant agencies should begin as soon as community leaders decide to pursue hurricane mitigation strategies.

The Beach and Shore Preservation Act

With Chapter 161, the State of Florida has acted forcefully to protect the physical coastline from ill-considered development. Coastal construction is regulated to enhance "erosion control." The Act states that "erosion control includes, but is not limited to, erosion control, hurricane protection, coastal flood control, shoreline and offshore rehabilitation, and regulation of work and activities likely to affect the physical condition of the beach or shore." The Legislature has expressly recognized that the coastal dunes act as a barrier against storm surge and therefore should be protected.

The heart of Chapter 161 regulations is the establishment of a county-by-county Coastal Construction Control Line (CCCL). Construction may not occur seaward of this line without meeting strict special requirements established through a permit from the Department of Natural Resources. The regulations exist to insure that the beach-dune system, any proposed structure, and adjacent properties are protected from, among other things, the hurricane surge.

Local participation during the permitting process occurs in several ways. County or municipal governments must notify DNR within 5 days after receipt of a request for a construction permit proposing activities inside the CCCL. Local officials also have 5 days to notify the applicant of the provisions of state law for coastal construction. The Division of Beaches and

Shores in DNR reviews the application and recommends either approval or denial of the permit. There is a period for review and comment by affected parties. Local officials may comment on issuance of the permit both at this hearing and at a final permit hearing before the Governor and Cabinet. Finally, local authorities can aid state authorities in enforcing CCCL regulations by contributing to the manpower with local building inspectors.

Conservation and Recreation Lands Trust Fund

The State of Florida, pursuant to Chapter 253, has declared that a mineral severance tax will serve as a revenue source for the Conservation and Recreation Lands Trust Fund. The stated purpose of this fund is to assure "the availability of public lands on which to recreate." Statutory guidelines also emphasize acquisition of environmentally sensitive and flood prone lands throughout the state.

Local leaders should be aware that there is a significant time lag involved in state acquisition of sensitive land. Proposed projects must be accepted and placed on a prioritized acquisition list by a committee of six members, composed of relevant agency and bureau heads. The Governor and his Cabinet, acting in their capacities as the Board of Trustees of the Internal Improvement Trust Fund, have actual power to release funds and claim title to land. Obviously, it will require political influence to have a flood prone area purchased by the state. Further, the land must serve another purpose such as conservation in order to make the Trust Fund List.

The Florida Environmental Land and Water Management Act of 1972

Chapter 380 of the Florida Statutes requires a comprehensive impact assessment and review when a project is designated a "development of regional impact (DRI)." These projects, because of their "character, magnitude, or location, would have a substantial effect upon the health, safety, or general welfare of citizens of more than one county." The DRI process identifies impacts the development will have on the area, including drainage. The Act states that, in considering whether the development shall be approved, denied, or approved subject to conditions, the local government shall consider whether:

1. the development is consistent with the local land development regulations; and

2. the development is consistent with the required report and recommendations of the regional planning agency.

Local governments must maintain integrity of their hurricane mitigation plans in the face of the multiple concerns presented by large developments. State agencies can assist in this task.

Water Quality Legislation

The Florida Water Resources Act gives as one of its basic policy provisions 373.016(2) (d) the prevention of "damage from floods, soil erosion, and excessive drainage." Both this water management legislation and water quality legislation (Chapter 403) are functionally under the auspices of the Department of Environmental Regulation (DER). The effect of permits required under these laws is to regulate construction and pollution activities. For both new and upgraded construction, local government should request DER to incorporate mitigation goals into permitting processes. Time taken to insure that drainage and sewer systems are safe from washout will be well spent if future replacement costs are avoided.

It is possible for local governments to take over some administrative responsibilities of Chapter 373 from the state. Sections 373.026 and 373.046 provide for interlocal agreements between DER and other government agencies. To qualify, local governments must show that they are "conducting programs related to or materially affecting the water resources of the state." Even if DER does not relinquish total control to a local body, they will "conduct, independently or in cooperation with other agencies, topographic surveys, research, and investigations into all aspects of water use and water quality." The state thus encourages local entities to take control over and manage water resources. Mitigating hazards posed by the ocean's destructive forces qualifies as resource management.

Clearly, the Florida legislature has provided the legal means for local governments to make their communities safer from hurricane damages. Local officials need ingenuity to utilize the right combination of laws in erecting a legal framework appropriate to local circumstances.

FIGURE 4-5
CRITERIA FOR EVALUATING MITIGATION STRATEGIES

Criteria	Strategy-Related Questions
1. Equity	Do those responsible for creating the hazard pay for its reduction? Where there is no man-made cause, is the cost of response fairly distributed?
2. Timing	Will the beneficial effects of this strategy be quickly realized?
3. Leverage	Will the application of this strategy lead to further risk reducing actions by others?
4. Cost to government	Is this strategy the most cost effective or could the same results be achieved more cheaply by other means?
5. Administrative efficiency	Can it be easily administered or will its application be neglected because of difficulty of administration or lack of expertise?
6. Continuity of effects	Will the effects of the application of this strategy be continuous or merely short term?
7. Compatibility	How compatible is the strategy with others that may be adopted?
8. Jurisdictional authority	Does this level of government have the legislated authority to apply this strategy? If not, can higher levels be encouraged to do so?
9. Effects on the economy	What will be the economic impacts of this strategy?
10. Effects on the environment	What will be the environmental impacts of this strategy?
11. Hazard creation	Will this strategy itself introduce new risks?

12. Hazard reduction potential	What proportion of the losses due to this hazard will this strategy prevent? Will it allow the safety goal to be reached?
13. Public and pressure group reaction	Are there likely to be adverse reactions to implementation?
14. Individual freedom	Does the strategy deny basic rights?

From: Disaster Planning - The Preservation of Life and Property. Harold Foster, 1980.

References

A Process for Community Flood Plain Management. November 1979. U.S. Department of the Interior, Office of Water Research and Technology, Planning Manual OWRT TT/79 9. Washington, D.C.

Anderson, James E., D. W. Brady, and C. Bullock, III. 1978. Public Policy Politics in America. Duxbury Press, North Scituate, Mass.

Baker, Earl J. (ed.) April 1980. Hurricanes and Coastal Storms. Florida Sea Grant College, Report No. 33.

Cross, John A. 1983. Hurricane Hazards: Perceptions of New Homeowners. In: Proceeding of the 38th Annual Meeting of the Southeastern Division of the Association of American Geographers. Orlando, Florida.

Crouch, Edward, and Richard Wilson. 1982. Risk/Benefit Analysis. Ballinger Publishing, Cambridge, Mass.

Design and Construction Manual for Residential Buildings in Coastal High Hazard Areas. January 1981. U.S. Dept. of Housing and Urban Development, Office of Policy Development and Research, a report prepared for Federal Insurance Administration, FEMA.

Division of Local Resource Management. 1981. Flood Plain Management in Florida, Volume 2. Florida Department of Community Affairs, Tallahassee, FL.

