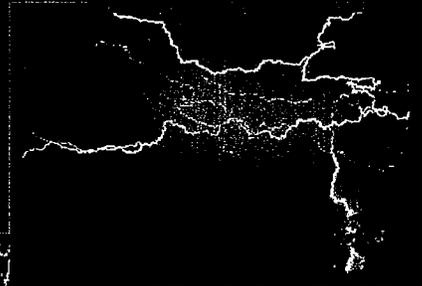
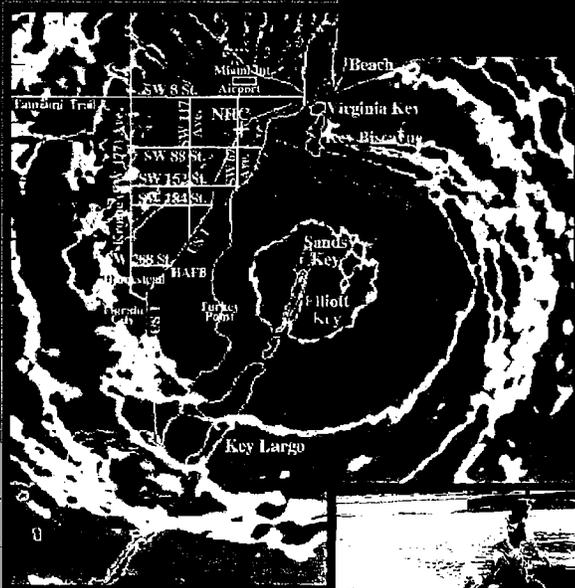




# Village of Key Biscayne Floodplain Management Plan

**Volume One**  
**Introduction; Plan Document;**  
**Plan Report; and Action Plan**



**Sponsored**  
**by the**  
**State of Florida**  
**Division of Emergency Management**  
**and the**  
**Village of Key Biscayne, Florida**

**March 1998**

*From Key Biscayne by  
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("1926 Hurricane").*

“On the exposed and isolated barrier island, there was no warning for the small community of around fifty people who later would tell of their terror. There was no time for preparations when the eye headed for them and the storm surge roared in from the ocean, whipped into a great and terrifying froth such as none of them had beheld before. The “white settlement” was grouped along the beach where monster waves crashed ashore as the winds and water rose. They waded in waist-high water, carrying their children on their shoulders to the highest ground, gathering in one or two cottages which, miraculously, remained standing in spite of blown-out windows, crashing ceilings, and much damage. The “Negro settlement” was closer to the center of the island by the big barn; as the howling winds, rising water, and driving rain rammed inland, the men in the long, trembling dormitory clung to the rafters to keep from being swept away; later it was believed that their weight is what kept the roof from blowing off. Other black workers and their families sought refuge in the second-story loft of the barn and watched in disbelief as the ocean water poured through the center of the building “from sea to sea.” They described it like a river rushing through a gorge carrying trees and parts of houses and equipment, sweeping them away. It was high tide on Key Biscayne from ocean to bay; the island was awash. In both settlements most of the structures were demolished, effectively demonstrating that the eye of the hurricane is, and always will be, color blind. The word hurricane is a Carib word, derived from the Taino *hurakán* (later translated into Spanish as *huracán*). In certain parts of the world it is equated to a tempest, typhoon, or cyclone.”



*The storm surge  
and erosion  
toppled worker's  
seaside cottage.  
(Matheson Family  
Collection ©Finlay  
B Matheson)*



# **Village of Key Biscayne Floodplain Management Plan**

## **Volume One Introduction; Plan Document; Plan Report; and Action Plan**

### **Village Council**

Mayor - John F. Festa  
Vice Mayor - Mortimer Fried  
Council - Martha Fdez-León Broucek  
Council - Gregory C. Han  
Council - Hugh T. O'Reilly  
Council - Michelle Padovan  
Council - Betty Sime

### **Village Manager**

C. Samuel Kissinger

### **Village Clerk**

Conchita H. Alvarez

### **Working Review Committee**

Deborah De Leon, A.I.A. - Chairman  
Maribel Balbin  
Robert Cuevas, P.E., D.E.E.  
Brian Flynn  
Gregory C. Han, Ph.D.  
Lee A. Niblock, CLP  
Ronald White

### **Village Staff**

Assistant to the Village Manager - James DeCocq  
Director of Building, Zoning & Planning - John Little  
Director of Fire & Rescue - John Gilbert  
Building Official - Leo Llanos  
Public Works Supervisor - Armando Nunez

**KBS Development Associates, Inc.  
Williams, Hatfield & Stoner, Inc.**

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**Part A**  
**Introduction & Summary**

## **Part A: Introduction and Summary**

## **PART A: Introduction and Summary**

### **Background**

#### Basic Condition and Response

As a barrier island, Key Biscayne is particularly vulnerable to hurricanes and severe rainstorms, resulting in substantial flood hazards and consequent damages to life and property.

The Village's response is reflected in a wide range of measures proposed to prevent and reduce flood damage. These measures generally involve activities designed to:

1. Increase public awareness;
2. Improve preparedness; and
3. Mitigate the damage.

#### Support system and participants

The support system of the Village's management of these activities involves a wide range of participants including notably:

1. The National Flood Insurance Program (NFIP), FEMA and the Insurance Service Office;
2. The State of Florida Department of Community Affairs;
3. The Miami-Dade County Emergency Management Plan and Response Organization;
4. The signatories to the "Statewide Mutual Aid Agreement for Catastrophic Disaster Response and Recovery";
5. The South Florida Water Management District;
6. The US Weather Service and the National Oceanic and Atmospheric Administration;
7. The Florida Park Service and Bill Baggs Cape Florida Recreational Area;

8. Miami-Dade Water and Sewer Department and Department of Environmental Resource Management – Restoration and Enhancement Section.

Current floodplain management activities and initiatives include:

1. Maintenance of state-of-art warning system, emergency management and response functions;
2. Completion of a Stormwater Master Plan;
3. Construction, accordingly, of a new Storm Drainage System, with upgrading of existing facilities;
4. Enactment and enforcement of a "Flood Ordinance";
5. Maintenance of an active program of flood-related information dissemination, including newsletters, notices, a flood library and Village staff technical and advisory assistance;
6. Issuance of "Elevation Certificates" in connection with all Key Biscayne construction activity; and
7. Filing of an Application with FEMA for participation in the NFIP "Community Rating System" (CRS).

Community Rating System (CRS)

The CRS Application was filed on October 11, 1996. In a letter dated March 5, 1998 FEMA has advised the Village that the actions it has undertaken "...exceed the minimum standards of the NFIP, have been verified and meet the requirements for a Class 7 rating in the CRS."

The FEMA letter further advises that "...the reward for (the) community's activities will be a 15 per cent discount for NFIP policies issued or renewed on or after April 1, 1998..."

Early in the process of seeking participation in the National Flood Insurance Program Community Rating System (NFIP/CRS), the Village was notified by FEMA that its records indicated the presence of 32 "repetitive loss" properties.

These are properties for which two or more claims have been paid by the NFIP within any 10-year period since 1978. The presence of that many repetitive loss properties in a community the size of Key Biscayne is a very serious matter to FEMA and to others concerned about the Village's public safety and welfare .

### **Need for Floodplain Management Plan**

**If FEMA's records had been proven to be correct, Key Biscayne would have been classified a Category C Community (i.e. one with 10 or more repetitive loss properties). As Category C Community, the Village would have been required, in accordance with CRS regulations, to prepare a "Floodplain Management Plan" as a prerequisite for CRS participation.**

The position of the Village on this matter, as reflected in the CRS Application was as follows:

1. **FEMA's records with respect to the number of repetitive loss properties should be adjusted downward from 32 to 3.**

The rationale advanced by the Village is that 28 of the properties should not be considered, according to FEMA Regulation, a repetitive loss property for CRS purposes because:

- A number of these properties have been protected by the new storm drainage system from the type of events that originally caused the losses; and
- The Village can demonstrate that almost all the repetitive losses were in fact caused by weather events that have recurrence intervals of over 100 years or more.

Since hurricane Andrew clearly already qualifies as a greater than 100 year event, the issue was reduced to one of whether an earlier rainstorm which occurred on or about October 8, 1991 and affected these 28 properties also qualifies as a greater than 100 year event.

2. **Regardless of the above matter's outcome, the Village's position was that a Floodplain Management Plan affirmatively addressing the problem of**

**repetitive loss properties should be prepared IN ANY CASE, not just to satisfy the NFIP/CRS requirements, BUT ON ITS OWN MERITS.**

In this connection, a Floodplain Management Plan represents a policy mandate and an umbrella under which the various aspects of flood-hazard mitigation activities of the Village can be structured.

As such, floodplain management efforts can be brought to bear in an organized manner, not only on the problem of the repetitive loss properties identified by FEMA, but on all properties that share a level of vulnerability comparable to that of the properties on the list.

The above position of the Village with respect to addressing the problem of repetitive loss properties has been validated in at least two respects:

1. Village Participation in CRS is now secure

The Village has been informally advised through the Insurance Service Office (ISO) that FEMA has concurred with the above rationale and that the production of a Floodplain Management Plan is no longer a condition for CRS participation. With the classification now in place, this matter can now be considered closed.

2. A Floodplain Management Plan is in fact necessary

Effective forward progress in the Village's flood protection efforts is dependent on the achievement of:

- a. a technical consensus backed by hard field information and scientific analysis with respect to the amount, frequency, characteristics and related information on severe rainstorms, storm surges and other flooding events; and
- b. a policy consensus which considers a wide range of possible floodplain management activities, structuring them into an evolving program of tasks and projects with a mandate for their systematic implementation.

**In conclusion**, the Floodplain Management Plan is a proper framework within which to satisfy these needs. Moreover, the combination of these needs plus the collateral benefit of earning additional points in the Community Rating System,

have provided a web of compelling reasons to undertake the preparation of such a Plan.

### **The State Grant**

To this end, the Village of Key Biscayne has applied for, and received a \$45,000 Grant under the State of Florida Department of Community Affairs, Emergency, Preparedness and Assistance Trust Fund Grant Program (EMPA) for the express purpose of preparing a Floodplain Management Plan.

By the time the work under this grant is completed:

1. The Village of Key Biscayne list of Repetitive Loss properties will have been reduced to 3 or 4;
2. The Village will have earned a classification in the Community Rating System of 7, resulting in Flood Insurance Rate reductions of 15%;
3. An AGENDA for on-going floodplain management activities and a PIPELINE of potential Projects will be formalized.

It should be noted that the step-by-step process, used in evolving the Floodplain Management Plan and its Action Plans, has been specifically designed to achieve, not only the above results, but also to perform as a mechanism to maintain the momentum generated through the plan preparation process.

