

HURRICANE OPAL

POSTSTORM

BEACH AND DUNE RECOVERY

STRATEGIC MANAGEMENT PLAN

for the

PANHANDLE COAST OF FLORIDA

FEBRUARY 1996

REVISED MARCH 1996



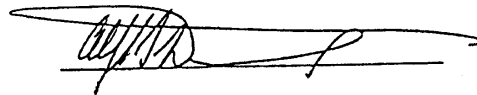
**BUREAU OF BEACHES AND COASTAL SYSTEMS
DIVISION OF ENVIRONMENTAL RESOURCE PERMITTING
DEPARTMENT OF ENVIRONMENTAL PROTECTION**

FOREWORD

This report was prepared by Mark E. Leadon, P.E., Section Administrator, Ralph R. Clark, P.E., Emmett R. Foster, P.E., of the Research, Analysis, and Policy Section, with contributions and oversight by Dr. Alfred B. Devereaux, Jr., Chief of the DEP Bureau of Beaches and Coastal Systems (the Bureau), and Dr. Robert G. Dean of the University of Florida, Coastal and Oceanographic Engineering Department. Also contributing to development of this report were Hal N. Bean, Assistant Chief of the Bureau, and Lonnie R. Ryder, Section Administrator of the Bureau's Beaches and Coastal Ecosystem Management.

Assistance and coordination was also provided by a number of local government officials in compiling of cost estimates for county plans; specifically, officials from the Santa Rosa Island Authority, Santa Rosa County, Okaloosa County, City of Destin, Bay County, Walton County, the City of Mexico Beach and Gulf County.

APPROVED BY

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Alfred B. Devereaux, Jr., Chief
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EXECUTIVE SUMMARY

This plan was developed to provide recommendations and cost estimates to assist in the post-Hurricane Opal recovery effort. Some related long term activities needed for management in this area are also included. Plan recommendations are based on a staff review and analysis of erosional conditions and recovery needs throughout the Florida Panhandle coastal zone for Escambia County through Franklin County.

The recommended plan includes natural recovery in undeveloped and non-vulnerable areas, completion of beach clean up and debris removal, beach restoration in the Panama City Beach area, dune restoration in varying degrees throughout much of the Panhandle, including replacement of dune walkovers at public access locations. The plan also identifies the need for removal of debris from marine waters, for sand search and supplemental sand placement, for inlet management and improved sand transfer at inlets, for innovative technologies to assist recovery efforts, and recommendation for additional technical assistance, data collection and analysis related to the post-Opal recovery.

Total cost estimate for work described in this plan is \$31.8 million, including \$16.8 million for county projects, \$14.5 million for area wide projects and \$.5 million for dune restoration at state park and recreation areas. The county projects include \$10.5 million for the state share of the federally authorized Panama City Beach Restoration Project based upon the post-Opal expanded project which compensates for the effects of the hurricane. Without the federal project, Opal recovery costs would increase by approximately \$8 million. Therefore without this federal project, total recovery cost would be \$28.8 million with an additional state share of approximately \$8 million for matching funds for the federal project due at a later date. Combining the two projects saves the state approximately \$8 million.

Note: The above cost estimates are revised from earlier cost estimates contained in the February 1996 version of this report based on new updated information.

I. INTRODUCTION

This plan identifies a strategy to respond to the effects of Hurricane Opal on the beaches and shorelines of the Florida Panhandle and estimates the costs of implementing both remedial measures and initiatives for the long term management of this area.

Hurricane Opal, which struck the coast of Florida on October 4, 1995, was one of the most destructive coastal storms in the modern history of Florida. More coastal structures were damaged or destroyed by coastal water and wave forces by this single event than by the aggregate of all the coastal storms occurring in Florida since 1975. The storm also caused significant coastal erosion over a 175.5 mile area of the Panhandle, leveling dunes and causing major shoreline and dune recession, threatening the economic viability of much of the region and leaving many areas vulnerable to future coastal storms.

In reviewing damages to the beach dune system caused by the hurricane, three primary remedial response strategies for restoration of the system were evaluated:

Natural recovery of both the beach berm and the dune to pre-storm conditions is expected to occur in many areas. However, in some areas it will be a slow process taking years or perhaps decades. That may be unacceptable to local citizens. However, all options should incorporate natural recovery to the extent acceptable within time and cost constraints. Natural recovery is especially appropriate for public lands such as local, state and federal parks. It is also appropriate in areas where an adequate setback existed prior to the storm and the existing poststorm beach dune system provides ample protection of upland property and development. Natural recovery is only useful in areas with an adequate sand supply accessible to wind and water action.

Assisted natural recovery options primarily let the beach berm restore itself naturally, then intervene to accelerate recovery of the dune structure. Mechanical placement of sand, use of sand fencing and revegetation are viable components of the approach. Effort can be made to restore and close gaps or blowouts, to construct an intermediate dune or to reconstruct the approximate original dune profile. These options are dependent on availability of a sand source, usually an upland one. Sand fencing and revegetation are labor intensive options and must also be actively managed.

Mechanical Restoration is normally reserved for areas where there are adequate economic or other social reasons to justify the activity. Beach or dune restoration are costly options and the restored beach may be of a different character than it was before the storm. Areas with chronic shoreline erosion stress before the storm and with enough upland development to warrant a public investment of funds are the most appropriate areas.

After each storm the lessons learned should be studied and public policy should be reviewed to determine whether it is effective. Although storms and their effects have been analyzed for years there is still a significant amount that is not understood. Specific

study target areas are; the effects of beach scraping, actual natural recovery rates; and the cost effective strategies to restore an area. In addition we need to assess the effectiveness of existing strategies such as coastal building regulation to determine what is working and what is not cost effective. Lastly, we need to calibrate and update our existing predictive models.

Time, sand supply and public cost are major impediments to beach and dune recovery. Impatience resulting in inappropriate actions can interfere with natural recovery and cause public and private costs to rise. Immediately after Opal there was an urgent effort to scrape the beach sand and place it on the eroded dune. While this may be effective in some cases if carefully managed and controlled, in other areas it damages the beach at the expense of adjacent parcels and places the areas which are to be "protected" in further peril. A second major impediment to recovery is debris left on the beach and in adjacent waters. This debris should not be buried on the beach as it will eventually surface and cause further problems. Until it is removed, restoration options are limited. Existing structures which survive the storm interfere with placement and recovery of sand relocated by the storm. Spacing between structures or other designated areas for beach access to facilitate poststorm recovery activities makes good sense.

DEFINITIONS

Beach - is the zone of unconsolidated material that extends landward from the mean low water line to the place where there is marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves). Unless otherwise specified, the seaward limit of a beach is the mean low water line. "Beach" is alternatively termed the "shore".

Beach Berm - is a nearly horizontal part of the beach or backshore formed by the deposit of material (ie, sand) by wave action.

Dune - is a mound or ridge of loose sediment usually sand-sized sediment, lying upland of the beach or shore and deposited by any natural or artificial mechanism (e.g., dune may also include a beach ridge, dune ridge, chenier, etc.).

Erosion - is the wearing away of land or the removal of beach or dune material by wave action, tidal currents, littoral currents or deflation. Erosion includes but is not limited to:

(a) Horizontal recession which occurs where the storm surge intersects but does not inundate the profile, and where horizontal littoral activity due to waves, currents and runup erodes the profile.

(b) Scour which occurs when the topography is completely inundated by the storm surge, and where wave and current forces erode the profile in the vertical direction.

II. SUMMARY OF HURRICANE OPAL IMPACT

In terms of both coastal erosion and structural damage Hurricane Opal may have been the most destructive storm ever to impact the coastal zone of Florida. Structural damage and beach and dune erosion occurred throughout the Panhandle from Escambia to Franklin counties. Beach erosion extended to a lesser degree into lower Gulf Coast counties as far south as Sarasota County. Although significant wind damage was observed, the most extensive damage in the coastal zone was the result of storm surge and accompanying wave heights and erosion. A more complete summary of damages to both structures and the beach dune system is found in Hurricane Opal Executive Summary of a Report on Structural Damage and Beach and Dune Erosion along the Panhandle coast of Florida.

A. STRUCTURAL DAMAGE

Structural damage from Opal's high storm surge was extensive, particularly along the most seaward line of construction, damaging or destroying many structures within a zone extending landward over the first two to three hundred feet from the beach.

Most damage occurred to habitable structures constructed prior to establishment of the state's coastal control line program and which were not subject to the more stringent construction standards needed to survive in a high hazard coastal zone. Habitable structures permitted pursuant to the CCCL standards survived throughout the Panhandle counties.

Structural damage to non-conforming structures generated large volumes of debris.

B. BEACH AND DUNE EROSION

Extensive beach and dune erosion occurred throughout the Panhandle. Lower lying areas in the eastern Panhandle experienced significant overwash. Generally, the beach and dune were both lowered and recessed. The lower dune elevations were responsible for much of the structural damage, however, many habitable structures were damaged by direct wave attack, as a result of first floor elevations which were too low. In overwash areas, extensive quantities of sand were transported landward by the surge.

Beaches and dunes are critical to the economic welfare of the Panhandle region and provide storm protection to upland development. The U.S. Army Corps of Engineers has estimated that a beach restoration project planned for Bay County prior to Hurricane Opal could have prevented 70% of the damages resulting from the storm.

C. OVERWASH EFFECTS

Much of the sand material from the Gulf-fronting beach and dune system was transported inland through overwash processes and is lost from the system. In a natural, undeveloped barrier island scenario, overwash processes where the shore-front erodes with deposition into inland areas are considered normal barrier island evolution. In developed areas the inland transport of sand has resulted in loss of sand from the shore-front area and deposition of the overwash sand on coastal roads and properties. Lost sand from the shore must be made up artificially if the pre-storm shoreline is to be reestablished. Overwash issues are addressed in the Appendix of this plan for each specific area.

D. INLET-RELATED PROBLEMS

Several altered coastal tidal navigation inlets in the Panhandle are significant contributors to the long-term behavior of the coastal system in the region. It is important that appropriate sand management practices for these inlets be adopted. Consideration of management for Panhandle inlets is provided later in the plan.

There are also a number of intermittent surface water outlets from inland water bodies which traverse the beaches in the Panhandle, particularly in Walton County. These outlets need to be monitored to determine their effect on recovery.

III. POSTSTORM RESPONSE

Post-Opal responses to Opal by local governments and private citizens surfaced problems including a need for emergency protection of structures and property, debris, beach scraping and rebuilding.

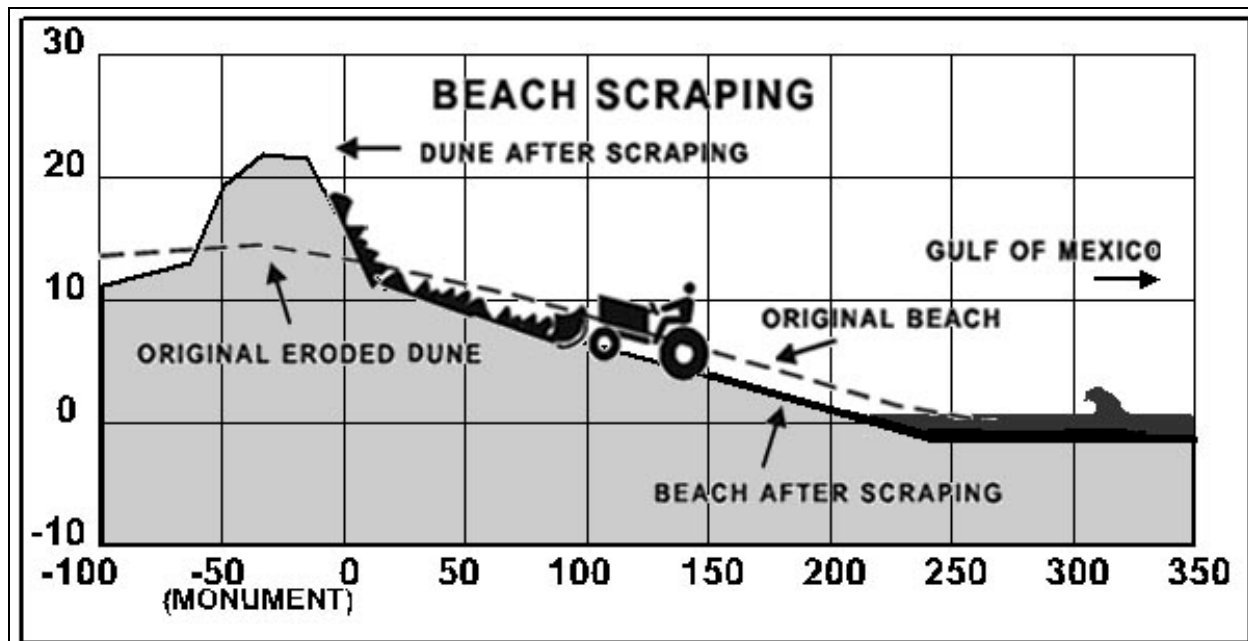
A. DEBRIS PROBLEM

Structural damage from Opal's storm surge, breaking waves, and wind coupled with beach and dune erosion and overwash generated a substantial amount of debris which could be buried. Debris blocked roadways created access problems and was also carried both in offshore and overland directions by storm surge and wave forces. Most of the debris was generated from the damage or destruction of non-conforming unpermitted structures. In some areas, the overwash sand and debris has been taken back to beach areas and placed in mound formations. Sand-sifting equipment must be employed to remove debris from these accumulations. Hazardous debris may also be buried on the beach and in nearshore, submerged regions. There has been little effort to retrieve much of this debris.

B. BEACH SCRAPING ACTIVITIES

Beach and dune erosion left many structures without soil support beneath their foundations and a loss of a storm-protective dune buffer seaward of them. To accelerate the beach and dune recovery process, a proliferation of beach scraping activities were undertaken by private citizens and local governments in some areas. Beach scraping consists of excavating sand material from the lower beach berm area and placing it in upper beach areas or at the base of the dune system. It is hoped that natural processes will replace the excavated sand. However, beach scraping does not add any "new" sand to the system.