Division of Public Safety Planning and Assistance. 1980. Post-Disaster Hazard Mitigation Study for Disaster Declarations 586 and 607. Florida Department of Community Affairs, Tallahassee, FL.

Division of Public Safety Planning and Assistance. 1980. Hurricane Hazard Mitigation at the Local Government Level. Florida Department of Community Affairs, Tallahassee, FL.

Federal Emergency Management Agency. October, 1984. Perspectives on Hurricane Preparedness--Techniques in Use Today. Washington, D.C.

Federal Disaster Assistance Program. August 1981. Documenting Disaster Damage Pursuant to Public Law93-288. FEMA, DR&R7, pp. 25.

FEMA Federal Flood Insurance Program. "Procedure for Calculating Wave Height Adjustment."

Flood Plain Management in Florida, Vol. 2: Appendices.

September 1981. Florida Dept. of Veteran and Community Affairs, Division of Local Resource Management, Tallahassee, FL.

Floodplain Management and Protection of Wetlands. Federal Register/Vol. 46, No. 204, Thursday, October 22, 1981/Rules and Regulations, FEMA, 44 CFR Part 9, pp. 51749-51753.

Foster, Harold. 1980. Disaster Planning - The Preservation of Life and Property.

Hershman, Marc J. 1981. Coastal Management: Readings and Notes--2nd Edition. Institute for Marine Studies, University of Washington, Seattle, WA.

Hurricane Frederic: Post Disaster Report. 1980. U.S. Army Corps of Engineers, Mobile District.

Hurricane Survey of Northwest Florida Coast. July 11, 1966. A report for Committee on Public Works, House document No. 459, 89th Congress, 2nd Session.

Kasper, Raphael G. 1980. Perceptions of Risk and Their Effects on Decision Making. In: Societal Risk Assessment: How Safe is Safe Enough? (Schwing and Albers, Jr., editors). Plenum Press, New York, NY.

Kessler, C. W. 1984. Monographs, Memorandums and Other Materials Prepared for the Select Committee on Growth Management--1983 and 1984 Sessions. Florida House of Representatives, Tallahassee, FL.

Kunreuther, Howard, et al. 1978. An Interactive Modeling System for Disaster Policy Analysis. Institute of Behavorial Science, University of Colorado.

Kunreuther, Howard. 1978. Disaster Insurance Protection Public Policy Lessons. New York: Wiley.

Kusler, Jon A. 1980. Regulating Sensitive Lands. Environmental Law Institute, Washington, D.C.

McElyea, W. D., D. J. Brower, and D. R. Godschalk. 1982. Before the Storm: Managing Development to Reduce Hurricane Damages. Center for Urban and Regional Studies, University of North Carolina, Chapel Hill, N.C.

Neumann, Charles, George Cry, Eduardo Caso, and Brian Jarvinen. July 1981. Tropical Cyclones of the North Atlantic Ocean, 1871-1980. NOAA, National Weather Service, Environmental Data and Information Service, Environmental Research Laboratories, Asheville, N.C., 174 pp.

Perspectives on Hurricane Preparedness: Techniques in Use Today. October 1984. FEMA.

Post Disaster Hazard Mitigation Study for Hurricane Frederic (Draft). May 1981. Florida DCA, Division of Public Safety Planning and Assistance and Division of Local Resource Management.

Quarantelli, E. L. 1983. Emergent Citizen Groups in Disaster Preparedness and Recovery Activities: An Interim Report. Ohio: The State University Press.

Rettig, B. R. 1974. Aspects of Conflicts Over Land Use in the Coastal Zone. Coastal Zone Management Journal 1: 305-340.

Rosenthal, J. C. 1980. Post-disaster Reconstruction Planning: Opportunity for Hazard Mitigation? In: Hurricanes and Coastal Storms (Earl J. Baker, editor), Report Number 33, State University System of Florida, Sea Grant Program.

Rossi, P. H., J. D. Wright, and E. Weber-Burdin. 1982. Natural Hazards and Public Choice: The State and Local Politics of Hazard Mitigation. Academic Press, New York, NY.

Slovic, Paul, Baruch Fischoff, and Sarah Fichtenotein. 1980. Facts and Fears: Understanding Perceived Risk. In: Societal Risk Assessment: How Safe is Safe Enough? (Schwing and Albers, Jr., editors). Plunum Press, New York, NY.

Southwest Florida Regional Planning Council. 1981. Regional Hurricane Evacuation Plan. Ft. Myers, FL.

Starling, Grover. 1979. The Politics and Economics of Public Policy: An Introductory Analysis with Cases. Dorsey Press, Homewood, Illinois.

State of Florida. 1981. Florida Coastal Management Progjram. Florida Department of Environmental Regulation, Tallahassee, FL.

Tampa Bay Regional Planning Council. 1983. Tampa Bay Region Hurricane Loss and Contingency Planning Study. St. Petersburg, FL.

Tools for the Non-Structural Management of the Flood Plains. November 1981. Florida Department of Veteran and Community Affairs, Division of Local Resource Management, Tallahassee, FL.

Vasu, Michael Lee. 1979. Politics and Planning--A National Study of Hurricane Planners. UNC Press, Chapel Hill, N.C.

CHAPTER 5

FINANCIAL AND LAND USE TECHNIQUES

INTRODUCTION

To mitigate many kinds of hurricane impacts government must be able to control certain uses of land. Sometimes this can be accomplished by such familiar techniques as zoning and regulation, adapted for mitigation purposes. Government may also develop certain types of ownership rights in important land areas, up to and including outright fee simple purchase. Obtaining ownership rights can sometimes be done without money changing hands, but often rights must be purchased. This can sometimes be done by "tax expenditures," which may be functionally defined for our purposes as legal provisions which reduce, postpone or abolish tax collections on property or property use in return for the owner's agreement to accept certain restrictions or requirements on his use of the property. To government, taxes not collected are an expense to the treasury as surely as though the tax had been collected and then spent; to the property owner, taxes which need not be paid are a form of income. However, there are conditions under which both parties may find "tax expenditures" a preferred way to finance property rights acquisition.

If ownership rights must be acquired by actual money outlay, there are a number of possible sources from which local government may raise funds. One method explored in this chapter is use of special districts for taxing and services. Another is tapping of state or federal funding sources, of which many exist.

Ability to raise money for hurricane mitigation is important for two reasons peculiar to hurricane-related disasters. First, hurricanes typically cause their greatest damage on exposed coastlines and bays: precisely the property so highly in demand for residential, commercial resort, and recreational use. When property values run several thousand dollars per front foot, as they do on the beach, property acquisition can drain local funds rapidly. Second, hurricane-related destruction cannot be predicted for any given time, and may not occur for years--but may be massive when it occurs and thus place on the local governments overwhelming demands for funding. It is important to recognize that although State and/or Federal disaster aid funds may be provided, it is always necessary that the local government bear large "up front" costs. Some immediate Federal aid may be available, but much is given on the basis of reimbursement for funds already expended--and the lag between expenditure and reimbursement is measured in months or even years.