### **Content and Organization of Documents**

The Floodplain Management Plan material is presented in three VOLUMES, as follows:

- **Volume One**, includes this introductory **Part A**, and the following **Other Parts**:

**Part B: “Floodplain Management Plan Document”**. This is the document formally adopted by the Village Council as Key Biscayne’s Floodplain Management Plan.

**Part C: “Floodplain Management Plan Report”** which provides all the supporting text and documentation on which the Floodplain Management Plan is based and justified.

The “Report”, more specifically, is the basis for “Recommendations for Decisions” by a “Working Review Committee” appointed by the Village Manager to advise on the proposals in the Plan.

The “Report” consists of Seven Sections, each representing one of the 10 Steps in the Planning and Decision Process recommended by FEMA and the ISO.

**Part D: The “1998/1999 Action Plan”** (Section VIII found in Volume One) describes the floodplain management activities that are of an On-Going nature and the Projects for the first Action Year under the plan.

This Section of the Floodplain Management Plan will be updated on an annual basis, while the Plan Document and the Plan Report will continue to provide the framework within which the Action Plan Activities and Projects are identified, designed and implemented.

- **Volume Two** contains the remaining 3 Sections of the 10-step planning process including:
  1. Section II which covers the matter of public involvement;
  2. Section IX which covers all documentation and material related to the review and approval of the Floodplain Management Plan including:
    - Actions by the Village Council, including all related records and approval documents;
    - Action by the State Department of Community Affairs;
    - Recommendation with respect to the Floodplain Management Plan from the Village Manager;
    - All actions by the Working Review Committee including the WRC’s vote on Recommendations for Decisions, Minutes of Meetings, etc.

3. Section X that deals with the implementation of the Floodplain Management Plan and the actions programmed beyond the Plan's adoption.
- **Volume Three** is the collection of Technical Support Documents behind the Floodplain Management Plan. As such Volume Three contains either copies or references to a wide range of support material which was used in formulating the proposals in the plan.

Because of the bulky nature of this material, only four full copies of this Volume have been prepared. However the Volume Three Index lists all of the material and is included in all copies of the Floodplain Management Plan. For material included by reference only, the Index provides directions for securing such documents.

### Scope

The language for the Scope of Work in the Agreement between the Village of Key Biscayne and the State Department of Community Affairs calls for:

- “Drafting, developing and completing a Floodplain Management Plan, using methods and approaches consistent with standard planning practices.”
- “Developing a Floodplain Management Plan that is consistent with the mitigation portion of Miami-Dade County’s Comprehensive Emergency Management Plan, the State’s Mitigation Plan and Draft Local Mitigation Strategy, as well as the National Mitigation Strategy.”
- “Use of a methodology in the development of the plan which clearly addresses the following areas:
  1. Guiding Principles and Mitigation Goals;
  2. Hazard Identification and Vulnerability Assessment;
  3. Mitigation Initiatives;
  4. Governmental Coordination;
  5. Public Participation;
  6. Evaluation and Enhancement.”

The Floodplain Management Plan is discussed in further detail in the National Flood Insurance Program Community Rating System Manual and in FEMA’s July

1996 publication on the subject, titled: "Example Plans". This publication is found as part of Volume Three.

"Example Plans" identifies a 10 step planning process, which is generally consistent with the scope of work and the areas of concern called for in the State Grant Agreement. The ten Steps (identified as "Sections" in the Floodplain Management Plan Report) are as follows:

- I. Organize to Prepare the Plan.
- II. Involve the Public. (See Volume Two)
- III. Coordinate with Other Agencies.
- IV. Assess the Hazard.
- V. Assess the Problem.
- VI. Set Goals.
- VII. Review Possible Activities.
- VIII. Draft an Action Plan.
- IX. Adopt the Plan.
- X. Implement, Evaluate and Revise. (See Volume Two)

The State Grant Scope of Work and FEMA's recommended Planning Steps have been structured into Key Biscayne's planning process as four Planning Phases, each summarized as follows:

**PHASE I** covers the areas of "**Organization to Prepare the Plan, Coordination with Other Agencies, Hazard Identification, and Vulnerability Assessment**", namely Sections I, III, IV and V of the Floodplain Management Plan Report.

The conclusions from this phase have formed the basis for the Plan's Goals.

**PHASE II** covers the "**Guiding Principles and Mitigation Goals**" for the Floodplain Management Plan. The Goals are cited in the "Plan Document" and they are repeated, explained and justified in the "Plan Report" under Section VI.

It is during this phase that achievable levels of mitigation and floodplain management performance criteria have been explored for feasibility and appropriateness in terms of the nature and extent of the hazards and problems identified in the first phase of the work.

**PHASE III** covers “**Mitigation Initiatives**” and “**Evaluation and Enhancement**” as stated in the Grant Agreement Scope and correspond to the following activities in the FEMA publication:

- **Section VII: “Review Possible Activities”**
- **Section VIII: “Draft an Action Plan”**

It is in this phase of the work that the actual production of the Floodplain Management Plan, including text, graphics, technical analysis, research and other material, validating the program of proposed actions and policies, was undertaken.

As such, during this stage:

- Some 31 possible floodplain Management Activities were analyzed and discussed in terms of 7 criteria.
- As a result, 9 of these activities have been eliminated from consideration by reason of relevance to Key Biscayne, appropriateness or feasibility.
- The remaining 22 activities include:
  1. 10 which represent **On-Going Tasks** which the Village must perform on a continual basis to maintain its standing in the Community Rating System;
  2. 2 which represent a range of activities from which **Action Projects** are to be selected;
  3. 2 which will require **Additional Study** as part of their implementation.
- Finally, Section VIII of the Floodplain Management Plan Report describes and analyses a range of potential projects suggested by the activities in 2. above. These were ultimately distilled through a participatory rating process, from which the 3 projects deemed by a majority of the Working Review Committee to be most appropriate were selected for inclusion in the 1998/1999 Action Plan, subject to Village Council ratification.

**PHASE IV** covers the ratification of the Floodplain Management Plan including the “**Public Involvement**” and “**Plan Adoption**” aspects of the approval process (see Section II and Section IX of the Floodplain Management Plan Report, to be found in Volume Two of the material).

Phase IV represents the culmination of the planning process with the taking of all administrative and legislative actions required to enable the implementation of the Floodplain Management Plan and secure the necessary commitments to assure its realization in the short and longer term.

As such the implementation, evaluation and revisions aspects of the Floodplain Management Plan (Section X of the Report, also to be found in Volume Two) are designed to assure that the Plan will not languish on the shelf by:

- Maintaining the existence of the Working Review Committee beyond the time of completion of the Floodplain Management Plan;
- Preparing an annual Action Plan which would report the status of floodplain management projects and introduce new projects if feasible;
- Monitoring day-to-day floodplain management activities and updating the Floodplain Management Plan as necessary to reflect such activities.

**Part B**  
**FMP Document**

## Part B: Floodplain Management Plan Document

### Premise

The Floodplain Management Plan seeks to address the FLOOD HAZARDS and PROBLEMS that exist in the Village of Key Biscayne.

- The entire Village is a floodplain and has been identified under the National Flood Insurance Program as a “Special Flood Hazard Area”. The community is constantly threatened and often impacted by severe, and sometimes disastrous, weather events.
- Yet, its connection to the mainland is dependent on bridges and a single causeway.
- Key Biscayne is a barrier island. Its topography and soil conditions are incompatible with the management of massive amounts of runoff generated by severe rainstorms. This condition and the existence of a high groundwater table combine to create major flooding hazards, particularly in the low-lying areas.
- Key Biscayne is also threatened by storm surges which occur as strong winds, such as from a hurricane, force the water levels in the ocean or the bay to rise catastrophically and flood the coastal areas as well as the rest of the island.
- The extent of these hazards is illustrated by the fact that FEMA has established a Base Flood Elevation (BFE)<sup>1</sup> for Key Biscayne that ranges between 7 feet and 12 feet National Geodetic Vertical Datum (NGVD). With the elevation of Village streets at approximately 5 feet NGVD, a weather event with a 100-year recurrence interval would tend to produce flood conditions of 2 feet to 7 feet in depth.
- The flooding hazards present a particularly serious problem for the many Key Biscayne properties that were built under the older Miami-Dade County Building Code. That code required a finished floor elevation of only 13 inches above the crown of the road. The floor elevation of attached garages under the

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<sup>1</sup> BFE is the level of flooding that occurs in a 100-year recurrence interval storm, i.e. one which has a 1% chance of occurring in any given year.

old code was even lower (6 inches). All of these properties, unless they have been floodproofed or rebuilt to current FEMA elevation standards, must be considered to be floodprone.

- The above condition has been exacerbated in instances where garages or carports have been enclosed and converted into living space.
- The existence of the above hazards and problems has produced a pattern of “Repetitive Loss Properties”<sup>2</sup> which negatively impact the Village’s standing with the National Flood Insurance Program and the affordability of flood insurance rates.

### **Need for the Floodplain Management Plan**

The Flood Hazards and Problems compel attention to the following major areas of needs:

- The problem of “Repetitive Loss Properties”, beginning with those already identified by FEMA and ultimately reaching out to all properties, on Key Biscayne with comparable vulnerability characteristics.
- The need for a legislative and administrative framework and support structure to continue and to enhance the vigorous pursuit of new and on-going floodplain management activities defined in the Floodplain Management Plan.
- The need for a technical support framework including availability of hard and reliable data as well as a network of technically endowed government agencies to shape and document the implementation of activities under the Floodplain Management Plan.
- The need for a Policy Consensus Mechanism to define and priority-rank Floodplain Management Plan Activities and Action Plan Projects.

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<sup>2</sup> Repetitive Loss Properties for which two or more claims of at least \$1,000 were paid by the NFIP in any ten year period since 1978.

## Overall Goals for the Floodplain Management Plan

The overall Goals implied by Key Biscayne's Floodplain Hazards and Problems and the need for a Floodplain Management Plan as a tool to organize and mobilize for the implementation of Floodplain Management Plan Activities include the following:

- **Consistency with Village Laws and Policies.**  
The Floodplain Management Plan shall be consistent with the goals and intents of the Village Master Plan, its codes and ordinances, as well as other official Village documents that reflect the Village's aspirations for the welfare, safety and quality of life of its residents.
- **Protection from weather hazard.**  
A primary goal of the Floodplain Management Plan is to reduce vulnerability to flooding hazards from major rainfalls, hurricanes and related severe weather events. This Goal applies to all Key Biscayne structures, their content and appurtenant assets and facilities.
- **Mitigation of problems caused by the hazards via Action Plans.**  
Related to the above is the goal to mitigate the extent and severity of the problems created by these hazards and to, collaterally, secure the necessary commitments and, to the maximum feasible extent, the necessary resources to implement mitigation Floodplain Management Activities in bi-annual Action Plans to achieve these goals.
- **Prevent additional "Repetitive Loss Properties".**  
A key goal of the Floodplain Management Plan is to do all in the power of the public and the civic sectors, at all levels, to prevent any additions to the list of "Repetitive Loss Properties" published annually by FEMA.
- **Reduce current number of "Repetitive Loss Properties".**  
A companion goal is to reduce the number of "Repetitive Loss Properties", to a point where Key Biscayne can qualify as a category A or B Community (i.e. a community containing no more than nine (9) repetitive loss properties).
- **Improve Standing in the Community Rating System.**  
An important goal of the Floodplain Management Plan is to assure incremental improvements in Key Biscayne's standing and classification in the Community

### Rating System of the National Flood Insurance Program (NFIP/CRS).

A related Overall Goal is to make flood insurance under the NFIP more affordable and reachable, while improving Key Biscayne's effectiveness in coping with flood hazards, problems and emergencies.