Guidelines were established by the Bureau to control scraping and to reduce adverse impacts. Beach scraping activities that transpired in the weeks following the storm significantly exceeded these guidelines endangering both the beach and upland areas. Many over-scraped areas resulted in restored dunes but leaving a low and narrow beach berm. A longer term analysis of the effects of the beach scraping on the poststorm recovery processes is included in the post-Opal recovery study currently being conducted by the Bureau.



C. REBUILDING

With the loss of countless minor structures and over 1000 major structures and damage to many more, rebuilding in the Panhandle counties is expected to continue for a number of years.

The Department staff provided guidance to the public regarding rebuilding and established three temporary field offices in the Panhandle to assist in the permitting process. A new, interim CCCL was adopted for Bay County to ensure that rebuilt construction conforms to the more stringent construction standards of the CCCL program. Special post-Opal permit procedures with general design parameters (ie, first-floor elevations) were developed for rebuilding certain types of structures, such as single-family dwellings. The Department staff will continue to need assistance in processing the large volume of permit applications for post-Opal needs and to manage the increased recovery activities.

D. F.E.M.A. POST STORM ASSISTANCE

The Federal Emergency Management Agency (FEMA) provided federal assistance to local governments and municipalities in post-storm recovery efforts. In order to protect vulnerable upland structures, FEMA authorized a program to construct temporary protective dunes in qualifying areas across the

Panhandle. This program included constructing a protection structure from sand, as performed in Pensacola Beach and Ft. Walton Beach, or from beach scraping, as performed in much of Okaloosa, Walton, Bay and Gulf Counties. The authorized level of protection is considered to be minimal and the effect is temporary. In some cases, the FEMA berm has now been constructed. FEMA has also assisted local governments in reconstructing damaged dune walkover structures at public access locations.

IV. EROSION/STORM SUSCEPTIBILITY ASSESSMENT

A detailed post-storm erosion analysis has been conducted for most of the Panhandle counties to determine beach and dune recession and volumetric losses. The post-storm vulnerability of existing development to future erosion damage was evaluated. To perform the post-storm evaluation, a decision model for application to each coastal segment within the Panhandle counties was developed. A general description of the procedure is given below, as well as, a listing of the most critically eroded areas.

In order to determine the amount of sand needed for restoration of critically-eroded beach and dune areas, the eroded volumes of beaches and dunes in each critically-eroded area were determined by comparing before and after Opal surveys. These volumes were used for estimating the quantity of sand need for restoration. A summary of this analysis and results is also given in this section of the plan.

A. EROSION DETERMINATION PROCEDURE

To evaluate the erosion conditions along the Panhandle, the erosion areas have been grouped into forty-one individual segments which have general similarities. For each identified area a separate analysis was done addressing erosion conditions from Opal, the degree of poststorm recovery, the level of existing development, the vulnerability of any development, and the recommended response to assist recovery of the beaches and dunes. Summaries of these analyses are provided for each county in the Appendices.

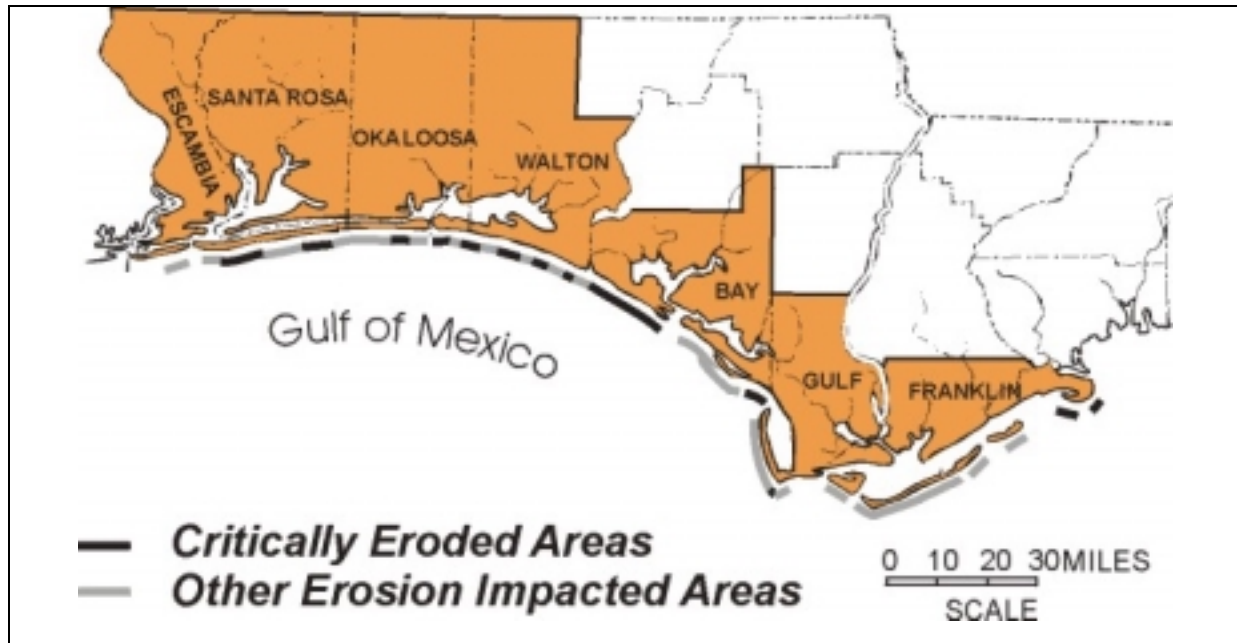
B. AREAS OF HIGH EROSION

Of the 221 miles of the six county northwest Florida Gulf of Mexico beaches, about 79 percent or 175.5 miles were determined to be significantly eroded by Hurricane Opal. Of these areas, 65.5 miles of coast have substantial development interests which have been rendered vulnerable to further damage unless mitigative corrective action is taken (see table).

The map illustration on the next page shows the area of beaches along the northwest Florida coast severely eroded by Opal. The vulnerable developed areas are highlighted on the map.

EROSION PROBLEM AREAS
VULNERABLE TO FURTHER DAMAGE AND
REQUIRING MITIGATIVE ACTION

<u>Area</u>	<u>County</u>	<u>Length, Miles</u>
Pensacola Beach	Escambia	7.0
Navarre Beach	Santa Rosa	3.6
Ft. Walton Beach	Okaloosa	3.0
Destin	Okaloosa	2.9
Eastern Okaloosa	Okaloosa	2.1
Western Walton	Walton	5.2
Beach Highlands/Dune Allen	Walton	2.9
Blue Mountain	Walton	1.0
Seagrove Beach	Walton	3.1
Seacrest Beach	Walton	1.7
Panama City Beaches	Bay	17.5
Mexico Beach	Bay	2.8
St. Joseph Peninsula	Gulf	1.4
St. George Island State Park	Franklin	8.4
S.W. Cape, Alligator Pt.	Franklin	1.1
Lighthouse Pt.	Franklin	1.8
		65.5



C. VOLUMETRIC EROSION SUMMARY

An evaluation of before and after Hurricane Opal beach and dune survey profiles of Panhandle counties was performed for each coastal segment considered to be in a substantially eroded condition as identified above, including determination of beach and dune erosion volumes. Inspection of the profiles indicated that a reasonable estimate for division between the beach berm and dune would be the +7 foot elevation.

Average beach and dune erosion volumes, per foot of shoreline length, for each identified coastal segment were determined for use in estimating the sand fill requirements for beach or dune restoration projects. The average volume was multiplied by the total shoreline length of the coastal segment to obtain a total fill volume estimate for the segment. The volumes are listed in the table on the following page.

These volumes represent the maximum volumes that would be needed to restore the beaches and dunes to their pre-storm condition based on immediate after-storm conditions without consideration of either natural or assisted recovery, which may have occurred since the storm. The recommended volume for restoration will likely be less than that listed on the following page. However, areas which were in need of restoration work prior to Hurricane Opal, such as Panama City Beach, will likely be recommended for greater volumes for restoration work than the volumes listed.

SUMMARY OF BEACH AND DUNE VOLUMETRIC
EROSION FROM HURRICANE OPAL ¹

(above mean sea level)

County/Location	Shoreline length (feet)	Dune (cubic yards)	Beach (cubic yards)
Escambia Pensacola Beach (R107-R151)	31,018	TBD ²	TBD
Santa Rosa Navarre Beach (R192-R210)	18,310	TBD	TBD
Okaloosa Ft. Walton Beach (R1-R16)	15,869	326,600	440,000
Destin (R17-R32)	15,477	197,600	229,100
Eastern Okaloosa County(R39-R50)	11,200	135,400	49,100
Walton Western Walton County (R1-R24)	25,859	549,500	160,800
Highlands/Dune Allen (R41-R55)	15,470	288,500	127,600
Blue Mountain Beach (R58-R63)	5,082	84,300	40,100
Seagrove Beach (R82-R98)	16,297	327,700	143,700
Deer Lk-Camp Creek Lk(R98-R106)	9,237	514,700	300
Bay Panama City Beaches (R6-R97)	90,979	888,000	776,100
Mexico Beach (R127-R144)	17,008	28,700	131,000

1. Note: The above erosion summary does not include Gulf and Franklin Counties due to insufficient survey data collection to assess the Opal impact in those counties.

2. Note: TBD indicates the erosion value is still to be determined. Survey control reestablishment and correlation with pre-Opal data is still underway.

V. STORM RECOVERY ALTERNATIVES

Poststorm recovery alternatives depend on the particular conditions at each erosion location segment and consideration of costs and benefits. Alternatives and related considerations addressed below.

A. NATURAL RECOVERY

In the event of storm-induced beach and dune erosion in many areas, eroded sand material is deposited offshore in bar formations. During natural recovery processes, the offshore sand returns to the beach and provides sand for natural berm and dune rebuilding.

All efforts to promote natural recovery will be made. This is a preferred option for undeveloped areas such as state and federal park lands. For a number of the eroded areas, however, natural recovery will not be sufficient. In overwash areas, sand has been removed from the Gulf fronting beach and dune system and will not return without intervention. In other areas, natural sand supply moving alongshore into eroded areas will not balance that which has been lost. Restoration efforts will be needed in these areas.

B. ASSISTED RECOVERY

In areas where natural recovery is not an adequate option, such as areas with significant development which is vulnerable to the threat of storm damage, various human-assisted recovery alternatives may be appropriate. Alternatives include:

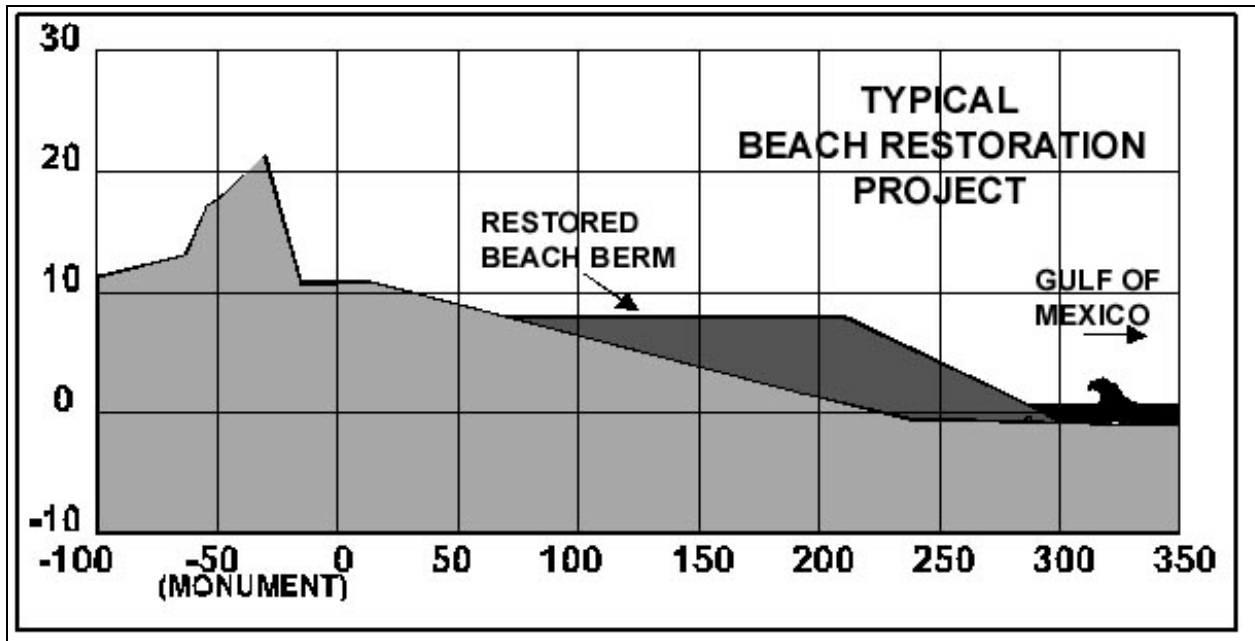
1. BEACH RESTORATION

Beach restoration is the primary alternative for reestablishment of a wide sandy beach to provide a storm protection buffer for threatened upland development in areas subjected to high erosion stress where sand supply is limited and where the protective benefits of the project are high as compared to its cost. A number of indirect benefits which are also derived from beach restoration projects, including recreational benefits for both residents and tourists and restoration of beach habitat.

Beach restoration generally consists of placement of sand obtained from a source outside the active beach and dune system onto the beach to reestablish the beach berm, widen the beach. An illustration of a typical beach restoration design cross-section is shown.

Sand fill placed in a restoration project is usually obtained from an offshore location. The sand is excavated from the seafloor by hydraulic dredge, transported to the beach and discharged by pipeline. Upland sand sources may also be available. The restored beach usually consists of a beach berm, at an elevation of about 7-10 feet above mean sea level, extending seaward a distance of about 200-300 feet.