This chapter describes briefly a number of methods by which local government may control land use and others by which the land may be acquired as public property. In addition, since

speedy action can shorten the reconstruction period to the benefit of both the private economy and government tax collections, several suggestions are made for preparation of measures which, either in effect already or on a stand-by basis for implementation after the storm, could speed recovery.

ZONING

The purpose of zoning as a tool for hurricane mitigation is to insure that irresponsible development in coastal high hazard areas is kept to a minimum. It is particularly useful because it allows some degree of control of the density and type of development, and it is relatively inexpensive when contrasted with fee-simple acquisition. Zoning in coastal regions requires special considerations. The tremendous development pressure makes traditional zoning approaches too difficult in some cases. Mixed zones, overlay zones, and PUD's offer a more flexible approach to zoning for developers and land-use planners. In Florida two basic methods of zoning seem to be used frequently: floodplain or flood prevention zones, and overlay zoning.

Floodplain or Waterfront Zones

Many coastal communities have included special waterfront zones as part of already existing zoning ordinances. This approach requires minimal legal revision to the standard zoning ordinance, but can focus special attention on coastal areas. The purpose of such a zone is to protect shoreline areas from increased storm hazard due to overdevelopment in areas susceptible to storm or hurricane damage.

Overlay Zones

An overlay zone is not a fixed zoning ordinance, but a flexible zone which may float over a community and can be put in place when and where it is deemed necessary. Special circumstances, such as a hurricane or another type of natural disaster, could trigger the initiation of a floating zone. Regulations for height, density, setbacks, and bulk can be effectively worked out in advance and then put in place when they are needed. Overlay zones are usually implemented for a short period of time, as interim devices that can be used until a local community is able to work out a revision to the zoning ordinance. This provides an advantage over a moratorium because the local government is able to test in advance if a zoning ordinance would be effective by using an interim floating zone. The overlay zone could also be used as a guideline for a permanent zone to come later. Overlay zones can also be used as a means of controlling runaway growth in areas where the population is exceeding the evacuation capability.

Collier County in Florida has adopted a special treatment zoning overlay ordinance that applies to sensitive areas, such as

wetlands and mangroves. All building plans within restricted areas must be reviewed individually. This ordinance also has a transfer of development rights clause (See Transfer of Development Rights).

Incentive Zoning

Incentive zoning is an alternative to conventional zoning. One of the most common forms of incentive zoning is "bonus zoning." In bonus zoning increased densities or increased floor space is usually given by the municipality in exchange for some type of public benefit from the developer. This method is often used for establishing beach access, dune walkovers and open space for such hazard mitigation purposes as protection of dune lines. Prince George County, Maryland has used this technique for many years as a means of managing growth. Gulf Shores, Alabama adopted (1984) a bonus zoning ordinance designed to encourage developers to locate structures farther from the surf. The public benefits to be gained and private incentives provided must be clearly established in the zoning ordinance. Listed below are some of the more common types of benefits and incentives.

Public Benefits	Incentives
Preservation of primary dune line for storm protection	Increased floor area or ratio of building capacity to lot size if located behind the dune line
Establishment of dune walkovers to reduce dune trampling	Increased residential units per acre
Increased open space along the shoreline for aesthetic and public use benefits	Street improvements, unit size, additional use types
Flood resistant structures to decrease storm damage	Favorable tax evaluations

Mixed Use Zoning

Mixed use zoning allows for more efficient land use because several different types of land use can be incorporated into one zone. The typical approach to zoning is to zone an area for only one type of use. In a mixed use zone multi-unit residential structures could be classified with single unit residential structures to form one district, instead of having two distinct classifications. Such an ordinance could combine setback limitations with density limits to achieve a clustering effect on beachfront property. This would be a very effective means of

preserving the beach and dune lines for storm hazard mitigation. In addition this clustering technique reduces the "walling-off" effect on the beach, opening vistas, increasing access and providing native landscaping large natural areas in which to grow. The natural vegetation builds up the dune system, thus protecting both public and private investments.

SUBDIVISION REGULATIONS

Subdivision requirements refer to the way land is divided up for development. There are several concepts which are very important for storm hazard mitigation.

Design Requirements

Regional development is sometimes subjected to certain minimal requirements in community design, such as right-of-way, street width, block size, building codes, and setback lines. This can be a valuable tool for community development. What should be examined, however, is whether the design requirements should be altered after a storm has damaged an area. The real issue is whether the community's interest is best served by rebuilding in the same pattern as before the storm. Occurance of storm damage could trigger a shift to a new set of requirements designed to improve resistance to future storm impacts and to improve community quality.

New construction in high hazard areas should be subjected to design regulations which are consistent with the area's status as a hazard risk.

Improvement Requirements

This concept requires a developer to contribute funds to help pay for the increased cost of services the development will impose on the local community. The developer must pay ("impact fees") for the increased demands on drainage, traffic flow, police and fire protection, and other services which are important to mitigation of natural disasters. This technique insures that community services keep abreast of development. If services are already overtaxed this increases the amount of time required for redevelopment after a disaster.

Dedication of Land

Requirements for dedication of roads and easements for utility space have been a customary practice for decades. Dedication of land for the purpose of reducing storm losses is a relatively new concept. Its success will depend largely on judicial review: the courts must determine what constitutes a storm hazard and what does not. Developers will often have the choice of dedicating land or paying a sum of money as an alternative. Land obtained through dedication is often fractured

into miscellaneous small parcels and is difficult to maintain. There is sometimes question over who will maintain the property once it is dedicated for open space. A community should therefore establish standards of acceptability for dedicated land.

Planned Unit Development

This is a mixed development technique that is sometimes described as a cross between zoning and an official map or comprehensive plan. In this concept regulations apply to an entire area rather than individual lots. Planned Unit Development (PUD) offers many flexible approaches to storm hazard mitigation, such as clustering and dedication of open space. PUD's in the past have been largely residential in nature, but there are signs that this trend is beginning to change and many new PUD's have commercial sections. One major drawback of PUD's is that they require a large amount of open space. In the coastal areas of south Florida this type of development may be cost prohibitive.

Transfer of Development Rights

In a Transfer of Development Rights (TDR) scheme an owner can sell his or her property development rights ("points") in exchange for a sum of money. In TDR development plans landowners are often required to have a certain amount of points before they can develop their property. These points are actually acquired property rights. The number of points acquired determines how intensively a property may be developed. Landowners in a TDR area may either attempt to acquire property rights of points or sell their property development rights to someone else. The quantity of land that may be developed in a given TDR area can be controlled by restricting the total amount of development but allowing the composition of the total to vary with the market result.