- **Increase Public Awareness.**

An overall Goal of the Floodplain Management Plan is to increase the continual dissemination of information, on a repetitive basis, with respect to the existence of flood hazards and the availability of measures to mitigate the problems presented by such hazards.

- **Storm Warning, Preparedness and Response.**

Another important overall Goal of the Floodplain Management Plan is to continually improve and maintain cutting-edge, state-of-the art, effectiveness of Key Biscayne's emergency warning, preparedness and disaster response capacity.

- **Coordination with Government Agencies.**

A further overall Goal of the Floodplain Management Plan is to increase the level of coordination of Floodplain management concerns, plans and activities at the Municipal, County, State and Federal levels of Government.

- **Implementation Commitment.**

The last, but critically important overall Floodplain Management Plan Goal, without which all other Goals are in danger of academic oblivion, is the Goal to secure an enforceable commitment for their implementation over the short and longer terms.

### Working Goals for Consideration of Floodplain Management Plan Activities

Within the context of the overall goals, the following are the Working Goals which shall be considered in the evaluation of floodplain management activities and the selection of Action Plan Projects.

- **Access**

- a. The Goal is to protect the ability to use the Rickenbacker Causeway in times of disaster and provide for continuous, free flowing traffic and

circulation as needed for the effective and unencumbered provision of emergency services and evacuation operations.

b. A related Goal, beyond the ability to use the Causeway, is the Goal to increase its roadway capacity and facilities to deal with:

- (1) traffic peaking;
- (2) lane blockages for any and all reasons;
- (3) accidents or other road stoppages;
- (4) operational requirements of service and emergency vehicles and equipment.

- **Critical Facilities**

a. The goal is to protect all critical facilities vital to disaster response. Such facilities include, among others, the structures occupied by the fire and rescue and police functions, fire fighting and rescue equipment stations and all other emergency-related equipment and facilities involved with the transportation, communication, and energy requirements for an effective response to a major rainstorm, hurricane or similar disaster.

b. A related goal is to explore the feasibility of a new municipal building complex, built to NFIP standards, with particular emphasis on the Village's capacity to provide a comprehensive state-of-the art response to disaster and emergencies.

- **Topography**

a. The Goal is:

- (1) To reduce the low points of Key Biscayne's topography to encourage the flow of stormwater away from structures and toward streets where storm drainage system facilities are concentrated; and
- (2) To eliminate or modify surfaces that would otherwise drain toward these low points.

b. In the short run, the Goal is to address, on a priority basis, the topography of those drainage basins containing the most vulnerable properties. These basins, which are identified as Numbers 3, 9 and "E" in the Village's

“Stormwater Master Plan”, also contain, predictably, about 80% (25) of the 32 repetitive loss properties.

- c. In the longer run, the goal is to address the remaining drainage basins. The Goal here is to seek modifications of the topography within manageable parameters, over time and on an opportunity basis, with the intent of eliminating, insofar as possible, features which impede the proper flow, channelization and absorption of storm water in ALL parts of the island.

- **Rainstorms**

One of the important goals of the Floodplain Management Plan is to achieve positive and effective flood protection for all Key Biscayne Properties against major rainstorms and severe weather events, short of hurricanes and storm surges:

- a. In the shorter run (about five years), this Goal would apply to weather events (except hurricanes and storm surges) that have recurrence intervals of over 25 years (i.e. a rainfall of about 10 inches in a 24 hour period).
- b. In the longer run (about twenty years), this Goal would apply to weather events (except hurricanes and storm surges) that have recurrence intervals of over 100 year (i.e. a rainfall of about 13.5 inches in a 24 hour period).

- **Storm Surges**

A goal of the Floodplain Management Plan is to reduce the severity of storm surges and to, correspondingly:

- a. Identify action programs as necessary and projects with the potential of mitigating the hazard;
- b. develop the means to fund such action programs and projects over-time; and,
- c. secure additional research into the behavior of storm surges.

A second set of goals of the Floodplain Management Plan, related to storm surges, includes the development of expanded policies and regulations, beyond current minimum code requirements:

- a. to encourage greater setbacks from shorelines for new developments of both beach-front and bay-front properties;
  - b. to encourage retrofitting and elevation of structures throughout the floodplain with high priority consideration for those built on beach and bay-front properties; and,
  - c. to seek opportunities to acquire, exchange or otherwise secure limited control of beach and ocean-front real estate in conjunction with large scale venture where public involvement is a factor.
- **Soil Conditions**
    - a. The Goal is to increase the drainage characteristics of the soils on Key Biscayne.
    - b. A related Goal is to preserve and expand the open areas in the Village.
  - **“Old Law” Buildings<sup>3</sup>**
    - a. The Goal of the Floodplain Management Plan is to reduce the number of structures built with finished floor elevations below the Base Flood Elevation.
    - b. A related Goal of the Floodplain Management Plan is to eliminate the use of garages for other than parking purposes unless the finished elevation of such garages is in conformance, at least with the older Miami-Dade County Code requirements for the main floor of structures.
    - c. A strategic Goal of the Floodplain Management Plan is to stimulate growth in Key Biscayne real estate values and to create consequent market-driven incentives for improvement of properties, including compliance with NFIP Standards.

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<sup>3</sup> “Old Law” refers to the older Miami-Dade County Building Code which only required the finished floor elevation of a structure to be 13 inches above the crown of the road

- **Flood Data, Information and Analysis**

- a. An important Goal of the Floodplain Management Plan is to reach the targets projected for the completion of the data base project initiated by the Village Building, Zoning and Planning Department. This would incorporate into the data base, among other elements, a wider range of property data, topographical data, storm drainage data, rainfalls as measured by the Bill Baggs rain gauge, building permit data, data on flood insurance, history of flooding, existing and changes in finished floor elevations, and the like.
- b. An equally important Goal of the Floodplain Management Plan is to extract, catalogue, organize (in a user-friendly manner) and make accessible, (through education and other means) at a central location:
  - (1) the extensive and continually growing web of legislative, regulatory and policy mandates which relate directly to Floodplain Management; and
  - (2) the wide and fast growing range of existing Floodplain Management Information, including NFIP information, State of Florida and Miami-Dade County Information, Village Information and ad-hoc information made available through the media; government Agencies such as NOAA, SFWMD, Universities, and the like.
- c. A further Goal in the area of data and information is to promote analysis and research to improve, and continue to evolve, the capacity and knowledge for state-of-the-art management of Floodplain Management Plan Activities. Specific areas of research and analyses will include among others:
  - (1) definitions of flooding and weather events in relation to the Flood Insurance Rate Map information;
  - (2) implication on Insurance Premiums (beyond CRS) resulting from the achievement of various levels of Floodplain Hazard Mitigation, including impact of such Mitigation on the Base Flood Elevation;
  - (3) measurement of Floodplain Vulnerability factors;
  - (4) measurement Storm Drainage System Effectiveness;

- (5) evaluation of Beach Nourishment, Dunes and related improvements as Storm Surge Mitigation Measure;
- (6) benefit-cost Analysis methodology.

- **Economic Goals**

- a. A major economic Goal of the Floodplain Management Plan is to support and, where possible, enhance the land component of real estate values on Key Biscayne, thereby creating a market-driven, rather than regulatory, environment for the improvement of structures with current finished floor elevations below base flood elevation to NFIP standards.
- b. Another important economic Goal is to manage and execute the activities the Floodplain Management Plan as cost-efficiently as possible with a minimum financial burden on Village residents and property owners, capitalizing where possible on the availability of grant-in-aid programs and on the Village's ability to secure same.
- c. The fundamental economic Goal of the Floodplain Management Plan is reduce the vulnerability of Key Biscayne to Floodplain Hazards, and to reduce the costs associated with such hazards, whether in the form of loss of building or content, flood insurance premiums, or other economic hardship.

- **Public Information and Involvement**

An important Goal of the Floodplain Management Plan is to increase the public awareness of floodplain hazards and problems and to educate the public through a widespread program of general information, media coverage and participatory involvement about the Floodplain Management Plan and the Action Programs to be undertaken therewith.

- **Organizational, Administrative, Managerial and Administrative Goals**

- a. The Goal is to make Floodplain Management a mainstream function in the organization, management and administration of Key Biscayne's municipal affairs.
- b. The collateral Goal is to spread (rather than concentrate in a separate department) the allocation of Floodplain Management responsibilities as

broadly as possible within the Village's administrative structure in order to assure longer-term continuity and full integration of Floodplain management functions into the operations of the Village.

A Working Goal is to accept the National Flood Insurance Program/Community Rating System as an integral part the administrative framework within which to:

- (1) budget and plan Floodplain Management activities; and
- (2) monitor, evaluate and report progress on the implementation of the Floodplain Management Plan.

### **Floodplain Management Plan Activities**

- **Focus**

In the analysis of flooding hazards and problems, and in the course of formulating Goals, an understanding has emerged with respect to what is reasonably achievable.

At the core of this understanding is an acceptance of the fact that substantial elimination of flooding from rainstorms is technically achievable, but that such results are clearly not achievable with respect to hurricane generated storm surges.

Accordingly, the nature of the floodplain management plan activities tends to cover the entire spectrum of mitigation measures related to flooding caused by severe rainstorms. In contrast, the mitigation of storm surges is almost entirely focused on dune and beach related activities and on the elevation of structures above the base flood elevation.

- **Process**

The Goals of the Floodplain Management Plan shall be achieved incrementally through the diligent implementation of TASKS and PROJECTS contained in ACTION PLANS.

Action Plans shall be prepared, reviewed and updated every two years.

They shall be based in all cases on this Floodplain Management Plan Document and on a range of the selected FLOODPLAIN MANAGEMENT ACTIVITIES determined through the following procedure:

1. Review & Evaluation of Activities

Some 31 Activities contained in the following six groups of "Floodplain Management Activities" have been reviewed and evaluated. These activities are recommended by the National Flood Insurance Program as representing the full range of such possible activities.