Sand fill used for restoration projects should be similar to the existing beach in terms of sand grain size, composition, texture, and color. The beaches of the Panhandle are known for their fine-grained, white sand.

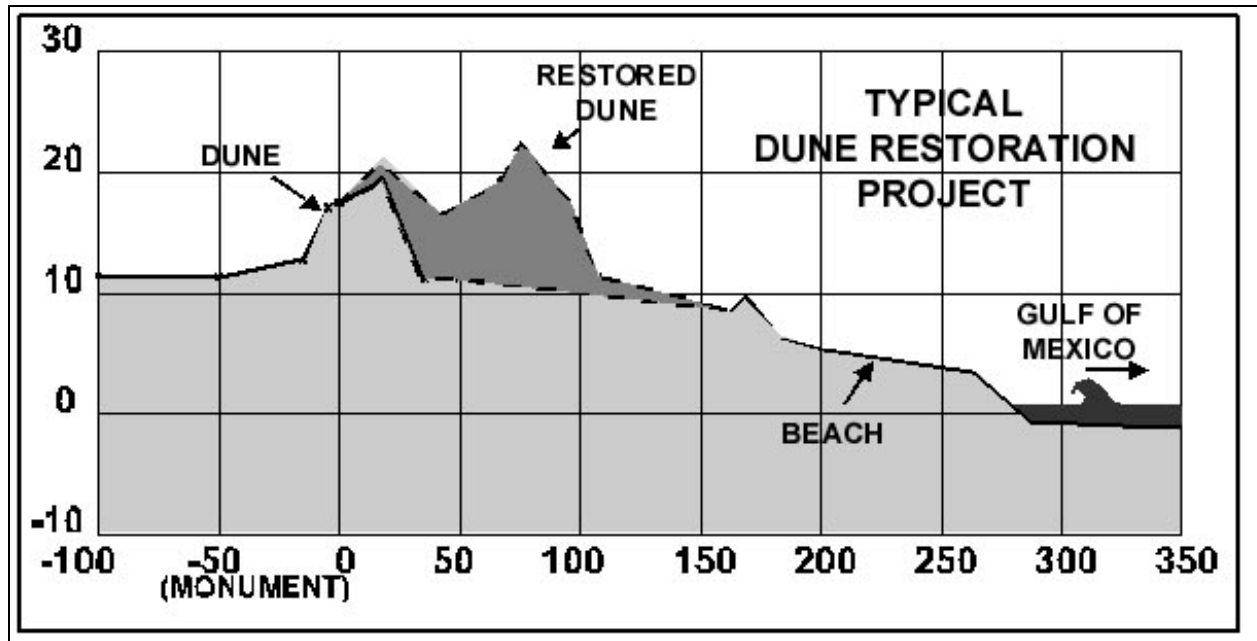


2. DUNE RESTORATION/REVEGETATION

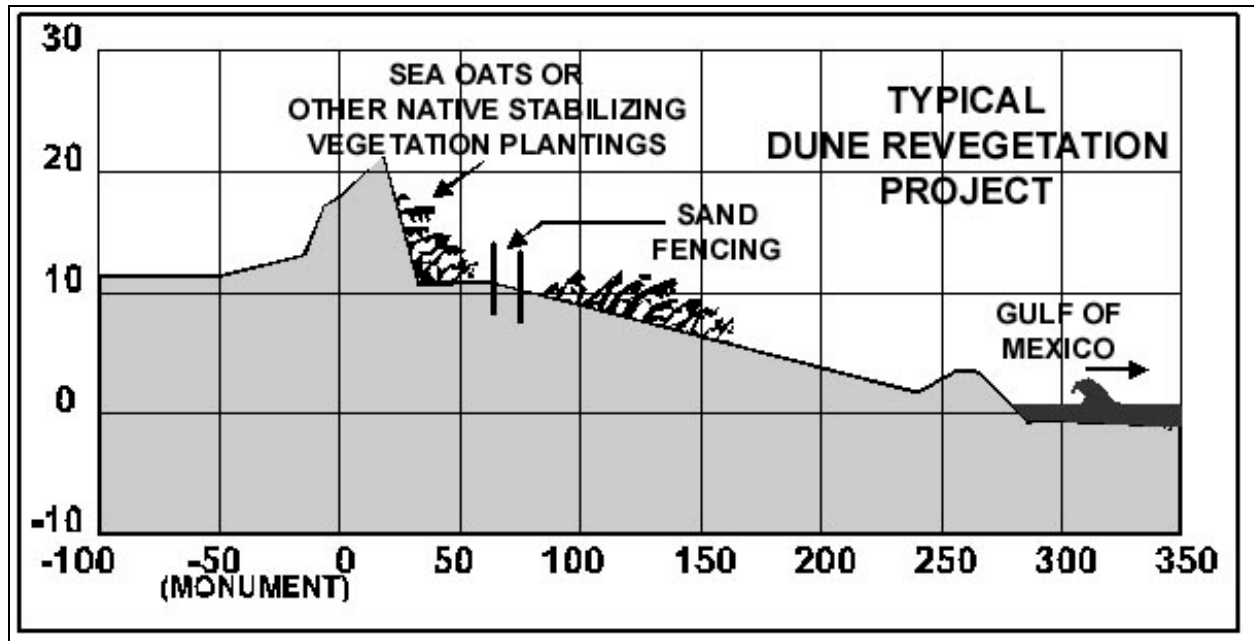
Dune restoration work consists of filling gaps and low areas in existing dunes, adding sand to increase the width and height of dunes where structures are threatened, and restoring dunes which were entirely eroded. An illustration of a cross-sectional view of a typical dune restoration project is shown below.

It is not essential that eroded dune areas be restored to their full pre-Opal configuration. In many cases, a smaller, "starter" dune would provide sufficient restoration and allow nature to take over. Typical dune dimensions of 8 feet in height above the berm elevation with a 40-foot base width are recommended. This would provide at least half the size of dune eroded from Opal in Escambia and Santa Rosa counties and about a third of the eroded dune in Okaloosa through Bay counties.

Sand material for dune restoration work should be derived from similar sources as those used for beach restoration and be compatible with the native sand material.



In most cases, restored dunes should be stabilized with vegetation. The In some areas, revegetation combined with placement of sand fencing may be recommended.



C. INLET MANAGEMENT

There are three major navigational inlets: Pensacola Pass, East Pass (Destin), and St. Andrews Pass (Panama City Harbor Entrance), and one minor inlet at Mexico Beach in the panhandle. Maintenance dredging at the three major inlets is performed by the Mobile District of the Army Corps of Engineers. Mexico Beach maintains its own inlet with a dedicated dredge.

Maintenance dredging at Pensacola Pass was last performed in 1989-91, with approximately 5 million cubic yards of sand placed on the beach within Perdido Key, Gulf Islands National Seashore, and approximately 3.9 million cubic yards of sand placed in a nearshore area (-22 ft. depth). Additional material was disposed of offshore for sand quality and economic reasons. No maintenance dredging is expected within the next two years. At the next dredging event, the plans should be reviewed to see if beach quality sand can be placed on nearby beaches, such as Pensacola Beach, rather than nearshore or offshore sites. Such beach placement may require state funds to pay the additional transport and placement costs. It is recommended that an inlet management plan be developed for this inlet.

Maintenance dredging at East Pass (Destin) occurs approximately every two years. The last dredging was completed in December 1995 (post-Opal). Most of the sand

was used to rebuild the washed-out sand spit (Norriego Point) on the northeast interior side of the inlet, which acts as a wave barrier protecting the inner harbor entrance. No sand was placed in the downdrift west side beach and nearshore disposal site, which is the other primary disposal site in addition to the disposal site on Norreiga Point. Staff will continue to analyze whether sufficient sand is being placed on the downdrift beach on the west side of the inlet to maintain shoreline stability. An inlet management plan should be developed for this inlet. Additional state funds may be needed to ensure proper bypassing of inlet sand to downdrift beaches.

Maintenance dredging at St. Andrews Pass (Panama City) is currently underway. Dredging occurs approximately once every two years. Approximately 105,000 cubic yards of sand from this dredging event will be placed on the beach west of the jetties, in St. Andrews State Park. Sand deposited in the park supplies the downdrift beaches to the west including Panama City Beach. Should the plans for future dredging events call for nearshore or offshore disposal of beach quality sand for economic reasons, the state should fund the additional costs for direct beach placement. It is recommended that an inlet management plan be developed for this inlet.

The Corps concurs with the state that all beach quality sand from inlets should be placed on the beaches if possible, however, federal law requires the state to cost share to get material placed on the beach when such disposal is not the cheapest option. Therefore, the state needs to maintain a contingency fund for such costs. These funds were included in the annual fixed capital outlay of the Department.

At Mexico Beach Inlet, a small jettied canal entrance in eastern Bay County, is being dredged by local interests. The combination of natural sand bypassing and inlet dredging has been maintaining a near stable downdrift (east) beach condition, through 1991 at least. The effect of Opal on this inlet needs to be studied and an inlet plan developed.

D. OTHER ALTERNATIVE AND INNOVATIVE TECHNOLOGIES

In addition to the options listed above there are other means which can be used to mitigate future hazards and there may also be more cost effective methodologies

One option to conventional remediation is to acquire impacted or endangered property or development rights to such property to prevent future development. This is an appropriate response in highly eroding areas and areas subject to major poststorm reconfiguration such as barrier islands, when development of the property could further endanger fragile ecosystems. It is also useful where there is a lack of public lands

for beach access or recreational use. The state has existing programs for this purpose, but they are primarily long range in nature and are not prepared to respond rapidly following coastal storms when acquisition opportunities arise. Coastal planners need to identify these areas before a storm strikes and then be prepared to act quickly afterward.

A second option is to provide relocation assistance to move existing exposed structures to better sites. Many people whose structures survived or who sustained only minor damage are reluctant to or cannot afford the cost of relocating or rebuilding in a more landward location. Chapter 161.053(13), F.S., and recent litigation and legislation on private property rights clearly limit the government's ability to require such action under existing regulatory programs. A program allowing government agencies to provide financial incentives to augment regulatory authority would be far cheaper than litigation and be perceived by the property owner as fair. At present Florida has no incentive program and it can be expected that many structures that should be relocated will be repaired in place.

In addition to the options listed above, major storms present unique opportunities to validate or refine existing beach management policies and to test out new technologies for aiding in poststorm recovery. Several promising technologies that could be useful, but which have not been tested in Florida, are the use of "soft" biodegradable mats and similar products to provide short term protection of dunes while facilitating reformation and stabilization (revegetation) and the use of "pinpoint" dredging to dredge in shallow waters under rough water conditions. The poststorm period also provides a unique opportunity to study natural recovery processes, private citizen and local governmental responses and their effects and a variety of other scientific and policy based questions. The Department has initiated effort to collect data and recalibrate its dune erosion models, to characterize the storm, to reassess 100 frequency year surge elevations for the Panhandle and to do special case studies of selected areas for program performance. In addition, a proposed prestorm planning model is being tested and refined before it is recommended for adoption. Funds need to be allocated for innovative technology testing.

VI. AREA-WIDE RESOURCE NEEDS

A. MARINE DEBRIS REMOVAL

Extensive amounts of construction debris from damaged structures were transported and deposited in nearshore marine waters of the Gulf of Mexico and in inland waters. This debris poses a substantial safety hazard to the public and it is in the best interest of the state to remove as much of this debris as possible. Removal of this debris should be included as a major component of the post-Opal recovery operations. An initial reconnaissance analysis of the debris conditions be conducted followed by a removal operation throughout the Panhandle counties.

Cost Estimate: \$3 million

B. SUPPLEMENTAL SAND RESTORATION

Restoration of all the beach and dune sand which was eroded by Opal will be difficult. A significant amount of the eroded sand has been recovered either by natural processes or assisted activities. Supplemental fill placement will further assist replacement of the eroded sand. The U. S. Army Corps of Engineers has identified an available source of beach quality sand which can be used for supplemental fill placement. The sand is currently stockpiled in an upland disposal site at Fort MacRae in Pensacola Bay. The sand was dredged from the Pensacola Bay Entrance channel and consists of a total of about 2 million cubic yards. It can be transported by barge to designated disposal sites in each of the Panhandle counties of Escambia through Walton, then by truck to identified beach and dune areas.

Cost Estimate: \$10 million

C. SAND SOURCES AND SAND SEARCH STUDIES

In addition to the Fort MacRae supply, additional sand will have to come from outside sources such as from offshore for beach restoration of Panama City Beach in Bay County, and from upland sources for the Stump Hole area of Gulf County.

The only existing offshore geophysical sand searches of significance have been those performed by the U.S. Army Corps of Engineers, Mobile District, in preparation for the proposed Panama City Beach restoration project. Approximately 9.5 million cubic yards of the best available beach quality sand, as judged by the Corps, has been located in seven nearshore borrow sites. The borrow sites are located close enough for pumping onto the shore. Under the pre-Opal proposed plan, this amount would be sufficient for the initial 7.5 million cubic yard placement including one advance renourishment. Other nearshore and

channel borrow areas containing equal and lesser quality sand have also been identified by the Corps, totaling another 12 to 13 million yards. Sand quality is a vital issue with the Panama City Beach project.

It is recommended that additional state funding be provided to conduct further sand search studies. Up to 1.6 million cubic yards of sand may be needed to replace sand eroded by Opal in the Panama city Beach area. Additional quality sand sources should be identified for other areas.

Cost Estimates: \$200,000

D. INLET MANAGEMENT

There is a special need for attention to be given to developing management strategies at seaward inlets within the Panhandle region as already discussed. Three inlets need state resources to ensure proper sand management practices, including Pensacola Bay Entrance, East Pass (at Destin), and St. Andrews Bay Entrance. It is recommended that inlet management plans be developed for these inlets and that funds be provided for any additional costs to place maintenance dredging material on downdrift beaches.