Allowing the land owner an option to sell his development rights to someone else also defuses the legal claim of "taking," under which government is held to have restricted the owner's property beyond any reasonable use. If the property owner is allowed to sell development rights to his property, it becomes much harder to prove that a "taking" has occurred than would be the case if the property were simply zoned for open space. Local government can also control what type of development occurs by specifying commercial, residential, or other rights instead of general rights. TDRs, like PUDs, also require large amounts of open space in the area for best effect, which may make this method less applicable in some coastal areas of south Florida.

SPECIAL DISTRICTS

Special districts are sub-units within local governments that provide a specialized function within the local government. They are sometimes formed because the area under consideration has special needs which cannot be met by normal local government action. These districts must have clearly defined boundaries. State enabling legislation grants local governments the right to establish special districts. Once established the power to tax within the district is provided.

Special Service Districts

The function of a special service district is to insure that local growth proceeds at a rate at which the local government is able to provide services for the area. In many coastal communities it is very difficult for services to keep abreast of the demand because of rapid rate of growth in many of these areas. Special service districts may be empowered to establish user and impact fees that are different from other regions in the local government's jurisdiction, to insure that the specific demand for services is met. If services such as utilities are already overburdened it is much more difficult to restore utility service to areas that have been damaged by a hurricane. If service facilities are operating with no margin of reserve, any degree of damage to the system may drop it below demand level.

Special Development Districts

This type of special service district has an expanded function over the special service district. These districts also have the power to establish user fees, but in addition they have a broader function which includes planning for community development. These districts usually have greater powers than special service districts, including use of eminent domain, limited taxation powers, and land use controls.

Hurricane Redevelopment District

Florida Statutes, Chapter 161.25-37 allows County Commissioners to function as the governing body for beach and shore Preservation Districts, which the Commission may establish after public hearings. An advisory committee of 3-5 citizens may be appointed for each district. These districts may make cooperative agreements, and implement them, with any Federal, state or other local government agencies, and may receive funds from other agencies. Beach and shore preservation districts may then "do all manner of things necessary or desirable in pursuance of this end," within legal limits. Specifically, a district may exercise eminent domain, otherwise acquire property, and make rules.

It may be possible to adapt these common features of coastal government for the specific purpose of post-hurricane reconstruction. Chapter 161.29 provides that the governing body

shall conduct an economic analysis of the benefits of its shore and beach preservation program, and may allocate those benefits by zone within the district. Hazard analysis could assist in delineation of hurricane high-risk area, and the benefits of a program apportioned as part of the economic analysis.

Once the benefits are apportioned, Chapter 161.37 allows districts to levy ad valorem taxes "in proportion to benefits said property will receive as determined by the most recent economic analysis." This section specifically provides that "special benefits shall be assigned to groups of specific properties which shall constitute zones because of the equal or comparable benefits such included property will receive."

Creation of Hurricane Development Districts as described above would allow the county government to have in place the structure for financing restoration of public services after a storm, or for paying the up-front expenses of special construction and provisions for public services in high risk areas. Property owners in those areas would bear a "fair share" of the public service costs rather than being subsidized by other county residents. The planning process could identify and establish rules to govern the reconstruction of the area, providing further mitigation for future storms.

METHODS OF ACQUISITION

The method used to purchase property is extremely important because it may affect the cost of the property, the speed by which it is purchased, and whether or not the purchase is viewed favorably by the public. Below are listed several techniques for land acquisition. Although these techniques are listed separately, in order for them to be effective, a combination of two or more of these acquisition techniques may have to be used.

Fee Simple Acquisition

This type of acquisition is probably the simplest. It is also the most expensive. Fee simple acquisition is outright purchase of the property title. There are two types of fee simple acquisition: that property which is purchased at market value and that which is purchased at below market value. Land which is purchased by government at below market value is usually donated or sold at a reduced rate for tax considerations. Land acquisition programs which rely on purchasing land for below market prices are strongly dependent on community good will and support.

The principle advantage of fee simple acquisition is that it provides local government with the greatest degree of control over how land is used. Financial incentives and regulations rarely give the degree of land use control that is available from land acquisition. There are, however, many disadvantages as

well. One of the largest of these problems is the prohibitive cost of coastal property in Florida.

There are two basic methods of fee simple acquisition: one involves the owner's voluntary sale of the property. The other method involves the use of the power of eminent domain by local government. The power of eminent domain guarantees the right of local government to purchase property in the interest of the public as long as the owner is justly compensated for the loss of his or her property. Use of eminent domain to acquire land can sometimes cause opposition and resentment within the community. This can be a very serious matter because many less than market value acquisition programs are directly dependent on the good will of the community and of the potential sellers.

Administering lands once they are acquired by local governments is also a concern. The cost and upkeep of maintaining coastal property can be very high, particularly in areas where public access is extensive. Another serious problem with fee simple acquisition is the loss of potential tax revenues to local government.

Fee simple acquisition must be combined with other techniques such as tax incentives and regulations if local government is to adequately reduce losses from future storms and hurricanes.

Leaseback

This fee simple technique can be used to encourage redevelopment or control development in an undeveloped area. In a leaseback arrangement local government purchases a tract of property and then leases all or only portions of it back for private development. Businesses which have suffered severe damage and financial loss could sell their property to the local government with a guarantee to lease the property at a low rate. Business could regain lost capital and not be required to relocate. Local government gains a greater control over the property by imposing restrictions or conditions on the lease. This type of arrangement allows local government to recover some of the acquisition costs by leasing the property for development. This technique is widely used to encourage industrial growth in newly formed industrial parks, and as a means of encouraging growth in areas suffering from urban blight. It does not completely stifle development as would be the case if all of the property were turned into a local park. Administration costs would also be defrayed because the party leasing the property would maintain it. A land tract in an undeveloped area could be purchased and then leased back for private development. The local government need not lease areas that are considered a high hazard risk, or they could lease the area only for uses which are compatible with area's high storm hazard vulnerability.

Conservation Easements

Easements allow the purchaser to obtain certain rights to a certain piece of land without actually having to purchase the title to the property. Conservation easements normally include items such as setback lines, building codes or others. They are intended to protect environmentally critical or naturally beautiful areas from development.

Land Banking

Land banking is still largely experimental in the United States. It has been widely used in both Sweden and the Netherlands since the end of World War II. In a land banking scheme land is purchased by a land banking agency and held in reserve until such time as conditions are right for reselling the property. Land banking can be a useful management tool to reduce growth in coastal areas, and for guiding and controlling eventual development. Several general rules must be followed if the local land banking agency is to be effective in managing community growth. The first rule is that the local government must have an adopted comprehensive plan. The goals of the land banking agency must effectively tie in with the goals of the local comprehensive plan. The land banking agency must also have the power of eminent domain which should rarely be used; however, the requirement to use it may be necessary as coastal conditions change. Large scale land banking is not very feasible on Florida beachfront due to the prohibitive cost of coastal property. Land banking on a small scale on beachfront, or on a larger scale behind the beach, may be one of the effective means of managing coastal growth.