- a. Flood Prevention Activities;
- b. Property Protection Activities;
- c. Natural Resource Protection;
- d. Emergency Services;
- e. Structural Projects;
- f. Public Information;

2. Evaluation Criteria

The review and evaluation of the activities was made in accordance with the following criteria:

- a. Appropriateness in terms of Key Biscayne Flood Hazards and Problems.
- b. Support and consistency with Floodplain Management Plan Goals.
- c. Benefits in relation to Costs.
- d. Affordability (cost in relation to available resources).
- e. Financeability (availability of funding sources).
- f. Legality.
- g. Environmental Impact.

3. Narrowing of Range

As a result of the review and evaluation:

- a. Nine (9) of the 31 activities have been eliminated for consideration as part of Action Plans, having been found to be

either not appropriate, feasible or relevant to Key Biscayne's circumstances;

- b. The remaining twenty two (22) activities have been found to be a proper basis for selecting and rating the On-Going Tasks and the Pipeline of Projects to be included in the Action Plans;
- c. Two (2) of these 22 activities will require further analysis before insertion in the pipeline, with the understanding that the undertaking such analysis shall be a matter of high priority.

#### 4. Range of Selected Activities

More specifically, the 22 activities from which On-Going Tasks and Pipeline Projects will be selected shall include the following:

a. Group 1 Activities: Prevention

Planning & Zoning  
Open Space Preservation  
Floodplain Development Regulations  
Stormwater Management  
Drainage System Maintenance  
Dune and Beach Maintenance

b. Group 2 Activities: Property Protection

Building Elevation  
Flood Proofing  
Insurance

c. Group 3 Activities: Natural Resource Protection

Erosion and Sediment Control  
Best Management Practices

d. Group 4 Activities: Emergency Services

Flood Warning  
Flood Response  
Critical Facilities Protection (New Facilities Analysis and Consensus)  
Health and Safety Maintenance

- e. Group 5 Activities: Structural Projects  
Beach Nourishment (Cost-Benefit Analysis)  
Storm Sewers

- f. Group 6 Activities: Public Information  
Map Information  
Outreach Projects  
Library  
Technical Assistance  
Environmental Education

5. Action Plans and Priority Projects

Based on recommendations from the Village Manager and feasibility documentation from staff:

- a. Those projects in the Action Plan pipeline that are deemed to warrant the highest priority shall be selected and prepared for execution.
- b. Concurrently, arrangements for the continued pursuit of the on-going tasks shall be procedurally integrated with the normal operations of the Village Administration.

**Floodplain Management Plan Maintenance**

The Floodplain Management Plan and the above steps relating to the selection of On-Going Tasks and Pipeline Projects shall be reviewed and updated as necessary every two years and such actions shall be certified as a new Action Plan to be formalized in every instance by the Village Council. It is through this process that progress on existing activities and projects will be evaluated and determinations made for the inclusion of additional projects or activities.



**Part C: Floodplain Management Plan Report**

## **PART C: Floodplain Management Plan Report**

### **I. Organize to Prepare the Plan**

#### **A. Staff Resources**

The person in charge of coordinating the planning process, under the Village Manager, is Mr. Peter Kory, the National Flood Insurance Program Community Rating System Coordinator for the Village of Key Biscayne. His technical support consists of: 1. Village Staff and Officials, including Mr. John Little, Director of the Village Department of Building, Zoning and Planning, and Mr. Leo Llanos, Village Building Official, and all the staff resources available to these individuals; and 2. Outside independent engineering support including notably the firm of Williams, Hatfield and Stoner, Inc.

Mr. Little brings to the effort a deep knowledge of Key Biscayne, its codes, ordinances, legislative history and the substance of its master planning, zoning and related programs.

Additionally, his evolving thrust to expand the Village's data base via sophisticated and state-of-the-art technology will prove invaluable in maintaining up-to-date information in assessing the nature and extent of the flood hazard and problems on an on-going basis.

Mr. Llanos, as the Village's Building Official, provides a wide range of in-depth knowledge of existing building conditions, history of island buildings, changes and events affecting the buildings, including their capacity to withstand major weather events.

Williams, Hatfield and Stoner, Inc. (WHS), as the engineering firm which prepared Key Biscayne's "Storm Drainage Master Plan" and designed, as well as partially supervised, the construction of the Island's Storm Drainage System, is ideally positioned, beyond its technical qualifications, because of its intimate knowledge of soil and other sub-surface conditions, topography and weather events and

behavior, to address the nature and extent of the island's hazards and flooding problems. The same knowledge and experience will prove invaluable, in the subsequent phases of the work for the formulation of goals and, ultimately the preparation of the Action Plan for the implementation of the goals.

## **B. Planning Committee**

The technical team identified above will be responsible for the preparation, validation and justification of all proposals and related material that will be reflected in "Recommendations for Decisions" which will constitute the "Floodplain Management Plan".

The group which will act on these recommendations (i.e. "the Planning Committee") is a **Working Review Committee** (WRC) organized to make recommendations to the Village Manager.

The Manager, in turn, will make the appropriate administrative determinations and dispositions with respect to the recommendations, referring, appropriate, some for legislative action by the Village Council and others for implementation by Village staff and technical support personnel.

As such, the WRC is designed as an administrative tool to act as a technical consensus adjunct to the Floodplain Management Planning Process, helping to crystallize the substance of proposed decisions and the issues of relevance. In this respect the WRC also represents an informal but effective forum for the expression of ideas and public participation.

The WRC membership consists of the following individuals who have each specialized backgrounds of particular relevance to the matters involved in the preparation of the Floodplain Management Plan:

The Chairman, Deborah DeLeon, is a local practicing architect, residing on Key Biscayne. She is thoroughly familiar with the Village, has been involved with a number of design projects on the Key and is otherwise active on the civic scene.

The South Florida Water Management District is represented on the WRC by Maribel Balbin who has been assigned by the Executive Director of the District as Liaison between the WRC and the extensive resources which the District can bring to bear on the work of the Committee.

Mr. Robert Cuevas is a resident of Key Biscayne and the recently retired Chief of Engineering for the Miami-Dade Water and Sewer Department (WASD). As such, he is not only familiar with the technical aspects of Flood Management, but his background will provide a very special access to WASD, as may be required in the course of the work. As a Professional and Environmental Engineer with decades of experience in the field, he is particularly well qualified to render judgment on the product of staff work and make recommendations thereon.

The Metro-Dade Department of Environmental Resource Management (DERM) is represented on the WRC by Mr. Brian Flynn, Chief of Restoration and Enhancement Section. In this capacity, he is at the cutting edge of the County's activities in beach restoration and dune development projects throughout the metropolitan area, including Key Biscayne. These projects are expected to play a critical role in the mitigation of storm surges, which are one of the great hazards faced by barrier islands like Key Biscayne.

Dr. Gregory Han is an Oceanographer by education and background. He is also a Village Councilman, which will prove useful during the later stages of the project as some of the recommendations for decisions will require legislative action.

Mr. Lee Niblock is a Certified Leisure Professional and is currently the Park Manager of the State's Bill Baggs Cape Florida Recreation Area which adjoins Key Biscayne to the south. His technical background is in management of environmental resources. His participation will be particularly valuable in light of his involvement with the beach re-nourishment and dunes project and the fact that the recently installed rain gauge is being maintained by the State park rangers.

From the standpoint of flood management, and the impact of "open space", it should also be noted that Bill Baggs Park has been considered in the Village's Community Rating Service Application, to be a part of the Key Biscayne "Community".

Mr. Ronald White is a Meteorologist and Weather Forecaster. He is also the retired head and chief forecaster of the National Weather Service for the Miami Region. As such, he is in a position to provide access to virtually all of the services and facilities under the jurisdiction of NOAA in this area. Additionally, the sharing of his technical knowledge, counsel and experience in this field during the planning process will prove invaluable.

### **C. Meetings**

Three pairs of regular meetings have been scheduled for the Working Review Committee, including one pair for each of Phases I, II, and III of the process.

Each pair of meetings will include a "Presentation Meeting" followed within ten days by a "Decision Meeting".

At the end of the planning process, in connection with Phase IV (i.e. the plan ratification phase) at least two meetings are contemplated, including a workshop to which the public will be invited and a Village Council Meeting.

Presentation meetings will include, as the name implies, presentations and reports from staff, backed up, as appropriate, with written documents, explaining, validating, expanding on, as necessary and justifying the information and proposals conveyed in the course of the presentations. It is also at such meetings that questions will be answered and discussion amongst Members of the Committee will take place. At the conclusion of each presentation meeting a "Checklist of Recommendations for Decision" will be made available to be acted upon at the subsequent "Decision Meeting".

The decision meetings agenda will be focused on the recommendations presented on the check list, including a vote by WRC Members on each proposal. These meetings will also seek to resolve all open issues, including discussion as necessary over the substance and implications of the decisions.

Minutes of the meetings will be kept and will become part of the official records of the Floodplain Management Plan (Volume Two). The Florida Sunshine Law will apply.

All WRC meetings will be open to the public and subject to the posting of public notice. Public participation will be encouraged at all time. However, formal publicly advertised workshops will be limited to two. One of these will deal, during phase II, with the setting of goals. The other will occur during phase IV in connection with the ratification of the plan.

The first and second WRC Meetings, focused on the material in this report, i.e. dealing with Phase I agenda, were held on July 18, 1997 (Presentation Meeting) and July 25, 1997 (Decision Meeting).

The phase II meetings are not scheduled but will occur in early October 1997. Phase III meetings will most likely take place during February or March 1998 and the "ratification" meetings (phase IV) may not occur until April 1998.

#### **D. Later Duties**

The staff resources, including the CRS Coordinator, the Director of Building, Zoning and Planning, the Building Official, WHS Inc., the members of the Working Review Committee (including over-time their successors or replacements), and the network of Governmental organizations involved in the preparation of the Floodplain Management Plan, represent a coalition of technical knowledge and talent which is intended to be preserved via ad hoc meetings, periodic reports from the CRS Coordinator and other means for the purpose of monitoring and, as the case might be, participating in the implementation of the Floodplain Management Plan.

## **II. Involve the Public**

The results of public interaction are presented in Volume Two.

### **III. Coordinate With Other Agencies**

#### **A. Agencies Involved**

The Governmental Agencies with which the planning process is being coordinated include:

- Village of Key Biscayne: Depts. Building, Zoning & Planning and Fire Rescue
- South Florida Water Management District (SFWMD)
- Metro-Dade Department of Environmental Resource Management (DERM)
- Metro-Dade Water and Sewer Department (WASD)
- Metro-Dade Office of Emergency Management
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service
- State of Florida Department of Community Affairs; Division of Emergency Management (DCA)
- Federal Emergency Management Administration (FEMA); Mitigation Division
- Insurance Service Organization (ISO)

Additionally, exchange of information and coordination of efforts are also taking place with the "Village Beach Resources and Management Task Force" whose mission is focused on beach re-nourishment and Mrs. Joan Gill Blank, the author of: "Key Biscayne: A History of Miami's Tropical Island and the Cape Florida Lighthouse". Said book and the underlying research contains a

wealth of significant information about weather events described factually and anecdotally within an historic context.