Cost Estimates: \$450,000

E. COASTAL MONITORING AND SPECIAL STUDIES

There is need to continue to monitor beach and dune recovery for purposes of assessing the recovery progress and any additional recovery needs, as well as, to improve understanding of the recovery process. Additional funding is needed to perform surveys to assess the beach and dune recovery. Analytical studies of hurricane impacts including beach and dune erosion and overwash, as well as, recovery processes are needed. Post-Opal storm data needs to be incorporated into recalibration studies of the DEP storm surge and erosion models.

Cost Estimates: \$350,000

F. TECHNICAL ASSISTANCE

Hurricane Opal has placed a major workload burden on the DEP staff which already was experiencing an overload. The number of damaged or destroyed structures that need to be replaced and the extent of damage to the beach and dune system significantly exceeds the ability of the staff to manage routinely. Therefore, OPS funds are needed to augment staff with special technical expertise. This supplemental assistance is expected to be needed for a minimum of 2 years at a cost of \$250,000 per year.

Cost Estimates: \$500,000

G. STATE PARK RESTORATION

Several state parks, recreation areas and other state-managed areas across the Panhandle counties which were impacted by Hurricane Opal. Severe beach and dune erosion occurred in these areas as well as damage to park facilities. In general, natural recovery of the beach and dune areas are expected. However, assisted recovery through placement of sand fencing and selected planting of dune stabilizing vegetation in high-use or critical portions of the parks is recommended. Dune walkover repair and reconstruction is also needed. A major portion of park access road is being replaced at the St. George Island State Park.

Cost estimates prepared by the Division of Recreation and Parks (DRP) for repair and recovery of park facilities and access roads have been provided to the Department of Community Affairs (DCA) for assistance which totaled \$3 million. These DRP cost estimates, however, did not include costs for needed dune restoration work to include sand fence placement and planting of dune vegetation. These additional dune restoration costs are listed below and included in the total funding request developed in this report.

<u>Locations</u>	<u>Dune Restoration Cost Estimate</u>
Topsail Hill Properties	\$ 30,000
Henderson Beach State Recreation Area	\$ 80,000
Grayton Beach State Recreation Area	\$ 50,000
St. Andrews State Recreation Area	\$ 75,000
St. Joseph Peninsula State Park	\$ 85,000
St. George Island State Park	\$180,000
Total Cost	\$500,000

VII. RECOMMENDED PLAN

A. DESCRIPTION OF PLAN

The recommended post-Opal recovery plan consists of a combination of natural and assisted recovery, inlet management and consideration of alternative measures. A detailed plan description for each of the Panhandle counties is presented in the Appendix. A number of specific projects are identified with specific cost estimates.

The plan generally calls for assisted recovery throughout most of the developed areas to consist of dune restoration including general cleanup and debris removal followed by placement of sand fencing, revegetation and construction of dune walkovers.

A major beach restoration project is identified for Panama City Beach. Inlet management is identified for three inlets across the Panhandle region. Special resource needs and poststorm recovery monitoring studies are also identified.

B. COST ESTIMATES

A summary of cost estimates for each identified county recovery projects is contained within the appropriate Appendix. Cost estimates for recovery work, unless specifically provided by local governments or unless applicable to a state park or state recreation area, are based on unit costs derived from cost estimates compiled by the Santa Rosa Island Authority in Escambia County. Costs also assume that the Panama City Beach Restoration project and post-Opal recovery activities are done at the same time. If they are not the total cost will increase by \$8 million.

Costs are generally state shares and are independent of funding source. Costs for post-Opal recovery assume that the state will pay for all state and local shares and have been discounted for federal reimbursement. The \$10.5 million cost for the Panama City Beach restoration project included in the Bay County Plan assumes that the local government will pay twenty-five percent of non-federal costs as required in Chapter 161, Florida Statutes. A summary of all costs identified in this recovery plan is below:

SUMMARY OF POST-OPAL RECOVERY COST ESTIMATES (State Share)

County Recovery Projects:	\$16.8 million
Area-Wide Resources Needs:	\$14.5 million
SUB-TOTAL	\$31.3 million
State Parks Restoration:	<u>\$.5 million</u>
GRAND TOTAL COST:	\$31.8 million

APPENDIX

COUNTY PLANS

A. ESCAMBIA COUNTY

B. SANTA ROSA COUNTY

C. OKALOOSA COUNTY

D. WALTON COUNTY

E. BAY COUNTY

F. GULF COUNTY

G. FRANKLIN COUNTY

A. ESCAMBIA COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

On October 4, 1995, the eye of Hurricane Opal passed over Escambia County, which had not yet recovered from the erosion impact of Hurricane Erin in August, 1995. Major beach and dune erosion was sustained along eastern Perdido Key and all of Santa Rosa Island. The 14.2 mile coastal reach between R32 and R107 (about 6.5 miles west and 7.4 miles east of Pensacola Bay Entrance) was experiencing significant long term erosion prior to Opal.

The 6.5 miles of eastern Perdido Key experienced significant beach and dune erosion in the lee of the eye of Opal, however, much of the beach has recovered. The 7.4-mile stretch along the Fort Pickens portion of the Gulf Islands National Seashore at the west end of Santa Rosa Island also experienced severe erosion. All the dunes between the entrance gate and the facilities at the fort were completely leveled. Some short term natural beach recovery has occurred but natural dune recovery will be a long slow process.

The 6.1-mile developed stretch of Pensacola Beach was severely eroded with part of the beach profile and most all of the dune system being transported inland and removed from the beach area as overwash material. With sand removal conducted along roads, driveways, parking areas, etc., much of this overwash material has been returned to the beach as dune restoration material. The Santa Rosa Island Authority has done an excellent job of retrieving the overwash sand. This has provided a good start for dune restoration. However, the retrieved overwash sand contains a significant amount of debris material. Continued measures to remove the debris are needed, after which placement of sand fencing and dune-stabilizing vegetation such as sea oats is needed.

Much of the beach material along Santa Rosa Island, which was transported offshore, is expected to return to the beach. The eastern 10.2 miles of Escambia County, within the Gulf Islands National Seashore, had not been experiencing significant long term erosion, but was severely eroded by Opal. The beach has already substantially recovered; however, dune recovery throughout this area will be very slow. Some of the beach and all of the dune material was lost in overwash deposits. It is not likely that all this material will be recovered for dune restoration activity. Long term, the erosion stresses on this area can be expected to rise along the shorelines between the overwash areas.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

Considerable portions of the erosion impacted areas of Escambia County are in undeveloped federal land and part of the Gulf Islands National Seashore, including eastern Perdido Key (R32-R67), Fort Pickens (R68-R107), and Santa Rosa Island (R141 - R192). Pensacola Beach (R107 - R139) is highly developed throughout with a mix of residential (single-family and multifamily) and commercial (hotel/motels and restaurants) structures. One major public

boardwalk, and one gulf fishing pier were destroyed and three major recreational areas were damaged. Much of the beachfront development in Pensacola Beach is vulnerable to future storms.

III. PLAN RECOMMENDATIONS

A. PLAN SUMMARY

The recommended plan for Escambia County is for natural recovery in most of the undeveloped areas of eastern Perdido Key, Fort Pickens, and Gulf Islands National Seashore, and assisted recovery through dune restoration in the developed areas of Pensacola Beach and where needed to protect federal park facilities. Inlet sediment management is also recommended for Pensacola Bay Entrance to mitigate long term erosion of the adjacent beaches and to provide an additional source of material for dune restoration at Pensacola Beach.

B. DETAILED PLAN DESCRIPTION

1. East Perdido Key (R32-R67) - Inlet sand transfer and natural recovery.

This area is undeveloped federal land. Long term erosion is expected to continue with short term poststorm recovery of the beach. A continuation of inlet sand transfer to this area can mitigate future erosion. Natural recovery is considered appropriate given its park status and lack of threatened upland development. An inlet management plan should be developed to assess and establish a long-term disposal plan for this inlet. For an additional cost to the normal maintenance dredging operation, inlet sand could be transported and disposed of along Pensacola Beach. Consideration should be given for this needed additional funding for alternate beach disposal.

2. Fort Pickens (R68-R107) - Natural and assisted recovery.

This area is undeveloped federal land and long term erosion is expected to continue with some short term poststorm recovery of the beach. Dune recovery will be a slow process. With the exception of the park road and some park facilities no development is threatened; therefore, natural recovery is generally recommended. Some dune restoration may be appropriate at the high use areas where water is available for dune plantings. Sand fencing could also be employed to reduce sand blowing problems at parking areas along the road accessway and to assist overall dune recovery. Asphalt debris from the road should be removed before it is buried by drifting sand. The road should be relocated more landward especially if damaged by future storm activity.

3. Pensacola Beach (R107-R151) - Assisted recovery.

This beach community is highly developed throughout with a mix of residential (single-family and multifamily) and commercial (hotel/motels, restaurants) structures. There is one major public boardwalk (destroyed) and public recreation area and fishing pier (now gone). There are two major public beach restoration areas (damaged) located at each end of Pensacola Beach. The beach and dune system was severely eroded and much of the beach and dune material was transported inland and lost as overwash material.

Fortunately, a significant amount of the overwash material has been recovered and returned to the beach as dune restoration material. This has provided a good initial step for post-Opal recovery. However, much of the fill is located too far seaward, needs to be reshaped and relocated and debris has to be removed prior to planting. This debris removal should be conducted as soon as possible to allow continued natural beach and dune recovery to occur with as little disruption as possible.

There is no need for full scale beach restoration at this time. However, the entire community is vulnerable to future storm flooding and erosion. To assist recovery of the beach and dune system and to mitigate against future storm damage to upland development, completion of dune restoration work is recommended for the entire stretch of Pensacola Beach. The primary source of dune restoration material for the post-Opal recovery effort is overwash deposits.

Additional material for continued dune restoration and any needed beach restoration identified in the future may be available from maintenance of the navigational channel through Pensacola Bay Entrance. Funds would be needed to obtain the dredged material and transport it to Pensacola Beach for beach restoration activities, but it could be expected to be a relatively low cost and make use of any significant amounts of good quality sand which would otherwise be dumped at sea in the Gulf. No dredging is planned at this time.

Dune Restoration Project: Dune restoration sand material has already been placed along 7 miles of Santa Rosa Island using recovered overwash sand. There is a substantial amount of debris within the retrieved overwash sand which should be removed as soon as possible to minimize disruption of natural dune recovery.

After debris removal, relocation and reshaping is completed, sand fencing and dune revegetation should be used to protect the entire restored dune. Approximately 24 acres of sea oat vegetation, and sand fencing throughout a 7 mile project area are needed.

Replacement dune walkovers are needed at 7 major public access areas. An additional 24 dune walkovers are needed at smaller public access points to assist in the overall dune recovery effort. Private developments will also need to replace dune walkover structures in front of those

properties. This work is being funded by FEMA.

As this area will be subjected to increased long term erosion stress due to overwash losses other alternatives to assist recovery of this area such as the relocation of some development during the redevelopment process need to be included. New or rebuilt dwellings along Ariola Drive should be resited landward up to and as close to the road as possible.

Cost Estimates: (based on estimates compiled by SRIA)

Debris Removal: \$447,000 (includes dune reshaping)

Sand Fencing: \$101,090

Revegetation: \$629,927 (sea oats; planted and watered)

Dune Walkovers: (funded through FEMA)

Total: \$1,178,017

Inlet Management Project: All sand dredged by the Corps or U.S. Navy from Pensacola Harbor entrance channel which is beach compatible sand should be placed on a designated adjacent beach disposal area. If funds are provided by the State, this sand could be placed in a location of need or where desired. An inlet management plan should be developed to establish a state plan for the most cost effective and environmentally acceptable utilization of the state-owned dredge material removed from the inlet.

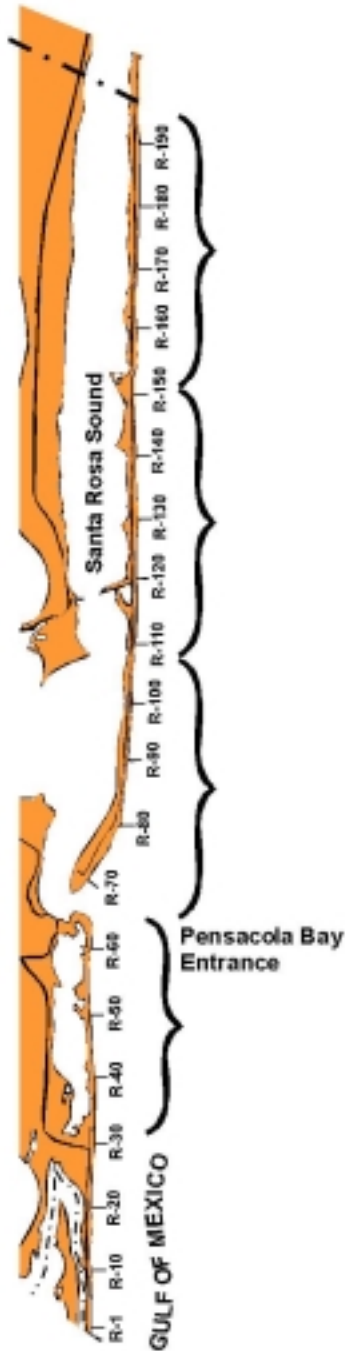
4. Gulf Islands National Seashore (R141-R192) - Natural and assisted recovery.

This area is federal land with National Park Service. The beach and dunes were severely eroded throughout and much material was lost to extensive overwash deposits. The federal government is not likely to recover this material for dune restoration activity. There has already been substantial natural recovery of the beach berm, but dune recovery will be very slow.

Some dune restoration should be performed in breaches in areas where prominent dunes still exist. Dune plantings may be appropriate at the high use facilities when water becomes available. Sand fencing can be used to reduce sand blowing problems at parking areas and vulnerable road locations. Road relocation further landward is also recommended where it would pose minimal environmental impact and would enhance dune recovery. Road reconstruction is already underway.