Land Exchange

This type of land acquisition is commonly used by local governments to acquire other public or private property. There are several different kinds of land exchange. One type occurs when land is transferred from one government agency to another. Another type of land exchange occurs when land is confiscated as payment for delinquent taxes. Another type of land exchange occurs as the result of release of government surplus property: when a federal or state government agency no longer needs a certain tract of land it can be declared surplus and transferred to the jurisdiction of local government. Or land exchange may simply consist of an exchange of one parcel of land for another. This technique has been widely used to preserve open space, as in Toledo's waterfront district, and for storm hazard mitigation.

Conservation Commissions

Local conservation commissions have been established in some areas, with the power to establish regulations and purchase property for the purpose of conserving vital natural resources

such as coastal areas. Appropriations for acquisition are sometimes based on a percentage of total local government revenues. Massachusetts has established the Self-Help Act, which provides financial assistance to communities which have established conservation commissions.

Partial Lot Acquisition

Local governments when purchasing property usually purchase the entire lot from an owner. This all or nothing approach may not be entirely necessary for hazard mitigation purposes. All that may be necessary to purchase is the area from high tide mark to just beyond the vegetation line, or other areas in a high hazard zone. This could considerably reduce the cost of acquisition when compared to purchasing the entire lot from the owner. This need not prevent the owner from using the remainder of the property.

FINANCING OF LAND ACQUISITION

Installment Purchasing

A tax incentive is usually given to the seller of the property in return for certain stipulations to go with the property. Usually the arrangement is that the local agency paying for the property will be allowed to pay part of the acquisition cost by a certain deadline and the rest of the money will come in periodic installments. Chapter 125.031 of the Florida Statutes, allows counties to enter into such agreements not to exceed 30 years in duration.

Federal Grant-In-Aid Programs

The future of many federal grant-in-aid programs for land acquisition seems to be in some doubt. Many of these programs have undergone recent funding cuts. The requirements for some of the programs are quite strict. Competition for grants is sometimes quite intense. Some of these programs may not have been intended entirely for storm hazard mitigation purposes, but they lend themselves for this purpose.

Land and Water Conservation Fund

Under this federal program states must provide funds on a 50/50 matching basis. Funds may be used for acquisition or conservation programs. The program is administered nationally by the Heritage Conservation and Recreation Service of the Department of the Interior. The Florida Department of Natural Resources, which administers the program, gives priority to purchase of coastal properties. Revenues for the program come from several sources: user fees at federal recreational sites, sale of surplus land, marine fuel tax, and offshore natural resources leasing. The federal program is guaranteed funds of at

least $300 million a year through 1989. The program is well suited for acquisition of coastal properties, but funds are extremely limited in practice because of the competition from projects in all states. The program's future after 1989 is uncertain.

The National Flood Insurance Program (NFIP), Section 1362

Under this program property which has been damaged by a storm can be purchased with federal money and donated to the local government. The reuirements for eligibility are rather strict. There must be a structure or property which is located in a flood hazard zone and covered by standard NFIP policy, and one of the four following criteria must apply:

1. The structure must have been damaged beyond repair by flooding;

2. It must have incurred significant flood damage on not less than three previous occasions over the previous five years, and each time, the cost of repair averaged at least 25 percent of the structure's value;

3. Local or state government regulations prohibit repair or restoration of property that has sustained damage from a single storm occurance; and

4. Local or state ordinances or regulations permit repair only at a significantly increased cost.

The property also must be of some benefit to the flood insurance program. Since the program is voluntary, the owner must be willing to sell and the local government willing to accept ownership. Funds are quite limited and criteria sufficiently stringent that this very useful program has limited application.

Resource Conservation and Development Program

This program is administered by the local office of the Soil Conservation Service. The program's purpose is to establish and carry out long range objectives for resource conservation and development within the community. Funds for acquisition are available on a 50/50 matching basis. Loans can be provided for the local portion of the matching funds through Farm Home Administration Program loans.

Small Watershed Programs

This program is also administered by the local office of the Soil Conservation Service, to provide "technical assistance" to "protect, develop, and utilize the land and water resources in small watersheds." There are various matching fund requirements. Where local funds are not available funds may be obtained through Farmers Home Administration loans.

Water Resource Development Funds

This program is administered by the Army Corps of Engineers, to aid local governments in acquiring or improving floodplains. The difficulty in obtaining funds is the strict requirements for eligibility. To be eligible the project or acquisition must be authorized by Congressional action and funded as a line item in the budget by Congress, or the project must be part of a continuing authority project for which the Corps of Engineers is funded for by Congress.

STATE LAND ACQUISITION PROGRAMS

The state grant and loan programs suffer from the same problems as their federal counterparts: strict requirements, limited funds, and uncertain futures. There are several programs at the state level.

Water Management Trust Fund

This program is financed by an increase in the documentary stamp tax on deeds and land transactions. Money from this tax is deposited into the Water Management Lands Trust Fund, administered by the Department of Environmental Regulation. The funds are utilized by Florida's five water management districts to purchase "the fee or other interests in lands necessary for water management, water supply, and the conservation and protection of water resources." Districts must file a five year plan for acquisition with DER.

Conservation and Recreation Lands Program and Trust Fund

This program provides funds for acquisition if the lands fall under several categories:

1. they are either marsh or estuary;

2. they are state parks, recreation areas, public beaches, state forest, wilderness or wildlife management areas;

3. restoration of altered ecosystems to restore damage; and

4. preservation of archaeological sites.

The Department of Natural Resources gives high priority to the purchase of lands near population centers, and to purchasing lands in coastal areas. Sites for funding are selected by a committee, although proposals for site acquisition may be prepared by other state agencies, individuals, or local governments. Competition among proposals is keen. Matching funds are required on a 50/50 basis.

The Land Acquisition Trust Fund

This program is also administered by the Department of Natural Resources, using funds generated from legislative appropriations and sale and lease of state resources. Special consideration is given to acquisition of beachfront properties.

LOANS

Resource Conservation and Development Loans

This program is administered by the Farmers Home Administration of the United States Department of Agriculture. It was designed to aid local governments to conserve and develop resources within the community to enhance economic opportunities for local people. The agency requesting the loan must be the original sponsor of the measure for which the loan is requested. A single loan for a single measure cannot exceed $500,000.

Watershed Protection and Flood Prevention Loans

This program is also administered by the Farmers Home Administration. The purpose of this program is to help local governments to pay their share in matching funds projects. This includes land acquisition for flood damage prevention purposes. The applicant must be the sponsoring organization, and must have the authority under state law to borrow funds.

POST-HURRICANE FINANCING

Federal Grants

After an area has been devastated by a hurricane the speed at which it can be rebuilt is often proportional to the extent of and swiftness by which federal grants can be obtained. Having the necessary personnel trained in advance to properly file for disaster aid grants can greatly reduce the response time. County and city clerks should be instructed in advance how to properly fill out FEMA disaster aid grant paperwork.