**B. Coordination**

Coordination that has occurred to-date and will continue to occur primarily via briefings and exchanges of information. More specifically:

Within each of the above Agencies and Entities contact has been established with an appropriate individual or representative and in some cases such contacts have evolved into fairly comfortable and productive relationships.

**C. Project Coordinator's Role**

Through such contacts the EMPATF Grant Coordinator has kept, and will continue to keep, these Agencies informed on the status of the planning process, including copies of Quarterly Reports to the State Department of Community Affairs, notices of Working Review Committee Meetings, technical reports and the like.

**D. Working Review Committee**

It is hoped that the Working Review Committee Meetings can also become a forum within which the above Agencies can participate express their views and keep informed. They will be invited to attend in every case and they will be provided with minutes of the meetings so that the opportunity for involvement will exist.

**E. Examples**

In many instances, coordination has to occur as a matter of necessity. For example, the preparation of the Floodplain Management Plan is not feasible without FEMA's conveyance of hard data with respect to the repetitive loss properties located on Key Biscayne. WHS

cannot do an effective assessment of floodplain hazards and problems without existing building and grade information from the Village Planner and statistical weather information from the National Weather Service, NOAA and SFWMD. The project Coordinator cannot effectively address the subject of the Plan's consistency with the County Emergency Management Plan without a thorough review of the proposals by the Metro-Dade Office of Emergency Management.

#### **IV. Assess the Hazard (See Note 1.)**

##### **A. Location**

The Village of Key Biscayne, Florida is located in the center of a barrier island (Key Biscayne) which is approximately 5.5 miles east of downtown Miami. Excluding water passage, the only access to the Village from the mainland is over the Rickenbacker Causeway. The Village encompasses most of the development on the island. North of the Village the island is composed of Crandon Park, a Metro-Dade County multi-functional park. Bill Baggs State Park makes up the southern portion of the island, south of the Village. The Village is bounded on the eastern and western bearings by the Atlantic Ocean and Biscayne Bay, respectively.

##### **B. Topography**

As is typical in south Florida, the land surface within the Village is relatively low and flat, with road crown elevations ranging between elevations 3.4 and 6.0 feet NGVD. Crandon Blvd., running in a north-south direction through the town, defines one of the few drainage basin divides. The land surface generally slopes away from Crandon Blvd. toward the two coastlines. However, the progression of development on the island has created depressional areas which tend to collect water during storms. Graphic material in Volume Three shows some of the depressional areas as defined by roadway centerline elevations. Most of the repetitive loss properties are located in the vicinity of these low spots.

##### **C. Type of Hazard**

There are two types of flooding hazards which occur in the Village - severe rainstorms and storm surge.

## 1. Rainstorms

Severe rainstorms over the island will generate massive amounts of runoff which, until recently, would accumulate and be stored in the low areas for extended periods of time. According to the South Florida Water Management District (SFWMD), as much as 13.5 inches of rain can be produced in a 24-hour period for a 100-year storm. Because of the high groundwater table and poor infiltration capacity of the soil, most of this rainfall will become stormwater runoff and flood the low lying areas. Prior to the construction of the storm water management system in the Village, small storms would cause minor flooding and storms with sufficient rainfall could cause flood waters to inundate much of the Village. The new drainage systems provide a positive outlet for the runoff to dissipate from the surface. The systems were designed to provide effective protection from flooding for the 5-year design rainfall event. This type of storm will produce a little over 7 inches of rainfall in 24 hours. For larger storm events, there will still be localized flooding but the duration and extent of flooding will be reduced because of the performance of the drainage system.

## 2. Storm Surges

Storm surge is the other flood threat to the Village. Storm surge occurs as strong winds, such as from a hurricane, force water levels in the ocean or bay to rise and flood the coastal areas. The only methods to inhibit the storm surge would involve the creation of dunes, or the construction of other massive man-made barriers, land or ocean floor forming devices round the island. While some of these measures may be feasible, the economic, legal and ecological considerations clearly place them beyond the scope of the present effort. For the purpose of the Floodplain Management Plan, the hazard of storm surges and their behavior is recognized and in the course of subsequent planning phases, recommendations will be made to link the plan with related programs, such as the Village's beach renourishment and dune development projects.

## D. Extent of Hazard; Base Flood Elevation (BFE)

The Federal Emergency Management Agency (FEMA) publishes the Flood Insurance Rate Maps (FIRM) which show the base flood elevations. The base flood is defined as occurring during the 100-year recurrence interval storm. This type of storm will have a 1% chance of occurring during any given year. The FIRM maps for the Village indicate the base flood covers the entire island, with flood elevations of between 7 and 12 feet NGVD. These elevations translate into flooding depths as much as 6 feet in some areas in the Village. This flooding would not be caused by severe rainstorms alone. For the flood waters from a severe rainstorm to reach elevation 12, there would have to be a physical barrier at or above this elevation to prevent the runoff from sheet flowing off the island. Therefore, the base flood elevation on these maps appears to reflect essentially storm surge rather than rainstorm events. According to these maps, the highest flood elevation would occur along the coastline where the wave action would be greatest. The flood elevation declines inland as the wave energy and height dissipates.

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Note 1 Sections IV and V of this report deal with ASSESSMENT OF THE HAZARD AND ASSESSMENT OF THE PROBLEM. Two matters of common concern need to be addressed before proceeding with the substance of the subject:

### A. Definition of terms: "Hazard" vs. "Problem"

For the purpose of this document these terms have been assumed to follow the intent of the language in the NFIP/CRS July 1996 publication entitled "Example Plans" wherein, on page I-3, step e.: "Assess the problem" cites the fact that "...A floodplain is only a problem if human development gets in the way of the natural flooding."

This distinction between a "Hazard" reflecting an act of nature and a "Problem" created as a matter of human development when encountering said act of nature, has helped organize this portion of the Report.

Example: Based on stage-storage computations for various storm recurrence, interval areas of flood hazard are identified. This would define the hazardous areas of flooding based on the existing ground contours. From the stage-storage elevations, areas of hazardous flooding would be evaluated based on the existing floor elevations of the dwellings. The flood problem would then be identified by the dwellings that have existing floor elevations below the stage-storage flood elevations. The dwellings in which the floor elevations are above the stage-storage flood elevations are still within a hazardous flood area but are not subject to flooding.

B. Focus of Floodplain Management Plan

As the entire Village of Key Biscayne is not only in a floodplain but in a Special Flood Hazard Area (SFHA), the “hazard” and “problem” areas covered by the Floodplain Management Plan are far too many and too broad for in-depth treatment under this current effort. Accordingly, it is the intent to approach the preparation of the Floodplain Management Plan on an evolutionary basis, focusing the current effort and its resources, under a triage-like philosophy, on those areas where effective action is feasible.

More specifically, the intent is to focus the current effort on the hazard of major rainfalls and weather events involving recurrence intervals of less (rather than more) than 100 years, and on the problem of flooding of repetitive loss residential properties (rather than all properties on Key Biscayne).

As such, the current effort should be considered the beginning of a process, to be continuously updated as additional data, new technology, research and resources become available.

## V. Assess the Problem

### A. Problem Statement

Village of Key Biscayne is an island with a single access to mainland Miami-Dade County. The island elevations are relatively flat and low. Much of the island was developed under the older Miami-Dade County building codes, which only required the finished floor elevation of a structure to be 13 inches above the crown of the road. By comparison, under the new code, where the Base Flood Elevation (BFE) governs, the finished floor elevation of the main structure would have to be some 5 feet to 7 feet higher. The floor of the attached garage only had to be six inches above the crown of the road. This resulted in the homes being subjected to flooding, not only by storm surges and other major weather events of recurrence intervals of less than 100 years, but also during major rainfall events. At some locations, the garages or carports have been enclosed and



**Example of a converted garage.** (P. Kory)

converted into living space, thereby increasing the risk of loss due to flooding. Therefore, the initial problem relates to the ability of the storm drainage system on Key Biscayne to handle the most severe rainstorms for extended rainfall periods. Because of the flat, low profile of the island, flood elevations would be limited to stage levels where storm water

would be directly discharging into the surrounding ocean and bay. After this point flood levels would stabilize at whatever rainfall intensity is present. This would be the limiting definition in regard to identifying flood hazard due to purely

rainfall induced flooding. It should be noted that this peak flood level could be more than 13 inches above the crown of the road and would threaten the homes with floor elevations set by the old code.

The second problem area relates to the hurricane potential due to Key Biscayne being in a hurricane prone area. This involves storm surges of both the ocean and/or the bay surrounding Key Biscayne. This surge would be controlled by water depths surrounding the island, the intensity and size of the storm and the direction of the storm. As discussed earlier, surging floodwaters can rise as much as 6 feet above the crown of the road. Storm drainage systems would not be effective in reducing the flooding since the volume of water would overwhelm the system and render it ineffective. The only benefit of the storm drainage system would be in reducing the flooding time after the storm surge had abated.

## **B. Problem Description**

Since the problem is a two-part definition, the initial decision relates to effective measures that can be implemented to reduce repetitive flood damage.

The problem related to storm surge limits the measures available to reduce flood damage. Short of developing major man-made barrier islands or dunes to break-up the storm surge, the only reasonable solution is raising the existing floor elevations above the storm surge elevations. This would present a major problem since a substantial number of dwellings are significantly below BFE, i.e. storm surge elevations. However, recent building code changes have required new structures to have floor elevations above the base flood elevation.

The problem related to flooding caused by rainfall presents a more manageable task. The improvements related to storm drainage systems would offer better protection to the existing dwellings with low floor elevations. The initial development of Key Biscayne only required the dwelling floor to be 13 inches above the road centerline elevation. This subjected many dwellings to potential flooding for long duration since only marginal storm drainage was available to

alleviate rainfall induced flooding. Soil conditions allowed only poor percolation. Therefore with the lack of storm drainage facilities, the flooding was frequent and of long duration.

Recently, storm drainage facilities were constructed to provide better flood protection. Therefore the problem related to flooding induced by rainfall would relate to the cost/benefit to provide a higher level of service from the drainage facilities.

One of the important reasons for undertaking the preparation of a Floodplain Management Plan is the existence of some 32 repetitive loss properties sustained in Key Biscayne. In reviewing the limited data, the repetitive losses fell into two categories, namely:

1. **Hurricane Andrew** - this was a small sized storm that had a band of extremely high velocity winds. This extremely high velocity band of winds did directly strike Key Biscayne. This did cause a major storm surge to inundate the island and cause major flood damage as well as the wind damage to the majority of structures on Key Biscayne.
2. **Rainfall** - the other major event was a high intensity rainstorm, which struck Key Biscayne and caused extensive flooding. This event took place on October 8, 1991, prior to the construction of the storm drainage improvements. Recently, a similar intense rainfall event occurred after the storm drainage construction and flooding conditions were significantly reduced.