TOTAL COUNTY COST ESTIMATE: \$1,178,017

Escambia County



Gulf Islands Nat. Seashore R-151 - R-192

1. Dune Restoration
2. Structure Relocation

Pensacola Beach R-107 - R-151

1. Dune Restoration
2. Structure Relocation

Fort Pickens R-68 - R-107

1. Dune Restoration
2. Preservation

East Perdido Key R-31- R-67

1. Inlet Sand Transfer
2. Preservation

B. SANTA ROSA COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

Santa Rosa County experienced the significant erosion during Hurricane Erin in August, and dune recovery had not yet taken place when Opal impacted the same area. With the exception of a small remnant dune at R211 near the old Navarre Pass, virtually all the dunes in Santa Rosa County were leveled. Part of the beach and dune sand was transported inland across Santa Rosa Island as overwash. Some beach material which was transported offshore has returned to the beach. Little of the overwash material can be returned to the beach to renourish the profile or to create much of a new dune system, and natural dune recovery will be very slow.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

The eastern third of Santa Rosa County is undeveloped federal land. The developed beach community of Navarre Beach occupies the western part of the county. This community was highly developed throughout with a mix of residential (single-family and multifamily) and commercial (hotel/motel) structures. Many were destroyed or severely damaged. One gulf fishing pier survived, without its pier house. Much of the beachfront development in Pensacola Beach is vulnerable to storm impacts.

III. PLAN RECOMMENDATIONS

A. PLAN SUMMARY

The recommended plan for Santa Rosa County is natural recovery in the undeveloped federal areas of Eglin Air force, and assisted recovery in the developed area of Navarre Beach. Dune restoration through placement of sand fencing and revegetation is recommended for Navarre Beach.

B. DETAILED PLAN DESCRIPTION

1. Navarre Beach (R192-R211) - Assisted recovery.

This beach community was highly developed throughout with a mix of residential (single-family and multifamily) and commercial (hotel/motel) structures. One fishing pier survived minus its pier house. Navarre Beach was very hard hit by Hurricane Opal. The beach and dune system was severely eroded with much of the beach and dune material transported inland and lost as overwash material. Very little overwash material has been returned to the beach. Recovery of this sand will be costly and would produce sand which contains significant amounts of debris and foreign material. The debris and foreign material will require removal at additional cost.

There has already been substantial natural recovery of the beach. Natural dune recovery has begun and is preferred considering the cost and compatibility problems associated with bringing sand back to the beach. Enhancement and assistance to the natural dune recovery processes should be performed through placement of sand fencing and revegetation with sea oats and other dune stabilizing vegetation. Some of this enhancement work along some of the properties has already been completed at this time.

Prior to performing further work assisting the dune recovery process, there is a need to complete cleanup and removal of debris which is scattered along beach and dune areas as a result of damaged structures. The cleanup of this debris should be performed as soon as possible so that it can be accomplished with as little disruption to the natural dune recovery process as possible.

Beach restoration is not needed at this time. However, this area should be monitored and a continued review of beach recovery should be conducted to assess if future restoration work is needed. Sand source studies will be necessary to locate an acceptable sand source if beach restoration is warranted in the future.

Dune Restoration Project: Some natural dune restoration is evident in certain areas along the 3.6 miles of Navarre Beach shoreline. Additional fill material will be necessary if the dunes are to be restored in many areas especially at the western end.

Debris in the sand should be removed as soon as possible to reduce disruption of the natural dune recovery process. Dune recovery should be assisted by placement of sand fencing along the 3.6 miles of recovering dune as well as revegetation of approximately 12 acres of sea oats and other dune stabilizing vegetation. Some of this work has been completed.

Dune walkovers are necessary at each of the public accesses. Private properties should replace dune walkovers in front of their properties.

Some development should be relocated to a more landward site during the redevelopment process. New structures should be resited back to the road.

Cost Estimates:

Debris Removal: \$219,720 (includes dune reshaping, if needed)

Sand Fencing: \$57,000

Revegetation: \$342,000

Dune Walkovers: (funded through FEMA)

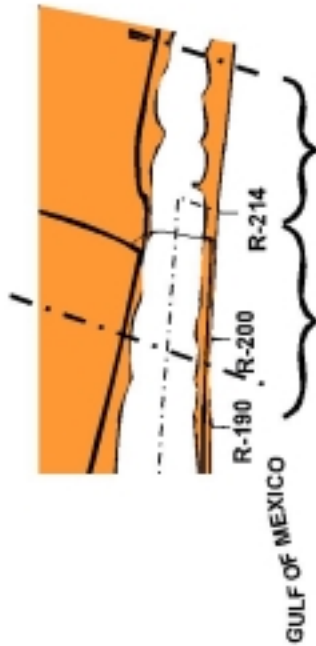
Total: \$618,720

2. Eglin Air Force Base (R211 - County line) - Natural recovery.

This federal land is part of Eglin Air Force Base. The beach and dunes were severely eroded throughout the area and much material was lost to extensive overwash deposits. There is no development in this area and natural recovery is recommended.

TOTAL COUNTY COST ESTIMATE: \$618,720

Santa Rosa County



Eglin Air Force Base R-211 - County Line

1. Preservation

Navarre Beach R-192 - R-211

1. Dune Restoration
2. Structural Relocation

C. OKALOOSA COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

The highest winds of Opal were experienced in Okaloosa County and the 20 miles of beach along eastern Santa Rosa Island were severely impacted by storm surge and wave overtopping. Dunes were leveled and coastal flooding occurred across the island.

The western 12.3 miles of county beach within Eglin Air Force Base experienced substantial overwash deposits from the beach and dune profile erosion. Long term erosion was not significant in this area. The beach should recover but dune recovery will be slow.

The 3-mile developed area of Okaloosa Island (Ft. Walton Beach area) lost up to 200 feet of vegetated dune width. Assisted recovery will be required. The easternmost portion of the 4.7 mile stretch of Eglin Air Force Base beach between Okaloosa Island and East Pass was experiencing long term erosion due to the inlet. Dune erosion along the east end of Santa Rosa Island toward the inlet was so severe that large breaches in the dune field resulted in the creation of a temporary flowing inlet and overwash which destroyed a segment of US Highway 98. The damaged road has been repaired.

East of East Pass in Destin, substantial overtopping similar to that which occurred along Santa Rosa Island was experienced along Holiday Isles (R17 to R32) with beach and dune material being transported upland and partly into Old Pass Lagoon as overwash. The prospect of beach recovery along Destin is good because of the favorable stabilizing influence of the East Pass east jetty, but the beach recovery may be slower than expected as a result of beach scraping activities along this area. Dune recovery is expected to be slow; however, activities such as scraping and sand fencing have accelerated recovery. The beach was low and flat in the scraped areas at the time of this report.

Shoreline recovery along the developed section of Norriega Point will be minimal without assistance. Damaged bulkheads and seawalls will need to be repaired. The Corps of Engineers has rebuilt the northern end of the sand spit which was washed out by Opal. The 1.4 mile segment of Henderson Beach State Park (R32 to R39) and the 2.1 mile segment (R39 to R50) at the east end of the County experienced little overwash loss but had significant dune erosion. Long term erosion of the eastern beaches is not significant. Most of the beach and dune material was moved offshore and has partially returned to the beach. Dune recovery of this area is expected to be slow; but, substantial beach scraping east of Henderson Beach has rebuilt a significant dune system. The beach was generally low and flat in scraped areas at the time of this report. Sand fencing and revegetation can be expected to further assist recovery in this area.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

The western half of Okaloosa County and the eastern 4.7 miles of Santa Rosa Island are generally undeveloped federal lands which are part of Eglin Air Force Base. There are only a few scattered Air Force facilities in these areas; however, between them is the 3 mile beach community of Okaloosa Island. This community is highly developed throughout with a mix of multifamily residential structures and commercial hotels/motels and restaurants. There is also one fishing pier which lost its seaward end during Opal. East of East Pass, the city of Destin includes the developed areas between the inlet and Henderson Beach and between Henderson Beach and the Walton County line. Henderson Beach is undeveloped except for state park facilities. The City of Destin is highly developed with a mix of residential (single-family and multifamily) and commercial (hotel/motel) structures. East of Henderson Beach along the old U.S. 98 the area is highly developed with multifamily residential structures and a few restaurants. There is also a developed public park access and recreational facilities. Much of the beachfront development in the beach communities of Okaloosa Island and Destin is vulnerable to further hurricane impact.

III. PLAN RECOMMENDATIONS

A. PLAN SUMMARY

The recommended plan for Okaloosa County is natural recovery in the undeveloped areas of Eglin Air Force Base, both west and east of Ft. Walton Beach, and at Henderson Beach, and assisted recovery in the developed areas of Ft. Walton Beach, Destin, and the east end of Okaloosa County and where needed to protect state park and Air Force facilities. Inlet sand management through sand bypassing to downdrift beaches is also recommended for East Pass (Choctawhatchee Bay Entrance) to mitigate long term erosion of eastern Santa Rosa Island, including Ft. Walton Beach.

B. DETAILED PLAN DESCRIPTION

1. Eglin Air Force Base (County line-R1) - Natural recovery.

This federal land is part of Eglin Air Force Base. The beach and dunes were severely eroded throughout this area and much material was lost to extensive overwash deposits. This area is generally undeveloped with a few isolated Air Force facilities. Natural recovery and natural revegetation is appropriate but dune recovery will be slow. The Air Force may desire to conduct isolated dune restoration and/or sand fencing to protect specific facilities. Other alternatives include relocating or deactivating damaged facilities as deemed appropriate by the Air Force.

2. Okaloosa Island (R1-R16) - Assisted recovery.

This beach community is highly developed throughout with a mix of multifamily residential structures and commercial structures (hotel/motels and restaurants). The beaches and dunes were severely eroded throughout the area with up to 200 feet, of

vegetated dune width seaward of the development. Long-term erosion has not been significant in this area in recent years; however, erosion may increase in the future if sufficient bypassing of inlet sand at East Pass to downdrift beaches is not performed. As a result of Hurricane Opal part of the beach profile and all of the dunes were transported inland across the island as overwash. Significant initial beach recovery has occurred.

Significant natural dune recovery is not expected to occur for a substantial period of time. However, as a result of Okaloosa County's efforts in retrieving overwash sand, dune recovery has been initiated by placement of a substantial restored dune formation along the backshore. However, the dune contains large quantities of debris which must be removed as soon as possible.

Some of the restored dune should be relocated further upland after debris removal is completed. Placement of a significant amount of additional dune sand should not be necessary at this time. After debris removal is completed, sand fencing and revegetation with sea oats should be installed along the seaward face of the dune.

There is no need for a beach restoration project at this time; however, the entire community will continue to be vulnerable to future storm flooding and erosion. Ultimately, inlet sand transfer to the west of East Pass, if it is placed properly on the downdrift beaches, can be expected to benefit the Fort Walton Beach area.

Dune Restoration Project: Dune restoration has already been initiated through the County's efforts of retrieving overwash sand and placing it in dune formations. However, substantial debris within the retrieved overwash sand should be removed as soon as possible.

Sand fencing and dune revegetation should be placed along the restored dune area after debris removal is completed. Sand fencing should be placed along the entire 3 miles and 10 acres of sea oat vegetation should be planted. Some of this work has been completed at this time.

Dune walkovers should be constructed at each of the public access points.

Cost Estimates:

Debris Removal: \$190,428 (includes dune shaping)

Sand Fencing: \$47,600

Revegetation: \$285,640

Dune Walkovers: (funded through FEMA)

Total: \$523,668

3. Eastern Santa Rosa Island (R16-R17) - Assisted and natural recovery.

This federal land is part of Eglin Air Force Base. Although generally undeveloped there are a few Air Force facilities including the Officers Club, the A2 Test Site, and the Beach Club, each of which was severely damaged. The shoreline west of East Pass (Choctawhatchee Bay Entrance) was experiencing long term erosion associated with inlet shoal losses. This erosion has been partially mitigated by a sand transfer operation consisting of disposing of outer channel dredged material into nearshore areas downdrift of the inlet conducted by the Corps of Engineers during maintenance of the federal navigation project through East Pass. Monitoring has been very limited and is needed. Hurricane Opal caused erosion so severe that large breaches in the dune field resulted in the creation of a temporary flowing inlet and overwash which destroyed a substantial segment of U.S. Highway 98 between Fort Walton Beach and Destin. The reconstructed highway remains vulnerable to lesser storms because of insufficient dune protection.

In lieu of beach restoration, sand transfer to downdrift beaches from the East Pass channel maintenance dredging is recommended. Dune restoration is also recommended for the protection of U.S. Highway 98. Sand fencing should be placed in all major breach areas.

Inlet Management Project: Sand dredged by the U.S. Army Corps of Engineers in East Pass should be placed along on the downdrift beach west of the inlet or in other approved sites identified in a plan approved by the Department. Some of this material could also be utilized in a dune project to protect the highway from another breakthrough. An inlet management plan should be developed to establish a state policy and plan for the most cost effective and environmentally acceptable utilization of the dredge material removed from East Pass. State funds should be made available for sand transfer if needed to ensure proper bypassing to downdrift beaches.

4. Destin (R17-R32) - Assisted recovery.

This beach community is highly developed with a mix of residential (single-family and multifamily) and commercial (hotel/motel) structures. Long term erosion is not significant; however Opal caused a large amount of overwash. The prospect for beach recovery along Destin is good because of the stabilizing influence of the East Pass east jetty. However, beach recovery will be slower than expected as a result of beach scraping activities along this area. Dune recovery is expected to be slow; however, activities such as scraping and sand fencing are assisting the dune recovery process. Following completion of dune restoration activities, this area will remain vulnerable to future flooding from major storms.