The Economic Development Administration has several programs which could be of considerable assistance in providing funds for restoration of public facilities, such as port accommodations, highways, water and sewer lines. The Business Development Program provides financial assistance to businesses which are in economically disadvantaged areas such as a hurricane damaged area. This financial aid could be of help, in that it would release budgeted funds that would normally be spent for operating costs, allowing the money to be spent on public reconstruction.

The Coastal Zone Management program provides grant funds for coastal planning assistance. Such planning assistance could be of help both in pre-hurricane mitigation and post-hurricane reconstruction. The Army Corps of Engineers has grant assistance funds for restoration of channels, restoring damaged flood

control structures, renourishment of eroded beaches, and other facilities restoration.

The Small Business Administration has several loan programs suitable for post-hurricane reconstruction. The economic disaster loans program provides low interest loans to declared disaster areas. Small business loans and structural disaster loans can also be of considerable assistance in revitalization of post-hurricane recovery areas.

Participation in the Federal Flood Insurance Program is another way to insure that the community has sufficient capital to rebuild after a hurricane. The community should seek to insure success of this program at the local level by encouraging its residents to support it. The Federal Flood Insurance Program requires certain structural standards for building in flood zones.

Taxing Incentives

Programs for taxing incentives can be used for pre-hurricane mitigation and post-hurricane recovery. Tax incentives can sometimes result in short-term loss of revenue; however, they may bring about a long term increase in revenues through increased values. There are several tax incentive methods that may be of value in hurricane redevelopment.

Abatements--Taxes are temporarily reduced or totally eliminated for a specified period of time to act as an incentive for redevelopment.

Exemptions--Property is eliminated from the tax rolls by special action of the local government. In the aftermath of a hurricane a community could mandate by legislation or executive order a special tax exempt hurricane reconstruction zone. This zone would last for an interim period of time and would allow money used normally to pay taxes to be used for reconstruction. The feasibility would depend on the size of the local tax base, how long the zone exists, the extent of federal aid available, and other conditions.

Tax By Hazard Assessment--This is a hurricane hazard mitigation technique which places a tax assessment on the extent of damage susceptibility. This technique could be used in conjunction with a property tax assessment. In other words, tax assessment would be a combination property and hurricane hazard assessment. Taxes need not be higher than existing values, in some cases less if the property is not particularly susceptible. This would also mean that the tax assessor would need training in hurricane damage

forecasting and understand the Federal Flood Insurance Rate Maps.

Parcel Development Agreements

This is a technique that allows an agreement to be negotiated between the governing agency and an individual property owner. This contract agreement obligates the landowner to make certain improvements on the property, such as dune walkovers and improved drainage facilities which tend to reduce hurricane susceptibility to the neighborhood, in exchange for tax breaks. The landowner is usually given a time period in which to complete the necessary improvements. This technique allows local government a degree of control over local coastal development and can protect the infrastructure from being destroyed.

Tax Increment Financing

After a hurricane has damaged an area severely the property tax assessment will be considerably reduced. Usually as reconstruction begins and progresses, property taxes will begin to increase over the redevelopment period. Tax increment financing takes advantage of natural rises in property taxes as a means of capital acquisition. The local government will usually sell tax increment bonds that can be used to finance reconstruction improvements such as repair of highways, bridges, and other important facilities. Every year the taxes are assessed slightly higher than the previous year in the redevelopment district. The amount above the base level is used to gradually retire the debt on various tax increment bonds. When all debt is paid the protess then stops.

Regulatory Simplification

Regulations concerning building and reconstruction permits can often be so time-consuming and the paper work so complex that they present a hindrance to rapid redevelopment. Many permits in fact overlap each other causing much wasted and repeated effort. Some states have attempted to consolidate their permitting process with that of the Federal government. Centralization of permitting information systems can also save much time during post-hurricane recovery. The State of Michigan has a permit information processing system that will tell an inquirer the status of permits, their number and type, areas of critical concern, soil conditions, and other types of information. This centralized information system reduces the amount of time required to review a permit.

Restoration of Public Facilities

After a hurricane has damaged an area, one of the best ways to provide incentives for rapid investment of development capital

is early restoration of public facilities. Attention should be paid to not only vital facilities such as highways, water, and sewage, but also to bulkhead restoration, shoreline, revegetation, and other improvements which would tend to encourage business interests. Since much of the investment attraction for coastal areas is due to scenic value, improvements such as beach nourishment and shoreline revegetation are very important to reconstruction of the community. Success in rapid restoration depends greatly on the local geomorphology, the extent of storm induced shoreline erosion, and the organization and financial capabilities of local governments.

Redevelopment Corporations

In some inner city waterfront areas hurricane damage may aggravate already blighted conditions. In some areas where little capital is available, complete recovery may be very difficult. Development corporations, authorized under Florida Statutes 162, range from public agencies to private profit making agencies. their purpose is to provide developmental planning and expertise, and assist in the overall development of an area with possible investment potential. This technique may also offer possibilities for redevelopment of hurricane damaged areas, particularly in areas where destruction has been severe. Quasi-public development corporations offer one of the best management possibilities for redevelopment. This type of development corporation is usually a non-profit organization, a mixture of government and private interests. Among the advantages of such a corporation are eligibility for Small Business Administration low interest loans. The development corporation usually has greater flexibility in operating conditions than a local government agency. The status as a corporation allows the redevelopment corporation to act as a third party in negotiations between private industry and local government. There are also special tax advantages available for non-profit organizations. Again, redevelopment corporations need to be mentioned in Florida's enabling legislation to be a truly effective tool in local government planning.

References

American Forest Products Industries, Inc.. 1965. Government Land Acquisition. Washington, D.C.

Herrington J. Bryce. 1979. Revitalizing Cities. Lexington, MA: Lexington Books

Robert W. Burchell. 1972. Planned Unit Development, New Communities American Style. New Brunswick, NJ: Rutgers University Press

Dennis W. Ducsik. 1974. Shoreline for the Public. Cambridge, MA: MIT Press.

Executive Office of the President, Office of Management and Budget. 1984. Catalog of Federal Domestic Assistance. U.S. Government Printing Office.

Jon Kusler. 1982. Innovation in Local Floodplain Management: A Summary of Community Experience. Boulder, CO: University of Colorado-Institute of Behavioral Science

Robert A. Lemire. 1979. Creative Land Development, Bridge to the Future. Boston, MA: Houghton Mifflin Co.

Peter Libassi and Victor Hauser. 1977. Revitalizing Central City Investment. Columbus, Ohio: Academy for Contemporary Problems

Daniel R. Mandelker and Roger A. Cunningham. 1979. Planning and Control of Land Development, Cases and Materials. Indianapolis, N.Y.: The Bobbs-Merrill Company, Inc.

Ocean and Coastal Policy Program, Center for Urban and Regional Studies. 1982. Before the Storm, Managing Development to Reduce Hurricane Damages. Chapel Hill, NC: The University of North Carolina

Office of Coastal Zone Management. 1980. Improving Your Waterfront, A Practical Guide. N.O.A.A., U.S. Department of Commerce

Office of the State Secretary. 1972. Florida Statutes Annotated. Sections 125, 163. St. Paul, MI: West Publishing Co.