### C. Areas of Concern

In identifying the problems it becomes evident that the emphasis should be directed toward eliminating the repetitive losses as they relate to flooding caused by rainfall events. Given that, according to FEMA statistics, "only a tiny fraction (less than 2%) account for 33% of all insurance claims paid", it stands to reason that **the action items that can be taken to provide maximum flood protection and eliminate repetitive losses caused by weather events of recurrence intervals of less than 100 years, within workable**

**economic parameters, should emerge as the primary focus and area of concern for the present effort.** To this end, the assessment of the problem will be concentrated on the 32 properties identified by FEMA as repetitive loss properties. Volume Two of this report contains a package of worksheets, one sheet per repetitive loss property, which reflects all available information with respect to such properties that may be pertinent to the problem.

Resolving flood losses associated with storm surge are economically limited for the Village of Key Biscayne. One of the important solutions, is the raising of floor elevations to meet present code requirements (i.e. BFE). Because of the major floor elevation differences between the old and new codes (5' to 7'), it does not appear economically practical to raise floor elevations short of a total rebuild of the structure. Since at the present time the major construction activity on Key Biscayne is in the upgrading of the structures, this is resulting in old structures being demolished and being replaced with new structures at new code floor elevations. This activity is reducing the number of dwellings at risk to flooding from storm surges and severe rainstorms. This re-construction activity should continue in the future and produce a greater number of dwellings with lower flood risk.

**Therefore the current effort will address traditional flood protection measures for flooding related mainly to rainfall events.** Although major improvements have been recently constructed to reduce rainfall event flooding, the level of service will be reviewed to determine if economic benefit can result from a greater level of service.

#### **D. Elevation Assumptions**

A major problem, which has been encountered in this assessment of hazards and problems, is accurate information with respect to existing floor elevations. This data is very limited. Therefore, to evaluate flood potential, floor elevations have to be assumed at the old code requirements, particularly for the older dwellings. This assumption is as follows:

- Garage Floor Elevations - 6 inches above roadway centerline elevation.
- Dwelling Floor Elevations - 7 inches above garage floor elevation (13 inches above roadway centerline elevation).
- Existing Contours - these were developed from roadway centerline elevations. These are the basis for determining the stage-storage calculations and the finished floor elevation of the repetitive loss properties as described previously.

## **E. Vulnerability or Risk Index**

The ability to rate the risk would be related to the following factors:

### **1. Floor elevations**

- a. Floors above FEMA map contours
- b. Floors below FEMA map contours
- c. Garage Floor Elevations

### **2. Location**

This would relate to dwellings in the lowest street elevation areas

### **3. Evaluation**

Dwellings above FEMA map contours would have the highest rating against floods. (i.e. the lowest vulnerability index number) The FEMA map contours do apparently recognize storm surge as well as rainfall flooding. Dwellings below FEMA map contours are assumed to be a higher risk to flood damage and this would relate to the elevation and location. The lower the elevation, the greater the vulnerability to flooding and if located in the lowest areas, it would be subject to a greater and longer flood period since the higher areas would drain to the lower areas and require a long time to dispose of the flood waters. Garage floors prior to code changes only required they be 6 inches above the centerline road elevation. Therefore they will be subject to more and greater flood depths. Since FEMA does include flood damage to garage contents, the dwellings with these low garage floors are considered to be at greatest risk of flooding.

Any risk index would have to be evaluated on these risk factors. It is contemplated to defer the construction of the index and the rating of properties in accordance with such index until Phase III of the preparation of the Floodplain Management Plan in order to maximize the technical information to be derived as a consequence of the Floodplain Management Planning process.

#### **F. Other Problems**

**Dwellings** - As noted garage floors are allowed to be at least 7 inches below dwelling floor elevations and are subject to greater flood risk. In a field review of dwellings, several dwellings were noted where it appeared that garages/car ports were enclosed and became living areas. This would intensify the potential flood damage. These types of modifications should be investigated and noted since they are potential greater flood problems that could result in repetitive claims due to the building modifications.

**Access** - A collateral benefit should be an evaluation of the potential flooding of the roadway and access systems. Improved flooding protection to the access system would provide a better evacuation system to an island with only one access point to the mainland and would also provide better fire and security access to the dwellings during potential flood conditions, which would improve dwelling security and fire loss during flooding conditions.

**Fire and Safety Buildings** - These facilities need to be assessed so that these facilities are not flooded during disaster periods so that fire and safety communication and access can be provided to the community.

**Major Utilities** - Inspection should be made of the FPL electrical subsystem located on the island to ensure it is not subject to flooding during the base flood event.

**Data Collection** - Since the Village of Key Biscayne is a newly incorporated municipality, data prior to incorporation was vested with Miami-Dade County. In addition, there is a lack of

development data since the initial development was in the early 1950's. Therefore, the ability to recover other than recent data is marginal. The ability to gather critical data is very difficult. A program of putting together an effective data base would be a major benefit to the program.

In addition the ability to gather claim data from FEMA has been limited due to the lack of data provided in the claim forms.

Organizational Structure - Although still in its infancy, the Village government is progressing toward a responsive coalition of elected and appointed persons. To maximize the product of the efforts put forth by these officials, improvements need to be made to the organization. Stronger bonds need to be formed between all involved so that the results of the program do not fall short of expectations.

## VI. Set Goals <sup>1</sup>

### A. Context and Introduction

#### 1. Context of Goals

This section (Section VI) of the Floodplain Management Plan Report focuses on the Goals for the Plan and, as such, stands as the bridge between an understanding of the Floodplain hazards and problems and Phase III of the work program which will “Review Possible Floodplain Management Activities” (Step G) and result in an “Action Plan” (Step H).

#### 2. Introduction to Goals

The Goals for the Floodplain Management Plan have been organized in two parts:

ONE deals with the overall goals for the Plan, expressing the subject in very general terms to help form a strategic base from which the policies governing the Floodplain Management Plan can be derived, organized and justified;

THE OTHER identifies more specifics “working goals” and relates them to:

1. The “Flood Hazards and Problems” that were assessed in Phase I of the Plan; and,
2. The “Possible Floodplain Management Activities” which may be considered in Phase III of the Floodplain Management Plan towards the achievement of the Goals.

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<sup>1</sup> The use of the term “Objectives”, and the distinction between that term and “Goals” is omitted, as these terms, when used in conjunction with one another, tend to subordinate the substance of the message to semantic perfection, while generally blurring the intent of the effort.

Once approved, these Working Goals will provide a solid basis for evaluating, selecting and justifying the Floodplain Management Activities and their implementation as part of the Action Plans.

Reaching agreement on the goals is contemplated as a three step process:

STEP ONE involves action on "Recommendation for Decisions" with respect to the Phase II Report (i.e. this report) by the Working Review Committee.

STEP TWO seeks substantive local resident input and reaction with respect to the goals by:

1. Conducting telephone survey of repetitive loss properties and seeking out properties with comparable vulnerability characteristics.
2. Using the results of the above efforts identify participants in a small meeting in the course of which the goals and other floodplain management topics will be examined in depth to help in the design of the Plan.

STEP THREE involves the consideration of the goals as part of the adoption of the entire Floodplain Management Plan (Phase IV of the planning process), including action by the Village Council and public meetings, as appropriate, which normally precede such action.

## **B. Overall Goals**

1. The Floodplain Management Plan shall be consistent with the goals and intents of the Village Master Plan, its codes and ordinances, as well as other official Village documents and endeavors reflecting its aspirations for the welfare, safety and quality of life of its Citizens.

2. A primary goal of the Floodplain Management Plan is to reduce vulnerability to flooding hazards from major rainfalls, hurricanes and related severe weather events. This Goal applies to all Key Biscayne structures, their content and appurtenant assets and facilities.
3. Related to the above is the goal to mitigate the extent and severity of the problems created by these hazards and to, collaterally, secure the necessary commitments and, to the maximum feasible extent, the necessary resources to implement mitigation Floodplain Management Activities in annual Action Plans to achieve these goals.
4. A key goal of the Floodplain Management Plan is to do all in the power of the public and the civic sectors, at all levels, to prevent any additions to the list of "Repetitive Loss Properties" published annually by FEMA, and,
5. As a companion goal, to reduce the number of Repetitive Loss properties, to a point where Key Biscayne can qualify as a category A or B Community (i.e. a community containing no more than nine (9) repetitive loss properties.)
6. An important goal of the Floodplain Management Plan is to assure incremental improvements in Key Biscayne's standing and classification in the Community Rating System (CRS), with the related consequences of making flood insurance under the NFIP more affordable and reachable, while improving Key Biscayne's effectiveness in coping with flood hazards, problems and emergencies.
7. An overall Goal of the Floodplain Management Plan is to increase the continual dissemination of information on a repetitive basis with respect to the existence of flood hazards and the availability of measures to mitigate the problems presented by such hazards.
8. Another important overall Goal of the Floodplain Management Plan is to continually improve and maintain cutting-edge, state-

of-the art, effectiveness of Key Biscayne's emergency preparedness and disaster response capacity.

9. A further overall Goal of the Floodplain Management Plan is to increase the level of coordination of Floodplain management concerns, plans and activities at the Municipal, County, State and Federal levels of Government.
10. The last, but critically important overall Floodplain Management Plan Goal, without which all other Goals are in danger of academic oblivion, is the Goal to secure an enforceable commitment for their implementation.

### **C. Specific Working Goals**

As indicated in the introduction, the more specific goals for the Floodplain Management Plan are presented in the context of:

1. The "Floodplain Hazards and Problems" identified in Phase I of the planning process; and,
2. The consideration (i.e. evaluation, selection and justification) of the range of relevant "Possible Floodplain Management Activity(s)" as defined in the NFIP/CRS Manual. As such, these "Working Goals" relate directly to Phase III of the Planning Process.

The list of Working Goals discussed in this section of the Report is summarized as follows:

1. Protection of Rickenbacker Causeway (Key Biscayne access).
2. Protection of Critical Facilities.
3. Reduction or Mitigation of Low Points in the Village's Topography.
4. Reduction and Mitigation of Rainstorm Hazards and Problems.
5. Reduction and Mitigation of Storm Surge Hazards and Effects.
6. Goals related to existing Soil Conditions.

7. Reduction and Mitigation of Problems from structures built below BFE.
8. Flood Data Information and Analysis.
9. Economic Goals.
10. Public Information and Involvement.
11. Organizational, Managerial and Administrative Goals.