Dune Restoration Project: Dune restoration has already been initiated through a combination of the County's efforts to retrieve overwash sand and beach scraping. There should not be a need for placement of additional sand at this time. However, debris within the retrieved overwash sand should be removed as soon as possible.

Sand fencing and dune revegetation should be placed along the restored dune area after debris removal is completed. Sand fencing should be placed along the entire 2.9 miles and a total of 10 acres of sea oat vegetation should be planted throughout the area. A significant amount of sand fence placement and revegetation has already been completed.

Dune walkovers should be constructed at each of the public access points.

Cost Estimates:

Debris Removal: \$185,724 (includes dune reshaping)

Sand Fencing: \$46,424

Revegetation: \$278,584

Dune Walkovers: (funded through FEMA)

Total: \$510,732

5. Henderson Beach (R32-R39) - Natural and assisted recovery.

This area is undeveloped except for state park facilities. Long term erosion is not significant in this area. Most of the beach and dune material was transported offshore and is expected to return to the beach. Natural recovery is generally recommended with limited supplemental dune restoration. Sand fencing would assist natural dune recovery and would help limit pedestrian impact on recovering dune areas. Revegetation with sea oats would also assist the dune recovery process. Repair or replacement of dune walkovers is needed. Recovery work is the responsibility of the Division of Recreation and Parks.

6. Eastern Okaloosa County (R39-R50) - Assisted recovery.

This area is highly developed with multifamily residential structures and a few restaurants seaward of Old U.S. Highway 98. Long term erosion is not very significant and most of the beach and dune material was transported offshore and is expected to return to the beach. Dune recovery is expected to be slow but substantial beach scraping has already recreated a significant dune system. A flatter, narrower beach also existed at the time of this report due to the beach scraping activity. Assisted dune restoration through placement of sand fencing and revegetation with sea oats is recommended. Dune walkover repair and/or reconstruction is recommended for public access locations. In addition, some of the rebuilt structures should be relocated landward.

Dune Restoration Project: Dune restoration has been initiated by the forming of dunes from beach scraping operations. Placement of additional sand at this time is not needed. However, there is a need to remove debris within the beach and dune areas as soon as possible to minimize disruption of natural dune recovery processes.

Sand fencing and dune revegetation should be placed along the restored dune area after debris removal is completed. Sand fencing should be placed along the entire 2.1 miles and a total of 7.2 acres of sea oat vegetation should be planted throughout the area. A significant amount of sand fence placement and revegetation has already been completed. Extensive debris removal may not be needed in this area.

Dune walkovers should be constructed at each of the public accesses.

Cost Estimates:

Debris Removal: \$134,400 (includes dune reshaping)

Sand Fencing: \$33,515

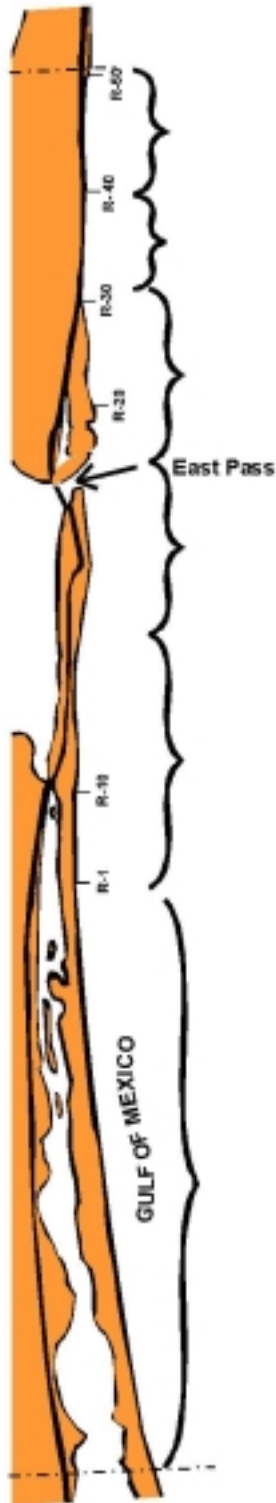
Revegetation: \$201,600

Dune Walkovers: (funded through FEMA)

Total: \$369,515

TOTAL COUNTY COST ESTIMATE: \$1,403,915

Okaloosa County



Eastern Okaloosa County R-39 - R-50

1. Dune Restoration
2. Structural Relocation

Henderson Beach R-32 - R-39

1. Dune Restoration
2. Structural Relocation

Destin R-17 - R-32

1. Dune Restoration
2. Structural Relocation

Eastern Santa Rosa Island R-16 - R-17

1. Inlet Sand Transfer
2. Dune Restoration
3. Structural Relocation

Fort Walton Beach R-1 - R-16

1. Dune Restoration

EGLIN AIR FORCE BASE County Line - R-1

1. Dune Restoration
2. Structural Relocation
3. Preservation

D. WALTON COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

Opal's storm surge and wave energy inflicted severe erosion along the beaches and dunes of Walton County. The Walton County dunes eroded by Opal are not expected to completely recover to their prestorm elevations and volume by natural processes. Long term erosion has not been significant in Walton County prior to the storm and some beach recovery is apparent. Substantial beach scraping in most of the developed areas has recreated a significant dune system which in some areas exceeds the dimensions of the prestorm conditions. Some overtopping losses were experienced between R46 and R47 into Oyster Lake (Dune Allen), at R55 into Draper Lake (Dune Allen), between R64 and R65 at Big and Little Redfish Lakes, between R72 and R73 into Western Lake (Grayton Beach), between R94 and R95 into Eastern Lake (Seagrove Beach), near R100 at Deer Lake and near R105 at Camp Creek Lake. In most of the other areas, dune erosion losses were transported offshore and are expected to remain in the coastal system and be available to return to the beach. The scraped beaches were observed at the time of this report to be relatively flat and narrow compared to pre-storm conditions. In scraped areas beach recovery will be impaired and take longer to occur.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

Walton County has several developed segments and a few undeveloped stretches of natural beaches and dunes. The western 4.5 miles is highly developed with residential multifamily and single-family dwellings and commercial hotels/motels. There is a checker board of high density development (e.g., Edgewater, Main Sail, Grand Villas, Sandestin) and single-family/multifamily (Tang O Mar, Caribe, Gulf Pines, Four Mile Village), plus one travel trailer park. To the east are three miles of undeveloped land owned by the state called Topsail Hill. East of Topsail Hill along county Road 30A are the predominantly single-family residential communities of Sunrise Beach, Beach Highlands, Santa Rosa Island, and Dune Allen Beach. East of Dune Allen is the undeveloped Blue Gulf Beach and to the east is Blue Mountain Beach which is developed with predominantly single-family dwellings along with several multifamily developments and one restaurant. East of Blue Mountain Beach are the beach communities of Gulf Trace, Grayton Beach, and Seaside which mix mostly single-family developments with undeveloped segments. The eastern 8.5 miles includes the beach communities of Seagrove Beach, Seacrest Beach, and Inlet Beach along with segments of undeveloped parcels. With the exception of the Grayton Beach and Seaside communities, most of the developed areas of Walton County is vulnerable.

III. PLAN RECOMMENDATIONS

A. PLAN SUMMARY

The recommended plan for Walton County is natural recovery in the undeveloped areas of Topsail Hill, Blue Gulf Beach, Grayton Beach State Park, Deer Lake to Camp Creek Lake, and Dana Beach, and assisted recovery in the developed areas of western Walton County, Beach Highlands, Dune Allen Beach, Blue Mountain Beach, Gulf Trace, Grayton Beach, Seaside, Seagrove Beach, Seacrest Beach, and Inlet Beach and where needed to protect state park facilities.

B. DETAILED PLAN DESCRIPTION

1. Western Walton County (R1-R24) - Assisted recovery.

This area is highly developed with residential multifamily and single-family dwellings and commercial hotels/motels. There is a checker board of high density development (e.g., Edgewater, Main Sail, Grand Villas, Sandestin) and single-family neighborhoods (Tang O Mar, Caribe, Gulf Pines, Four Mile Village), plus one travel trailer park. Long term erosion is not significant. Most of the beach and dune material was transported offshore. Substantial beach scraping has created a significant dune area which in some areas exceeds the dimensions of the prestorm conditions but is at the expense of beach berm recovery which is narrow and low in places.

Dune Restoration Project: Dune restoration has been initiated by the reforming of dunes from beach scraping operations. Completion of dune restoration is recommended. No additional fill placement is needed at this time. Additional work includes revegetation, irrigation, fertilization, sand fencing, and walkovers. Much of this work is complete at this time. Extensive debris removal may not be needed in this area.

Dune walkovers should be repaired or reconstructed, as needed, at public accessways. Also, some rebuilt structures should be relocated landward.

Cost Estimates:

Debris Removal: \$310,308 (includes dune reshaping)

Sand Fencing: \$77,566

Revegetation: \$465,459

Dune Walkovers: (funded through FEMA)

Total: \$853,333

2. Topsail Hill (R24-R41) - Natural recovery.

This area is undeveloped state land and natural recovery is recommended.

3. Beach Highlands/Dune Allen Beach (R41-R55) - Assisted recovery.

This area was highly developed with predominantly single-family dwellings along with a few multifamily dwellings. Many of the poorly-designed dwelling structures built prior to the coastal construction control line were destroyed. Rebuilding of the structures will be problematic due to the seaward locations of many of the lots. Long term erosion is not very significant in this area. A substantial portion of the eroded beach and dune material was transported offshore and a substantial portion was overwashed. This area experienced substantial beach scraping which has restored much of the dune but left the beach berm low and narrow.

Natural dune recovery would be slow, but substantial beach scraping has recreated a significant dune system. Some overtopping losses were experienced between R46 and R47 into Oyster Lake and at R55 into Draper Lake.

Dune Restoration Project: Dune restoration has been initiated by the reforming of dunes from beach scraping operations. Completion of dune restoration is recommended. No additional fill placement is needed at this time. Some additional work to be completed may include revegetation, irrigation, fertilization, sand fencing, and walkovers. Much of this work is completed at this time. Extensive debris removal may not be needed in this area. However, significant debris exists on lots where houses were removed without adequate cleanup.

Dune walkovers should be repaired or reconstructed, as needed, at public accessways.

Cost Estimates:

Debris Removal: \$185,640 (includes dune reshaping)

Sand Fencing: \$46,400

Revegetation: \$278,458

Dune Walkovers: (funded through FEMA)

Total: \$510,498

4. Blue Gulf Beach (R55-R58) - Natural recovery.

This area is undeveloped private land and natural recovery is recommended.

5. Blue Mountain Beach (R58-R63) - Assisted recovery.

This area is highly developed with predominantly single-family dwellings along with several multifamily dwellings and one restaurant. Long term erosion is not significant in this area. Most of the eroded beach and dune material was transported offshore. A portion of the sand has returned to the beach and has been scraped into a dune system. Natural dune recovery should be slow with complete recovery of the high elevation cliff features unlikely given the high elevations and large volume lost. However, substantial beach scraping has restored a significant portion of the eroded dune profile at the expense of the beach berm which is narrow and low in many places.

Dune Restoration Project: Dune restoration has been initiated by the reforming of dunes from beach scraping operations. Completion of dune restoration is recommended. No additional fill placement is needed at this time. Some additional work includes revegetation, irrigation, fertilization, sand fencing, and walkovers. Much of this work is completed at this time. Extensive debris removal may not be needed in this area.

Dune walkovers should be repaired or reconstructed, as needed, at public accessways.

Cost Estimates:

Debris Removal: \$60,984 (includes dune reshaping)

Sand Fencing: \$15,243

Revegetation: \$91,475

Dune Walkovers: (funded through FEMA)

Total: \$167,702

6. Gulf Trace, Grayton Beach, Seaside (R64-R82) - Natural and assisted recovery.

This area is undeveloped between R64 and R67; developed with single-family dwellings for 1400 feet near R68 (Gulf Trace Beach); undeveloped between R69 and R71; developed with single-family dwellings for 1800 feet between R71 and R73 (Grayton Beach); undeveloped between R73 and R79 (Grayton Beach State Park); and developed with single-family dwellings and some commercial buildings with good setback for 2800 feet between R80 and R82 (Seaside). Long term erosion throughout this area is not significant and the prospect for beach recovery is good; however, dune recovery will be slow. Overtopping losses were experienced at Big and Little Redfish Lakes (R64 - R65) and at Western Lake (R72 - R73).

Only the 1400 feet of dwellings at Gulf Trace Beach and a few seaward dwellings at R71 in Grayton Beach can be considered threatened at this time. Landward of the coastal construction control line and seaward of Hotz Street in Grayton Beach, at least eleven single-family dwellings sustained major structural damage due to the storm surge flooding. These structures are outside of the state's regulatory jurisdiction and the local government enforces construction within the coastal building zone. The rebuilt structures should be elevated above + 17 feet (NGVD).

Natural recovery is recommended for this area. While dune restoration is appropriate in the developed areas and to some degree in the state park, beach scraping has partially restored the eroded dune profile at Gulf Trace and Seaside. These scraped areas have not had a severe effect on the beach berm which, although low, remains relatively wide in most areas. Those areas need revegetation, irrigation, fertilization, sand fencing, and walkovers, much of which is already completed. Sand fencing and walkovers should also assist recovery of the dunes in the state park. Dune walkovers are recommended for all public beach access locations. Extensive debris removal is not necessary in this area.

7. Seagrove Beach (R82-R98) - Assisted recovery.

This area is highly developed with predominantly single-family dwellings between R82 - R88, R91-R94, R95 - R96, and multifamily dwellings between R88 -R91, and at R94, R96, and R98. Given the high dune elevations, Seagrove Beach dwellings were historically founded on concrete slabs and footings. Following the severe erosion of Opal, much of the beach front development in this community will continue to be vulnerable to future storms.