C. L. Siemon. Winter 1985. Of Regulatory Takings and Other Myths. Journal of Land Use and Environmental Law, Vol. 1, No. 1. Florida State University.

Francis S. So. 1979. The Practice of Local Government Planning. Washington, D.C. American Planning Assoc. and the International City Management Assoc.

Town of Gulf Shores, Alabama, "Zoning Ordinance", 1984.

U.S. Department of Commerce. 1981. The Florida Coastal Management Program, Final Environmental Impact Statement. N.O.A.A., Office of Coastal Zone Management and the State of Florida Department of Environmental Regulation, Office of Coastal Zone management, Tallahassee, FL.

CHAPTER 6

PUBLIC PARTICIPATION

INTRODUCTION

Participation, in the context of a post-hurricane development plan, refers to the public's involvement in the planning process, its influence upon decisions, and its role in actions taken to guarantee proper implementation. In a democratic society, both legal requirements and the value basis of the society require public involvement in policy. Public officials often find public involvement a painfully time-wasting, frustrating way to "mess up" a perfectly good plan, or view the process as simply one of the hurdles that must be jumped on the way to what "we" are going to do anyway. These can be accurate perspectives--particularly so if these are the attitudes held when the process begins.

But public involvement can also be viewed positively, as a source of added information, different perspectives, new ideas. Even more importantly, in the context of this Report, extensive public participation in preparing the post-hurricane plan provides a strong base of political legitimacy to rely upon during the difficult times which will arise during later implementation of the plan. Potential contributions of public participation in planning include:

- build support and acceptance of the plan by the public, which aids in adoption and implementation of the plan;

- serve as a means of discovering additional information and thus improve the quality of the plan;

- help make the plan more responsive to local needs by reflecting local perceptions, habits, and attitudes;

- protect the right and interest of the general public in the decision making process by lessening the likelihood that a select few will interject their personal wants, needs, and biases into the final decision; and

- aid participants in understanding by introducing them to points of view and the need for trade-offs involved in reaching decisions on complex issues.

The public believes that planning for emergencies is the business of the local officials. However, as soon as an emergency takes place it becomes the public's emergency, and their needs and wants should take priority in being solved. If their needs are not met the public may be less cooperative and there is a tendency to blame local officials. This can not only cause disruption in implementing the plan, but may lower community morale and also may have consequences during the next election.

OBJECTIVES OF PUBLIC PARTICIPATION

There are two basic functions of public participation. To inform and educate the public, and to carry out the desires of the public expressed in the democratic planning and decision making process. Unless the public has information and knowledge of the major issues as well as an idea of how the planning process works, it cannot effectively interact with local governmental agencies taking part in the planning process.

The first question to be addressed, and the first task of any public participation program, is that of defining "the public." Who will be, should be, and are most likely to become involved? What parties are most likely to be impacted? On any given issue, the public may be composed of a number of different interests and jurisdictions. These may include federal and state agencies, local government officials and agencies, special interest groups, public service organizations and clubs, and the general public. Different approaches and methods of involvement can be designed for each public.

Five principles are essential to the success of any public participation program (Alaska, 1979). These principles should be considered by anyone involved in organizing public involvement in the planning process.

Well Defined Issues and Responsibilities

Before any program is initiated, especially one involving public participation, the major issues to be addressed should be identified and the role and responsibility of all expected participants should be clearly defined. If broad based goals and policies are the objective, then the views of the general public are important and should be sought, because these views will reflect the needs and hopes of the community. On the other hand, the opinions of people and groups with special knowledge and expertise will be needed for specific problems relating to program elements, economic, or environmental issues. The views and opinions of both general and special interest groups will be beneficial to development of any plan for post hurricane development.

Representative Participants

All segments of the public who may be affected by the plan must be identified and involved in development of the plan. Special attention should be given to identifying and including those members of the public who may not know that they may be affected. This will assist in obtaining adequate representation of the interests of all affected groups.

Timely Participation

Public participation should begin as early as possible in the planning process. It is important that the public becomes involved before decisions are made, not after. It must be decided at the start at what stages in the process public participation will be desired and needed to benefit all concerned.

Opportunities to Participate

Once the best times for public involvement have been pinpointed, opportunities for appropriate participation by individuals and groups must be provided and widely publicized. It is important that public involvement precede the making of any real decisions, and equally important that later the public should be informed of how their participation and views were integrated into the decisions and the final plan. Doing so will help legitimize the plan by making it "the people's plan" rather than a strictly bureaucratic decision. In the high-stress environment of post-hurricane recovery "our community plan" is socially and politically more compelling and defensible, thus more readily and speedily implemented. As Chapter 3 indicated, speed in implementation is a critical consideration.

Sufficient Resources

No matter how much care is taken in getting the public involved in planning, effectiveness of this involvement may be hampered by an insufficient amount of time and/or money to adequately oversee the task. Failure to provide the public with adequate background or technical information will also be a hinderance to participation. Care must be taken in programming for the amount of time, the amount of money, and the completeness of information required for useful public participation. It is easy to underestimate these factors, and a poorly executed program could arouse opposition rather than support.

IDENTIFYING THE PUBLIC

A number of different groups and individuals make up "the public." It is important to identify these, because each will require different approaches to effectively include them in the participation process. The Regional Planning Association of New York, for example, has identified five distinct groups which comprise the public.

Civic Leaders (Volunteers)

These are the easiest individuals to recruit into a participation program. In fact, they may need to be restrained to avoid over-representation. They are the ones who become civic leaders, attend meetings, write to their representatives, organize citizen actions groups, and occasionally get themselves elected to other than full time public office. These are

individuals who want to help shape society. Little effort by government agencies will be needed to attract their input. Included in this group are those with a special interest in development such as professional planners, architects, environmental activists, builders, and others.

Non-Volunteer Middle Class

This group consists of those who are less interested and concerned about planning issues than the civic leaders. Depending on the demographics of the area under consideration, this group could make up the majority of the residents for an area. Participation from this group is best obtained through organizations whose main purpose is not civic activities. These include mens and womens clubs, church groups, and trade unions.

Difficulty in recruiting representatives of this group is often due to their apathy towards planning, in part a function of their focus on other concerns. Even with great amounts of preparation and effort participation from this group can be disappointing. It is very unlikely that members of this group would go out of their way to volunteer their ideas or feelings on any planning issue. The best results would probably come from talking to them during a club meeting where they are a captive audience, and gain responses on questionnaires turned in at the end of the meeting. Again, the sheer size of this group makes it a significant target, worth serious effort.