### 1. Access

- a. The Goal is to protect the ability to use the Rickenbacker Causeway in times of disaster and provide for continuous, free flowing traffic and circulation as needed for the effective and unencumbered provision of emergency services and evacuation operations.
- b. A related Goal, beyond the ability to use the Causeway, is the Goal to increase its roadway capacity and facilities to deal with (1) traffic peaking; (2) lane blockages for any and all reasons; (3) accidents or other road stoppages; (4) the operational requirements of service and emergency vehicles and equipment.

***The above Goals relate to the following Floodplain Hazards and Problems:***

- (1) Key Biscayne's dependence on the Rickenbacker Causeway as the only means of access and egress to and from the Key;*
- (2) Key Biscayne's complete dependence on the availability, in good operating order, of the three bridges (i.e. the "toll plaza", "William Powell" and "Bear Cut" bridges) that separate the Key from the mainland;*
- (3) The impact, on the Causeway's passability, of major rainstorm and storm surges which carry the potential of flooding and pavement washouts..*

- (4) *The fact that the Causeway is limited to two lanes in each direction with marginal berms and turn-off space and that, at times, outbound traffic volumes tend to exceed roadway capacities, particularly as traffic tends to accumulate as it nears the mainland.*

***The above goals imply the consideration of the following Possible Floodplain Management Activities identified in the NFIP/CRS Manual:***

- (1) *“Emergency Services, involving the protection of critical facilities”*

*Because of its importance to emergency management, the Rickenbacker Causeway is considered a critical facility and its protection is an indispensable element of the island’s disaster and recovery plans and programs.*

*Accordingly, all maintenance activities, repairs to causeway bridges and other structures, as well as all actions, policies and programs with respect to traffic control and regulatory devices on the Causeway will be considered as potential activities under the Floodplain Management Plan.*

- (2) *“Structural Projects”*

*Any alterations to the Rickenbacker Causeway roadway consistent with the above Goals, as well as any improvements to the three bridges that link the Causeway to the mainland will be considered Floodplain Management Activities under the Floodplain Management Plan.*

## **2. Critical Facilities**

- a. The goal is to protect all critical facilities vital to disaster response, including the structures occupied by the fire and police headquarters, fire fighting and rescue equipment

stations and all other emergency-related equipment and facilities involved with the transportation, communication, and energy requirements for an effective response to a major rainstorm, hurricane or similar disaster.

- b. A related goal is to explore the feasibility of a new municipal building complex, built to NFIP standards with particular emphasis on the Village's capacity to provide a comprehensive state-of-the art response to disaster and emergencies.

*The above goals, while not related to specific hazards and problems, imply the consideration of the following Possible Floodplain Management Activities identified in the NFIP/CRS Manual:*

(1) "Structural Projects"

*Any retrofiting, flood proofing or new construction of critical facilities will be subject of consideration for inclusion as Floodplain Management Plan activities.*

### 3. Topography

- a. The Goal is: (1) to reduce the low points of Key Biscayne's topography in each of the drainage basins in order to encourage the flow of stormwater away from structures and toward streets where storm drainage system facilities are concentrated; and, (2) to eliminate or modify surfaces that would otherwise drain towards these low points.
- b. In the short run, the Goal is to address, on a priority basis, the topography of those drainage basins containing the most vulnerable properties, including greatest number of repetitive loss properties i.e. Drainage Basins: 3, 9, and E, which contain about 80% (25 of the 32) of the repetitive loss properties.

- c. In the longer run, the goal is to address the remaining drainage basins and seek modifications of the topography of Key Biscayne, within manageable parameters, with the intent of eliminating, insofar as possible, features which impede the proper flow, channelization and absorption of storm water in ALL parts of the island.

***The above Goals relate to the following Floodplain Hazard and Problem:***

*The land surface within the Village is relatively low and flat, with road crown elevations ranging between 3.4' and 6.0' NGVD. While the land surface generally slopes away from Crandon Boulevard towards the two coastlines, this natural advantage has been offset with the progression of developments, which have created depressional areas that tend to collect water during storms. Most of the repetitive loss properties are located in the vicinity of these low spots.*

***The above Goals imply the consideration of the following Possible Floodplain Management Activities identified in the NFIP/CRS Manual:***

***"Preventive Activities"***

*The Preventive Activities to be considered in connection with these Goals relate to the following sub-activities: "Stormwater Management"; "Planning and Zoning"; "Open Space Preservation"; and "Floodplain Regulations". Together, the consideration of these activities as part of the Floodplain Management Plan should spell a combination of public policies, regulatory actions, as well as private initiatives that should substantially decrease the vulnerability of Key Biscayne structures to flooding from, at the very least, major rainfall events.*

#### 4. Rainstorms

One of the important goals of the Floodplain Management Plan is to achieve positive and effective flood protection for all Key Biscayne Properties against:

- a. In the shorter run (about five (5) years), this Goal would apply to major rainstorms and similar weather events (except hurricanes and storm surges) of a greater than 25 year recurring frequency (i.e. a rainfall of about 10 inches in a 24 hour period).
- b. In the longer run (about twenty (20) years), this Goal would apply to major rainstorms and similar weather events (except hurricanes and storm surges) of a greater than 100 year recurring frequency (i.e. a rainfall of about 13.5 inches in a 24 hour period).

***The above Goals relate to the following Floodplain Hazards and Problems, including:***

*Severe rainstorms will generate massive runoffs which, but for Key Biscayne's new storm drainage system, would flood low-lying areas. The drainage system provides a positive means for the runoff to dissipate from the surface, providing effective protection from flooding for the 5 year design rainfall event.(i.e. a 7" rainfall in a 24 hour period.) For larger storm events, there will still be localized flooding but the duration and extent of flooding will be reduced.*

***The above Goals imply the consideration of the following Floodplain Management Activities identified in the NFIP/CRS Manual:***

(1) "Preventive Activities"

*Preventive activities to be considered in connection with the above goals are expected to be focused on "Drainage System Maintenance" to assure optimum effectiveness in the operation of the existing system.*

(2) “Structural projects”

*A major project to be considered in the Floodplain Management Plan, related to the above goals, will be an upgrading and fine tuning of the new and existing Storm Drainage Systems, consistent with appropriate Benefit-Cost justification, as necessary to achieve the goals over a reasonable period of time.*

*Of critical importance in addressing these goals, is the acceptance of a working assumption that as stormwater runoff begins to flood the streets and yards, there a physical limit above which the floodwaters will not rise. This limiting elevation, which has not yet been measured, but which is apt to be several feet NGVD, i.e. substantially below Base Flood Elevation, is related to the lowest ground elevations near the perimeter of the island where surface runoff will flow into the ocean or Biscayne Bay. These low areas establish a storage volume for surface runoff. Additional runoff, after floodwaters have reached this elevation, will not cause the flooding to get appreciably higher. Storm drainage systems increase the level of service for flood protection by, in effect, removing stormwater runoff from the surface volume thereby making this volume available for additional runoff.*

**5. Storm Surges**

A goal of the Floodplain Management Plan is to reduce the severity of storm surges and to, correspondingly:

- a. Identify action programs as necessary and projects with the potential of mitigating the hazard.
- b. develop the means to fund such action programs and projects over-time
- c. secure additional research into the behavior of storm surges

A second set of goals of the Floodplain Management Plan, related to storm surges, includes the development of expanded

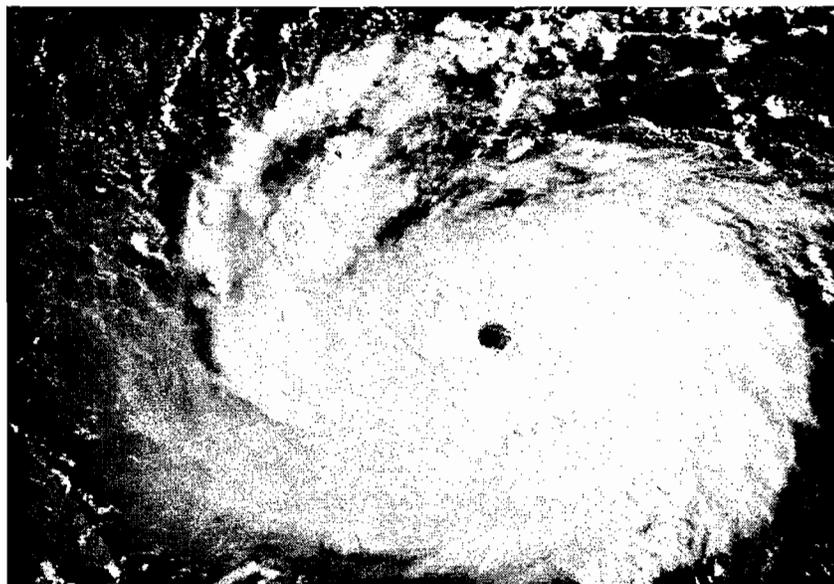
policies and regulations, beyond current minimum code requirements:

- d. to encourage greater setbacks from shorelines for new developments of both beach-front and bay-front properties;
- e. to encourage retrofitting and elevation of structures throughout the Floodplain with high priority consideration for those built on beach and bay-front properties;
- f. to seek opportunities to acquire, exchange or otherwise secure limited control of beach and ocean-front real estate in conjunction with large scale venture where public involvement is a factor.

***The above Goals relate to the following Floodplain Hazards and Problems:***

*(1) Storm surges*

*They occur as strong winds, such as from a hurricane, force water levels in the Ocean or Biscayne Bay to rise*



**Hurricane Andrew bearing down on south Florida's east coast.  
(NOAA)**

*and wash over Key Biscayne. Unlike rainstorms, this type of hazard tends to be of a greater than 100 year recurrence interval.*

*As such, a storm surge will tend to cause waters to reach the FEMA-established Base Flood Elevation or above, i.e. a range of between 8 feet and 12 feet NGVD, or*

*about six feet or more above the typical elevation of street crowns. This*

*compares to a much tamer one to two feet of water*

*(limited by the elevation of the island's perimeter) above typical street elevation that can be expected in a greater than 100-year recurrence interval rainstorm event.*

*It is for this reason that, the capability appears potentially available for, not only mitigating substantially, but ultimately eliminating, even the most severe rainstorms as a floodplain problem. The same cannot be said, however, for the hazard of storm surges which require drastically different mitigation approaches..*

*(2) Beach Erosion*

*A combination of factors, including weather patterns and man-made improvements have resulted in major Beach erosion along the Key Biscayne Oceanfront. This represents a hazard and a problem by virtue of the fact that beaches and, where they exist, dunes represent virtually the only storm surge mitigation tool that can exert a measurable effect on the problem.*

***The above Goals imply the consideration of the following Possible Floodplain Management Activities defined in the NFIP/CRS Manual:***

- (1) "Preventive Activities" including: "Open Space Preservation"; "Floodplain Regulations"; "Dune and Beach Maintenance".*
- (2) "Natural Resource Protection" including: "Erosion and sediment Control"*
- (3) "Structural Projects" including "Beach Nourishment" and dune development.*
- (4) "Public Information" including making common cause with the Village of Key Biscayne Beach Resource and Management Task Force which is deeply involved with, and the moving force behind, the Village's Beach Nourishment Project which includes a high degree of public exposure and participation.*

## 6. Soil Condition

- a. The Goal is to increase the drainage characteristics of the soils on Key Biscayne.
- b. A related Goal is to preserve and expand the open areas in the Village.