Long term erosion is not significant in this area. Most of the eroded beach and dune material was transported offshore and a portion of the sand has returned to the beach and been scraped into a dune system. Overtopping losses were experienced at Eastern Lake (R94 -R95). Dune recovery will be slow with complete recovery of the high elevation cliff features not likely given the high elevations and large volume lost. However, substantial beach scraping has restored a significant portion of the eroded dune profile. All that is now needed in this area is completion of revegetation, irrigation, fertilization, sand fencing, and walkovers.

Dune Restoration Project: Dune restoration has already been initiated by the reforming of dunes from beach scraping operations. Completion of dune restoration is recommended. No additional fill placement is needed at this time. Some additional work to be completed may include revegetation, irrigation, fertilization, sand fencing, and walkovers. Much of this work is already completed at this time. Extensive debris removal may not be needed in this area.

Dune walkovers should be repaired or reconstructed, as needed, at public accessways.

Cost Estimates:

Debris Removal: \$195,564 (if needed, includes cost of dune reshaping)

Sand Fencing: \$48,884

Revegetation: \$293,344

Dune Walkovers: (funded through FEMA)

Total: \$537,792

8. Deer Lake to Camp Creek Lake (R98-R106) - Natural recovery.

This area is undeveloped private land and natural recovery is recommended. The prospects for beach recovery is good; however, dune recovery will be slow. Dune overtopping losses were experienced at Deer Lake near R100 and R105. A large portion of this area is presently being purchased by the Department under the Conservation and Recreation Lands program.

9. Seacrest Beach (R106-R115) - Assisted recovery.

This area is highly developed with predominantly single-family dwellings in the vicinity of R106 to R107 and R114 to R115, and predominantly multifamily dwellings with some single-family dwellings between R107 and R114.

Long term erosion is not significant and most of the eroded beach and dune material was transported offshore. A portion of the sand has returned to the beach and been scraped into dune systems. Dune recovery will be slow with complete recovery of the high elevation cliff features not very likely given the high elevations and large volume lost. However, substantial beach scraping has restored a significant portion of the eroded dune profile. This area needs completion of revegetation, irrigation, fertilization, sand fencing, and walkovers.

Dune Restoration Project: Dune restoration has already been initiated by the reforming of dunes from beach scraping operations. Completion of dune restoration is recommended. No additional fill placement is needed at this time. Some additional work to be completed may include revegetation, irrigation, fertilization, sand fencing, and walkovers. Much of this work is already completed at this time. Extensive debris removal may not be needed in this area.

Dune walkovers should be repaired or reconstructed, as needed, at public accessways.

Cost Estimates:

Debris Removal: \$110,844 (if needed, includes cost of dune reshaping)

Sand Fencing: \$27,707

Revegetation: \$166,265

Dune Walkovers: (funded through FEMA)

Total: \$304,816

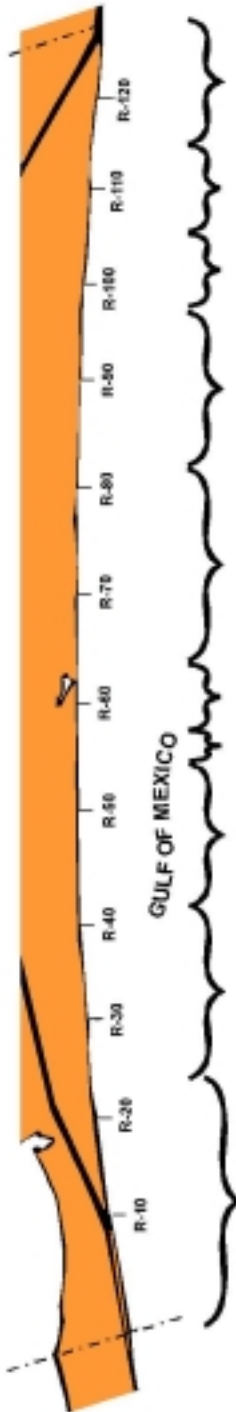
10. Dana Beach/Inlet Beach (R115 - R127) - Natural and assisted recovery.

The area of Dana Beach is generally undeveloped with new infrastructure currently being provided as lots are subdivided. Inlet Beach is moderately developed with single-family dwellings between R122 and R124, undeveloped between R124 and R125, and moderately developed between R125 and R127 with a mix of single-family and multifamily dwellings.

Long term erosion is not significant. Most of the eroded beach and dune material was transported offshore but a portion of the sand has returned to the beach and been scraped into dune systems. Dune recovery will be slow and complete recovery not likely given the high elevations and large volume lost. Substantial beach scraping has restored a significant portion of the eroded dune profile. All that is needed in the scraped areas is revegetation, irrigation, fertilization, sand fencing, and walkovers. Relocation is a viable option for only a couple structures in this area.

TOTAL COUNTY COST ESTIMATE: \$2,374,141

Walton County



Dana Beach/Inlet Beach R-115 - R-127

1. Dune Restoration
2. Structure Relocation

Seacrest Beach R-106 - R-115

1. Dune Restoration

Deer Lake to Camp Creek Lake R-98 - R-106

1. Acquisition

Seagrove Beach R-82 - R-98

1. Dune Restoration

Gulf Trace/Grayton Beach/Seaside R-64 - R-82

1. Dune Restoration

Blue Mountain Beach R-58 - R-63

1. Dune Restoration

Blue Gulf Beach R-55 - R-58

1. Acquisition

Beach Highlands/Dune Allen Beach R-41 - R-55

1. Dune Restoration
2. Structural Relocation

Topsail Hill R-24 - R-41

2. Preservation

Western Walton County R-1 - R-24

1. Dune Restoration
2. Structure Relocation

E. BAY COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

Bay County beaches were severely eroded by Opal's high storm surge and extreme wave energy. Prior to the storm the 6.8-mile segment of beach between R63 and R97 was experiencing long term erosion associated with the impacts of St. Andrews Inlet. Long-term erosion throughout the beaches west of the inlet has occurred as a result of offshore disposal of approximately 10 million cubic yards of sand from inlet dredging. The erosion has been held largely in check in recent years as a result of placement of the inlet dredging material on the beaches at St. Andrews State Recreation Areas. West of R63, the beach did not appear to be experiencing significant long term erosion, however it was severely impacted by the storm. Development along the Panama City Beaches has displaced much of the dune system. There is insufficient sand in the beach and littoral system to expect the system to recover to a condition providing adequate protection to upland development. If the Panama City Beaches are not restored, conditions will continue to deteriorate. The public land areas east of St. Andrews Inlet were experiencing long term erosion before and severe erosion due to Opal. A new inlet broke through west of Eloise Inlet which has now widened so dramatically that it appears that the barrier island (Crooked Island) is disintegrating. Mexico Beach at the east end of the county was experiencing long term erosion resulting from the impact of the Mexico Beach Canal Entrance. However, bypass placement of sand from the canal entrance by local officials along the Mexico Beach shoreline has helped stabilize the shoreline. Beach recovery is expected to continue; however, dune recovery will be slow and there is insufficient sand to expect full recovery. Beach scraping has also occurred in many areas.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

The Panama City Beaches are intensely developed with a mix of single-family and multifamily residential structures and many hotels/motels, restaurants, lounges and recreation facilities including three fishing piers. St. Andrews State Park is undeveloped except for park facilities. East of St. Andrews Inlet there are over 22 miles of undeveloped beaches including Shell Island, and Crooked Island. The eastern nearly 3 miles of Bay County beaches is the community of Mexico Beach which is highly developed with predominantly single-family dwellings with some multifamily dwellings, several motels, a restaurant and fishing pier. All the developed areas of Bay County are vulnerable to future damage from storm flooding, storm wave activity, and erosion.

III. PLAN RECOMMENDATIONS

A. PLAN SUMMARY

The recommended plan for Bay County is natural recovery in the undeveloped areas

of Shell Island and Crooked Island and assisted recovery in the developed areas of Bay County. Beach and dune restoration is recommended for the Panama City Beaches and dune restoration is recommended for the Phillips Inlet and Mexico Beach areas. Inlet sediment management is recommended for St. Andrews Inlet and Mexico Beach Canal Entrance to mitigate long term erosion of the adjacent beaches.

B. DETAILED PLAN DESCRIPTION

1. Phillips Inlet (ROA-R6) - Natural and assisted recovery.

Opal inflicted major beach and dune erosion in this area. The prospects for beach recovery are good; however, dune recovery will be slow.

Between R1 and R2 the Pinnacle Port development destroyed the dune system when it was constructed in the early 1970's so natural dune recovery is not possible. An artificial dune which had been constructed in front of the Pinnacle Port development prior to Opal was washed away by Opal. Extensive beach scraping was conducted by the development after Opal to reestablish the artificial dune. The beach, at the time of this report, was very narrow and flat. The extent to which the beach will recover is unknown, but is probably very limited.

Beach scraping has been conducted in front of the recently constructed, predominantly single-family development east of Pinnacle Port between R2 and R6. Sand fencing has been installed and dune walkovers have been reconstructed. It appears that no further assisted recovery work is needed in this area at this time. The extent to which the beach will recover is unknown at this time.

2. Panama City Beaches (R6-R97) - Assisted recovery.

The Panama City Beaches are intensely developed with a mix of single-family and multi-family residential structures and many hotels/motels, restaurants, lounges and recreation facilities including three fishing piers. The St. Andrews State Park beach between R92 and R97 is undeveloped except for park facilities. The beach segment between R63 and R97 (6.8 miles) was experiencing long term erosion associated with the impact of St. Andrews Inlet and the offshore disposal of its maintenance dredging material. The U.S. Army Corps of Engineers has placed some of the maintenance dredging sand on the park beach in recent years and is planning to place sand from a channel expansion project on the park beach. Additional funding may be needed to ensure that all inlet sand is placed on the downdrift beaches. An inlet management plan may also be needed.

Much of the beach in Panama City Beach was very narrow prior to Opal. The U.S. Army Corps of Engineers had designed a 18.5 mile long beach restoration project for Panama City Beach before the storm. Severe beach erosion was inflicted by Opal

along the Panama City Beaches and there is insufficient sand in the beach system to expect recovery to a condition of viable protection to the upland development.

Bay County and private interests performed beach scraping throughout most of Panama City Beach following Opal to form a recovery berm or dune. Limited beach area resulted in little or no sand accumulation from scraping in many areas. The County has initiated an extensive debris cleanup operation. A major beach restoration project is recommended after completion of the debris cleanup and should include a vegetated dune feature.

Beach Cleanup Project: Bay County is conducting an extensive debris cleanup operation throughout the county. It is recommended that the debris removal from the beach dune system above mean high water be completed prior to conducting beach and dune restoration work.

In addition to construction debris there are also remnants of destroyed seawalls which should be removed before sandfill is placed. Seawall remains to be removed include those located at about 200 feet east of R-84 and between R-88 and R-90.

Beach and Dune Restoration Project: Execution of the federal beach restoration project is recommended for the Panama City Beaches. The Panama City Beach area in Bay County has been in need of beach restoration for a number of years. Hurricane Opal resulted in severe additional erosion throughout the already stressed area. Portions of the beach now are extremely low and narrow providing minimal storm protection and reduced recreational beach for tourists. The U.S. Army Corps of Engineers has designed a comprehensive restoration project for the area which has been updated to account for erosion losses from Opal. The total cost has been estimated at \$38 million. The state share has been estimated to be \$10.5 million and will include cost of dune restoration work. These costs assume that the Panama City Beach Restoration project and post-Opal recovery activities are done at the same time. If they are not combined the total cost will increase by approximately \$8 million. Up to 1.6 million cubic yards of sand was eroded from the area by Opal. The preOpal fill design by the Corps of Engineers was for placement of about 6.5 million cubic yards of sand. It is highly recommended for economic and design efficiency to combine Opal recovery work with the pre-Opal project. The sand material to be placed in the restoration project would be obtained from offshore borrow sources and channel harbor deepening.

Cost Estimate:

Beach Restoration: \$10,500,000

Note: It is highly recommended that consideration be given to providing sufficient State funds in addition to that needed to recover losses from Opal to include the State's share

of the cost for the pre-Opal, Corps of Engineers designed beach restoration project in order to achieve a better project in a more cost-effective manner.

Dune Revegetation Project: Dune restoration is also recommended to supplement the beach restoration project to provide upland protection from future storms. Some relocation is also recommended for many rebuilt structures. The cost for reconstructing a dune to supplement the beach restoration project is included in the cost estimate for the federal restoration project.

Inlet Management Project: For the beach west of St. Andrews Inlet, inlet sand transfer is highly recommended to mitigate the long term erosion losses directly caused by the offshore disposal of inlet dredge material and the resulting depletion from the sediment budget of the Panama City Beaches. State funds should be made available for sand transfer if needed to ensure bypassing to downdrift beaches. An inlet management plan is needed for this inlet.

3. Shell Island/Crooked Island (R98-R127) - Natural recovery.

This 22.3-mile segment of beaches between St. Andrews Inlet and Mexico Beach is generally undeveloped and has a long term history of erosion. Shell Island is both state and federally owned and experienced severe erosion and major overwash. On Crooked Island, part of Tyndall Air Force Base, a new permanent inlet broke through west of Eloise Inlet which opened in 1975. Eloise Inlet has been widened so dramatically by Opal that it appears that much of the barrier island is disintegrating.

Natural recovery is recommended, however, given the trend of continued shoreline change in this area is expected.

4. Mexico Beach (R127-R144) - Natural and assisted recovery.

Mexico Beach is highly developed with predominantly single-family dwellings with some multifamily, several motels, a restaurant and fishing pier. Severe beach and dune erosion and structural damage occurred during Opal. This area has experienced long term erosion associated with the impact of the Mexico Beach Canal Entrance. Sand bypassing operations at the canal entrance; however, have helped to maintain the shoreline position over the last twenty years.

Beach restoration is probably not justified at this time, however, continued sand transfer around the Mexico Beach Canal Entrance is necessary. Natural beach recovery is appropriate, but dune recovery will be slow and given the threat to existing development from future storms dune restoration is recommended. Substantial beach scraping has already created a significant dune system and revegetation, watering, fertilization, sand fencing and walkovers are now needed,

some of which has already been completed. Relocation is also a viable option for some of the rebuilt structures.