The Poor

The major hurdle to the poor becoming involved in planning is that they do not see the majority of the issues raised as relating to them. Their problems are more immediate, in terms of surviving from day to day. They see planning issues of this type as too long range to be worried about. It will take special preparation and sustained effort at communications to help the poor understand the relevance of these issues to their lives. In areas where the poor have become involved they have made a beneficial impact on planning. It also should be remembered that many of the people of this group are poorly educated; special consideration must be taken to guarantee that these individuals can understand information that is disseminated to them. Potential sources of valuable information from this group are welfare workers, public housing managers, and leaders or organizations sponsored by the Office of Economic Opportunity. Religious leaders can be very effective in conveying a consensus on major issues, as can ethnic leaders, ward politicians and patriarchal community figures. But it must be emphasized that direct participation should be sought wherever possible.

Experts in Planning Related Fields

In planning for post-hurricane development, planners need to consult with experts in fields which are not directly involved in the planning process, but are related in the sense that they influence or can influence through their actions any future development. These include experts involved in recreation, education, conservation, retail home building, and industrial and office development to name a few. For an adequate and comprehensive plan to be developed the special conditions and needs of each of these interests must be known to the planner. In turn, the planning agency can aid these professions by providing economic and demographic projections on which to base decisions of future needs and trends and by providing a certain stability and predictability through development of the recovery plan.

Representatives of Major Institutions

Valuable information and sometimes assistance may be obtained from major institutions and groups directly concerned with planning issues: large corporations and their professional advisers, public and private educational systems, universities, foundations, women's organizations, and conservation groups. All of these groups may have great influence on planning decisions made by government and should be consulted. Plans by institutions should be coordinated with the local government comprehensive plan or serious problems may arise.

Ethnic Participation

Ethnic communities have become established in many coastal areas. These communities may have cultural and linguistic differences which will need to be addressed in the planning and public participation process. Some ethnic groups possess a unique hierarchy or communication system which will need to be identified and followed if participation from these groups is to be obtained. The leading individuals in ethnic communities may or may not be publicly well-known, or hold official political positions in the community, but their assistance will be essential to obtain cooperation from the community.

This can become a serious problem during hurricane evacuation and reconstruction, especially if the native language is other than English. It would be a good idea to have a trusted individual from ethnic communities, such as clergy or an elected official, as a liaison between the local government and the community to assist with the two-way communications before and after a hurricane.

PROGRAM FOR PLANNING

Involvement of the area citizenry in development of a Post-Hurricane Development Plan is not only recommended, but required by a number of state and local laws governing the various

elements which would be included in a project of this type. The flowchart provided (Figure 6-1) outlines a model public participation program associated with the planning process. Steps of the planning process are outlined along with key points at which citizens' views and ideas are desired. Various techniques to inform the public, encourage their participation, and express their views and ideas are also identified.

In the beginning of the process, the essential requirement is to inform the public that a mitigation study and plan is being initiated and that their ideas and concerns will be asked for and needed. As Chapter 4 discusses, public perception of both hurricane risk and the value of mitigation are critical to success. The media play an important role here. Radio and television announcements, along with a series of newspaper articles can inform a large number of people with minimal effort and expense. To tap the ideas and concerns of both the general public and community leaders, surveys either personal interviewing or mail, can be useful. In the early stage the purpose is to identify general issues and ideas which will be refined later. As soon as possible develop a mailing list and keep it up to date.

The development of committees will be useful in formulation of a hurricane recovery plan. These can take the form of technical and citizens advisory groups, which can aid the planning department by providing technical advice, developing possible alternatives, or presenting the concerns of the public on different issues. They may also later be of assistance during implementation of the plan.

Technical Advisory Committees

Before the first draft of a hurricane preparedness or mitigation plan is developed, advice of local experts from various related disciplines should be requested. The major subtopics of the plan can be outlined and a local expert identified to act as an advisor. The local Red Cross representative who is knowledgeable about food requirements for those using shelters, the emergency management supervisor, the local Coast Guard representative are examples of those who could be named to a technical advisory committee. Not only do these committee members provide inputs to the first draft of any plan but they will review later drafts and make recommendations. Once the technical advisory members selected have accepted nomination to the committee and the first meeting has occurred, members and their group affiliation should be identified to the public through the media. This group's expertise will provide and promote the legitimacy of the plan and serve as liaison with "expert communities." They can sample reactions to the proposed plan from other individuals working in their field of expertise and direct these inputs to the group writing the plan.

Citizens Advisory Committee

A citizen advisory committee is a very important element of public participation for any agency drafting a plan that will affect the public. Individuals should be selected to participate on this committee not because of expertise in any field but as representatives of the general population affected by a hurricane plan. These individuals should represent general groupings of local citizens, such as homeowner associations, ethnic and business groups. These individuals should sample public opinion and provide inputs to the plan writers if significant trends in public opinion develop. Participants on this committee should be identified to the public and should play prominent roles in reporting progress on the plan. Inputs made to the citizen advisory representatives by individuals or groups, if found to be beneficial to the plan, should be reported back to the originators as an inclusion in the draft. The citizen advisory group can forward their recommended inputs to the technical advisory committee and to the plan drafters. Public credit should be given for ideas and revisions originating from the citizen's representatives, to increase the plan's legitimacy.

Workshops and Public Meetings

A series of workshops each focusing on a special topic can be used to identify issues of special concern to the community and to develop policies and alternatives for these concerns. All workshops need to be preceded by announcements and background information on the particular topic. Workshops are good for groups to "think things through," while general public meetings serve as a means for presenting information to the citizenry. Public meetings should be used throughout the planning process, especially after decision stages such as identification of issues of special concern or development of alternatives.

Plan Approval and Maintenance

Once the post-hurricane recovery plan has been formulated, the public must be given the opportunity to comment on it. Usually this will take the form of a public hearing. If the public has been involved throughout the planning process and has been kept informed about developments at each stage in the process, they will be more familiar with the plan and less likely to "blow up" at the public hearing when taken by surprise (Swanson, 1975).

As with any other plan, a post-hurricane development plan should be constantly updated and revised. As the plan is implemented, it should be examined to identify problems which surfaced during the implementation stage and to develop alternatives or other mitigation measures to reduce the chances that those problems would happen again.

References

Alaska. July 1979. Guide to Public Involvement. Anchorage: Department of Community and Regional Affairs.

Burke, E.M. 1979. A Participatory Approach to Urban Planning. Chestnut Hill, MA: Boston College.

Ditton, E.V., J.L. Seymour, G.L. Swanson. 1977. Coastal Resources Management. Lexington, MA: Lexington Books.

FEMA. October, 1984. Perspectives on Hurricane Preparedness. U.S. G.P.O.

Florida Endowment for the Humanities. 1983. Governor's Challenge 1983: Florida 2000--Growth Management.

Kartez, J. 1984. Crisis Response Planning as Social Learning: Toward a Contingent Analysis. J. American Planning Association, Vol 50, No. 1.

Perry, R., M. Greene, A. Mushkatel. 1983. Minority Citizens in Disaster. Seattle, WA: Battelle Institute.

Swanson, G.C. 1975. Coastal Zone Management from an Administrative Perspective: A Case Study of the San Francisco Bay Conservation and Development Commission. Coastal Zone Management Journal, Vol. 2, No. 2.