Dune Restoration Project: Dune restoration has been initiated by the reforming of dunes from beach scraping operations. Completion of dune restoration is recommended. No additional fill placement is needed at this time. Additional work to be completed includes revegetation, irrigation, fertilization, sand fencing, and walkovers. Some of this work is completed at this time.

Additional debris removal may also be needed in this area.

Dune walkovers should be repaired or reconstructed, as needed, at public accessways.

Cost Estimates:

Debris Removal: \$204,096 (if needed, includes cost of dune reshaping)

Sand Fencing: \$51,016

Revegetation: \$306,142

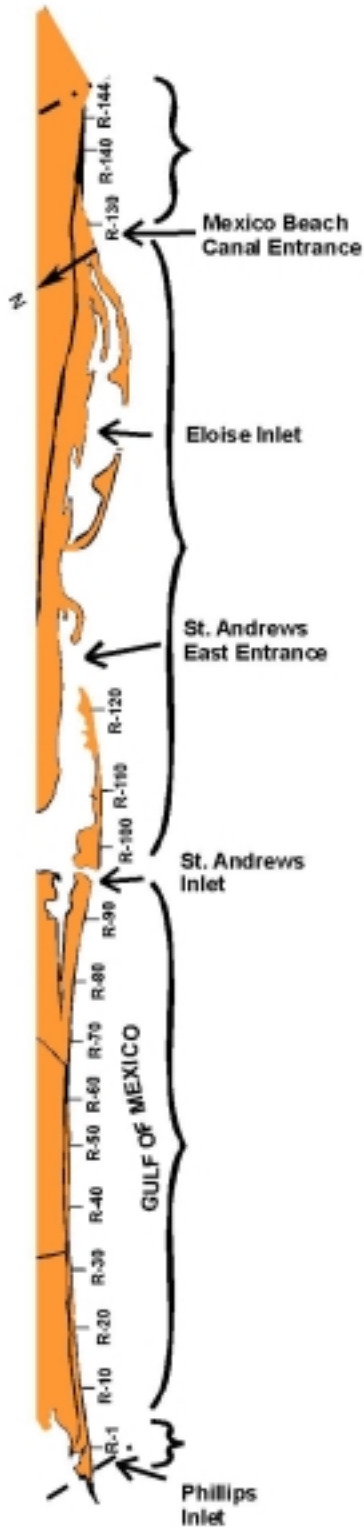
Dune Walkovers: (funded through FEMA)

Total: \$561,254

TOTAL COUNTY COST ESTIMATE: \$11,061,254

Note: These costs assume that all Bay County projects are accomplished as a part of the beach restoration project. If they are done separately total costs will rise approximately \$8 million due to the separate beach and dune restoration effort to address the Opal related damages, primarily the loss of approximately 1.6 million cubic yards of sand. A subsequent federal project will result in a slightly lower state share than the \$10.5 million currently estimated. Therefore, it is recommended that the two efforts be combined to expedite recovery and reduce overall costs.

Bay County



Mexico Beach R-127 - R-144

1. Inlet Sand Transfer
2. Dune Restoration
3. Structure Relocation

Shell Island/Crooked Island R-98 - R-127

1. Preservation

Panama City Beaches R-6 - R-97

1. Beach Restoration
2. Inlet Sand Transfer
3. Dune Restoration
4. Structure Relocation

Phillips Inlet R-0A - R-6

1. Dune Restoration

F. GULF COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

The portion of Gulf County along the mainland between R-1 and R-31 experienced minor erosion from Opal and natural recovery is recommended. Opal's storm surge and waves caused the greatest erosion impact on St. Joseph Peninsula since hurricanes Elena and Kate in 1985. The southern 14.3 mile reach of the peninsula had been experiencing significant long term erosion prior to the storm. The northern tip was stable or accreting. Little natural recovery is expected to the beach and dunes in the reach from R90 to Cape San Blas. The highest long term erosion rate on the Florida Gulf of Mexico coastline is at Stump Hole just north of Cape San Blas which sustained a major overwash area resulting in the destruction of the county access road to the peninsula. The long term prospect for recovery on this area is not good. At the east end of the county, the 2.6 mile stretch of Indian Peninsula has experienced long term fluctuations between erosion and accretion and experienced accretion during Opal. Except for some erosion along the Indian Pass shoreline most of Indian Peninsula is in excellent condition.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

The northern stretch of the peninsula between R32 and R75 is undeveloped within the St. Joseph Peninsula State Park. The remainder is characterized by single-family dwellings between R75 and R77, undeveloped between R77 and R78, multifamily dwellings between R78 and R79, undeveloped between R79 and R81, single-family dwellings between R81 and R86, and handicap state park between R86 and R87, undeveloped between R87 and R90, a couple of single-family dwellings and several multifamily dwellings between R90 and R91, undeveloped between R91 and R94, lightly developed with single and multifamily dwellings between R98 and R104, and generally undeveloped between R104 and R114 except for the Air Force facilities at R110.

Indian Peninsula is moderately developed with single-family dwellings. Development along St. Joseph Peninsula is vulnerable to storm impact, while most of that on Indian Peninsula's accreting beaches are not threatened.

III. PLAN RECOMMENDATIONS

A. PLAN SUMMARY

The recommended plan for Gulf County consists of natural recovery in the undeveloped areas of St. Joseph Peninsula and Cape San Blas, and assisted recovery in the developed area of St. Joseph Peninsula.

B. DETAILED PLAN DESCRIPTION

1. St. Joseph Peninsula (R32-R114) - Natural and assisted recovery.

Except for the northern 2.2 miles which is accreting, the peninsula is eroding, with the most extreme erosion rate fronting the Florida Gulf coast occurring at Stump Hole along the southern part of the peninsula just north of Cape San Blas at least 15 feet per year. The Cape San Blas lighthouse has been relocated six times. Hurricane Opal inflicted severe damage to beach and dune system along the peninsula and natural recovery is not expected, particularly south of R90.

Dune restoration is recommended for the developed areas of the peninsula and to close the large dune breaches between R71 and R74 at the State Park. Dune restoration is recommended to be conducted by private interests to protect threatened private structures; however, success will be limited south of R90 due to the frequent erosion events which historically stress the area. Sand fencing, particularly north of R90, may be quite effective due to the large volume of wind blown sand transport in the area. Dune walkovers are recommended throughout the peninsula where needed, particularly at public access locations.

Other alternatives to assist recovery of this area include the inland relocation of structures.

Dune Restoration Project: A total length of 7300 linear feet of shoreline along the Peninsula has been identified as needing dune restoration. This shoreline includes the Stump Hole area which is discussed in detail below.

Cost Estimates:

Sand Fencing: \$45,432

Revegetation: \$101,944

Total: \$147,376

2. Stump Hole (R105-R106) - Assisted recovery.

Hurricane Opal overwashed St. Joseph Peninsula at Stump Hole and eroded virtually all sandy sediments from the beach leaving large exposed peat deposits. Natural recovery is not expected as this area will continue to erode. Revegetation and sand fencing would not be effective due to the lack of a viable beach or dune system. Gulf County Road C-30-E at Stump Hole was destroyed by the storm surge. The road is more vulnerable now and will become a continual maintenance and repair problem unless measures such as elevations, armoring or bridging

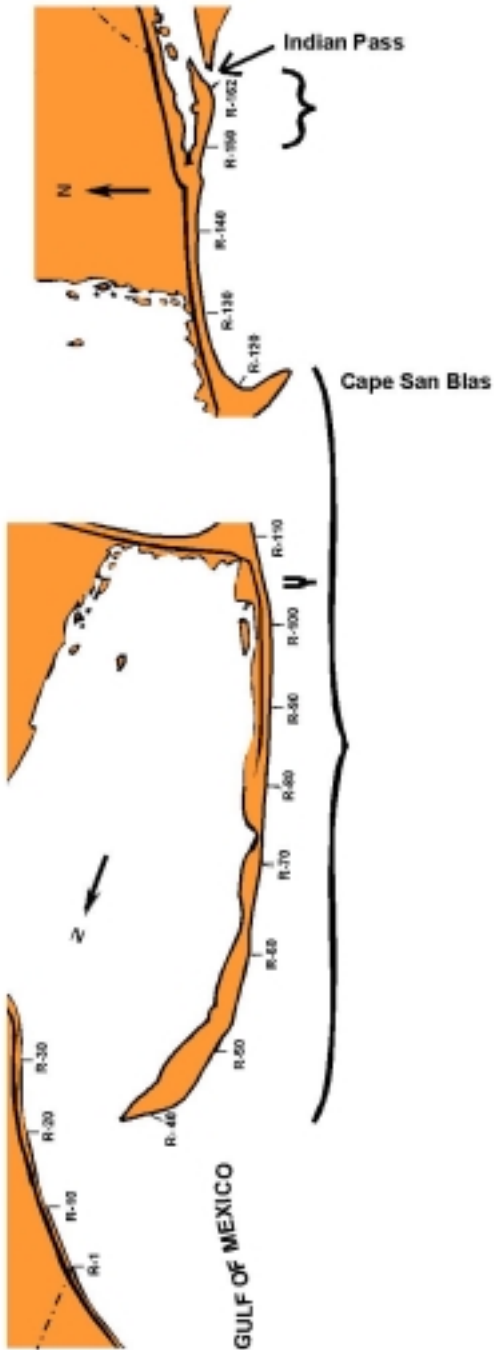
are taken to mitigate future flooding from higher frequency storm tide conditions.

3. Indian Peninsula (R150-R162) - Natural recovery.

Indian Peninsula has been experiencing long term beach width fluctuations due to the inlet shoal system, however, Opal did not severely erode the beach and dunes as occurred elsewhere. Except for some erosion along the Indian Pass shoreline, most of Indian Peninsula is now in excellent condition. This area should be monitored to determine if this condition is temporary or a new trend. The beach to the west between R114 and R150 has historically been stable to mildly accretional and no change is expected.

TOTAL COUNTY COST ESTIMATE: \$147,376

Gulf County



G. FRANKLIN COUNTY

I. EROSION CONDITIONS AND POSTSTORM RECOVERY

Severe erosion occurred along much of St. Vincent Island, a national wildlife refuge, Cape St. George on Little St. George Island, and western St. George Island, a state preserve. The beaches and dunes in these areas will not recover to prestorm conditions. East of Sike's Cut, the 3.3 miles of the St. George Plantation experienced erosion. The St. George Plantation is in a state of continual erosion stress and will probably not recover to prestorm conditions although there will be a viable beach at a further landward location. The eastern 8.4 miles of St. George Island has experienced significant long term erosion. The State Park which had been substantially eroded by Hurricanes Agnes (1972), Elena and Kate (1985), the extratropical storm of October, 1992, and tropical storm Beryl (1994) was severely overwashed as was Dog Island. The western 2.4 miles of Dog Island are not expected to recover given its trend of erosion stress, while the eastern 2.6 miles may recover partially with some overall shoreline retreat. The Southwest Cape, and Lighthouse Point of Alligator Point all experienced erosion stress. These areas are expected to continue their erosion trends with little natural recovery.

II. LEVEL OF DEVELOPMENT AND VULNERABILITY

Much of Franklin County's beaches are either undeveloped or sparsely developed. Remaining portions are either highly or moderately developed. St. Vincent Beach, a national wildlife refuge, Little St. George Island and western St. George Island (between West Pass and Slices Cut), a state preserve, the eastern 8.4 miles of St. George Island, a state park, and about half of Dog Island are all undeveloped areas with the exception of park facilities on eastern St. George Island. St. George Island between Sikes Cut and the state park is moderately developed with predominantly single-family dwellings which are well set back from the beach, one motel and a few multifamily residential structures. The remaining half of Dog Island is sparsely developed with single-family dwellings and one small motel. Alligator Point is highly developed west of Lighthouse Point and moderately developed north to Bald Point. On St. George Island, only the portions of the state park road and public recreation facilities are vulnerable. The state is relocating the access road and some park facility to a more landward location. All of the beachfront development on Dog Island and along the Southwest Cape and Lighthouse Point segments of Alligator Point is vulnerable.

III. PLAN RECOMMENDATIONS

1. Inlet sand transfer at western St. George Island.
2. Natural recovery with limited assistance with sand fencing at St. George Plantation, eastern St. George Island, eastern Dog Island, Southwest Cape and Lighthouse Point.

3. Relocation of the access road and certain structures and assisted restoration and revegetation of the dune system in the State Park in St. George Island.
4. Natural recovery on St. Vincent Island, western Little St. George Island, Cape St. George, eastern St. George Island, western Alligator Point.

Note: A post-storm recovery project for the St. George Island State Park has been developed by the Division of Recreation and Parks. Work to be performed at the Park include major repair and reconstruction of damaged portions of the access road, dune restoration work and repair and reconstruction of damaged dune walkovers. The cost estimate obtained from the Division of Recreation and Parks is for a total cost of \$1,282,312.

Franklin County



Lighthouse Point R-220 - R-229

1. Dune Restoration
2. Structural Relocation

Southwest Cape R-210 - R-216

1. Dune Restoration
2. Structural Relocation

Western Alligator Point R-194 - R-196

1. Preservation

Eastern Dog Island R-170 - R-184

1. Dune Restoration
2. Structural Relocation

Western Dog Island R-157 - R-170

1. Dune Restoration

Eastern St. George Island R-105 - R-149

1. Dune Restoration
2. Structural Relocation
3. Preservation

St. George Plantation R-53 - R-69

1. Dune Restoration

Western St. George Island R-34 - R-51

1. Inlet Sand Transfer

Cape St. George R-17 - R-24

1. Preservation

Western Little St. George Island R-3 - R-5

1. Preservation

St. Vincent V-17 - V-34

1. Preservation