***The above Goals relate to the following Floodplain Hazard and Problem:***

*Severe rainstorm over the island will generate massive amounts of runoff which, until recently, would accumulate and be stored in the low areas for extended periods of time. Because of the high groundwater table and poor infiltration capacity of the soil, most of the rainfall will become stormwater and flood the low lying areas.*

***The above Goals imply the consideration of the following Possible Floodplain Management Activities identified in the NFIP/CRS Manual:***

(1) Preventive Activities

*Preventive activities to be addressed in connection with the above Goals are "Open Space Preservation" to preserve and where possible create the amount of open space and "Planning & Zoning to limit the amount of development (i.e. impervious area) that can be created on individual properties and to specify the type of soil to be used as fill material.*

(2) Public Information

*"Environmental Education" projects will be considered designed to promote the functions of swales and green areas in storing and treating stormwater runoff.*

## 7. “Old Law” Buildings<sup>2</sup>

- a. The Goal of the Floodplain Management Plan is to reduce the number of structures built with finished floor elevations below the Base Flood Elevation.
- b. A related Goal of the Floodplain Management Plan is to eliminate the use of garages for other than parking purposes unless the finished elevation of such garages is in conformance, at least with the older Miami-Dade County Code requirements for the main floor of structures.
- c. A strategic Goal of the Floodplain Management Plan is to increase land values of Key Biscayne real estate in relation to the value of existing structures, thereby creating an incidental market-based incentive system to encourage the redevelopment of properties to NFIP Standards.

***The above goals relate to the following Floodplain Management Hazards and Problems:***

- (1) The initial development of Key Biscayne only required the dwelling floor to be 13 inches above the road centerline elevation. This subjected many dwellings to potential flooding for long duration since only marginal storm drainage was available to alleviate rainfall induced flooding. Soil conditions allowed only poor percolation. Therefore, with the lack of storm drainage facilities, the flooding was frequent and of long duration.*
- (2) Recently, storm drainage facilities were constructed. Therefore the problem related to flooding induced by rainfall would relate to the cost-benefit of providing a higher level of service by the drainage facilities.*
- (3) Current laws cannot compel a change in finished floor elevations retrofitting, or other flood proofing work unless*

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<sup>2</sup> “Old Law” refers to the older Miami-Dade County Building Code which only required the finished floor elevation of a structure to be 13” above the crown of the road.

*substantial improvements to the property in excess of 50% of its value are contemplated (the 50% rule)... or, of course, if total reconstruction is involved. For all practical purposes however, the 50% rule is less than fully effective as the determination of "cumulative" improvement costs covers a period of only one year, after which the owner, may apply the rule anew.*

***The above goals imply the consideration of the following Possible Floodplain Management Activities as identified in the NFIP/CRS Manual:***

- (1) "Preventive Activities" including "Planning and Zoning" as well as "Floodplain Regulations" to address the issue of garage conversions and to re-visit the 50% rule.*
- (2) "Property Protection" including a focus on "building elevations" and "Flood Proofing" on one hand and a different interpretation of the "Acquisition Activity" treated as a leveraging and evaluation of land appreciation circumstances into a market driven reconstruction program.*
- (3) In connection with the above, "Public Information" activities will be considered in making the connection between rising land values, retrofitting and reconstruction.*

## **8. Flood Data, Information and Analysis**

- a. An important Goal of the Floodplain Management Plan is to reach the targets projected for the completion of the data-base project initiated by the Village Building, Zoning and Planning Department, incorporating, among other elements, a wider range of property data, topographical data, storm drainage data, rainfalls as measured by the Bill Baggs rain gauge, building permit data, data on insurance, history of flooding, existing and changes in finished floor elevations, and the like.

- b. An equally important Goal of the Floodplain Management Plan is to Catalogue, Organize (in a user-friendly manner) and make accessible, (through education and other means) at a Central Location, the wide and fast growing range of existing Floodplain Management Information, including NFIP information, State of Florida and Miami-Dade County Information, Village Information and ad-hoc information made available through the media; government Agencies such as NOAA, SFWMD; Universities, and the like.
- c. A further Goal in the area of data and information is to promote analysis and research to improve, and continue to evolve, the capacity and knowledge for state-of-the-art management of Floodplain Management Plan Activities. Specific areas of research and analyses will include among others:
  - (1) Definitions of flooding and weather events in relation to the Flood Insurance Rate Map information;
  - (2) Implication on Insurance Premiums (beyond CRS) resulting from the achievement of various levels of Floodplain Hazard Mitigation, including impact of such Mitigation on the Base Flood Elevation;
  - (3) Measurement of Floodplain Vulnerability factors;
  - (4) Measurement Storm Drainage System Effectiveness;
  - (5) Evaluation of Beach Nourishment, Dunes and related improvements as Storm Surge Mitigation Measure;
  - (6) Benefit-Cost Analysis methodology.

***The above Goals relate to the following Floodplain Management Plan Hazards and Problems:***

- (1) *Since the Village of Key Biscayne is a newly incorporated municipality, data prior to incorporation was vested with Miami-Dade County. In addition, there is a lack of development data since the initial development was in the early 1950's. Therefore, the ability to retrieve other than recent data is marginal. The ability to gather critical data (such as finished floor elevations and rainfall measurements) is very difficult. A program of putting*

*together an effective data base would be a major benefit to the Floodplain Management Plan. However time and cost would have to be compared with effective benefits.*

- (2) The lack of rainfall data coupled with the fact that SFWMD maintains its records at locations remote from Key Biscayne such as Miami Beach, the Airport or Homestead, has forced the Village to rely on empirical rather than scientific data and information in measuring the severity of weather events.*

***The above Goals imply the consideration of the following Possible Floodplain Management Activities, as defined in the NFIP/CRS Manual:***

- (1) Property Protection: gaining additional data on the vulnerability of individual properties and their potential for flood proofing and/or elevation.*
- (2) Structural Projects: research on the perfecting and fine-tuning of the storm drainage system and on the Benefit-Cost aspects of such projects as Beach Nourishment, dunes and placement of utilities underground.*
- (3) Public Information: Enhancing the Floodplain Management section of the Public Library, extending outreach projects and increase map information beyond the data currently provided by provided by the FIRM.*

## **9. Economic Goals**

- a. A major economic Goal of the Floodplain Management Plan is to support and, where possible, to enhance the land component of real estate values on Key Biscayne, thereby creating a market-driven, rather than regulatory, environment for the "Substantial Improvement" (i.e. More than 50% of Value) of structures with current finished floor elevations below base flood elevation.

- b. Another important economic Goal is to manage and execute the activities the Floodplain Management Plan as cost-efficiently as possible with a minimum of financial burden on Village Residents and Property Owners, capitalizing where possible on the availability of grant-in-aid programs and on the Village's ability to secure same.
- c. The fundamental economic Goal of the Floodplain Management Plan is reduce the vulnerability of Key Biscayne to Floodplain Hazards, and to the costs resulting from such hazards, whether in the form of loss of building or content, flood insurance premiums, or other economic hardship.

***The above Goals relate to the following Floodplain Hazards and Problems:***

*(1) The cost of retrofitting most one or two-story single family homes on Key Biscayne and raising them to and several feet above Base Flood Elevation is either not affordable or*



*not economically feasible given that the structures are typically of masonry or concrete block construction above a reinforced concrete slab.*

*At the same time, in most instances the land on which these structure were built has dramatically appreciated in relation to the value of the structures. To wit:*

**Mitigation through elevation isn't so new ... Zimbabwe, circa ???**  
(P.Kory)

*In 1992 vacant residential land on Key Biscayne was appraised at \$32,985,000. In 1997 this value has climbed to \$120,961,000 for a similar number of parcels; representing an increase of about 267%.*

*On the other hand, single family homes on Key Biscayne were appraised in 1992 at \$472,852,000. In 1997 this value rose to \$621,981,000. An increase of only about 31.5%.*

*These circumstances have created almost fatal disincentives for investing in flood proofing and retrofitting older buildings. Collaterally, however they have produced powerful and growing incentives for the reconstruction or substantial improvements where the appreciated land values can be leveraged into vastly improved overall value of the real estate asset...built or re-built, as the case may be at or above the Base Flood Elevation.*

- (2) The cost of many mitigation projects may not be affordable unless shared with other units of government (i.e. County, State or Federal). There exists, however, a wide range of loan and grant programs which would have to be tapped, at various government levels and sometimes on an unconventional basis to implement the Floodplain Management Plan. For example, given the chronic condition of budget limitations there is often a need for multiyear funding for some of the projects that are suitable for staged execution. This will require a great deal of collaboration with Government Agencies as well as a total Program Context that can serve as funding policies and criteria.*

***The above goals imply the consideration of the following Possible Floodplain Management Activities, as identified in the NFIP/CRS Manual:***

- (1) "Property protection" including development of the best policies and approaches for dealing with the economics of reducing the problems of individual properties with respect to Floodplain Hazards.*
- (2) "Structural Projects", including the development of a funding strategy, coordinated with other levels of*

*government to finance major mitigation projects, such as storm drainage system improvements, underground utilities and beach nourishment/dunes.*

- (3) *"Public Information", relating to the securing funding process and participation financing on-going outreach projects and funding technical assistance in research projects.*

## **10. Public Information and Involvement**

An important Goal of the Floodplain Management Plan is to increase the public awareness of floodplain hazards and problems and to educate the public through a widespread program of general information, media coverage and participatory involvement about the Floodplain Management Plan and the Action Programs to be undertaken therewith.

***The above Goal relates to the following Floodplain Hazards and Problems:***

*An uninformed public is probably the greatest hazard and problem in the management of the floodplain. This is manifest at three levels:*

- (1) *At the preventive level, prior to the occurrence of a disaster, when flood insurance, flood proofing, retrofitting, and evacuation as well as other disaster preparedness activities will make a significant difference in the ability to cope with, and in some instances, survive disaster.*
- (2) *During a disaster, lack of information about the organization of the disaster response system may prove devastating with such things as evacuation procedures, routes, and destinations; protection of property, security of assets and the ability to obtain assistance and vital information.*

- (3) *At the post-disaster level, during the recovery stage, the awareness that such dark events can, in fact, usher in small and larger scale renewal efforts, fulfilling many of the Floodplain Management Plan Goals is a matter that cannot be achievable without broad public support and understanding.*

***The above Goal implies consideration of the following Possible Floodplain Management Activities as identified in the NFIP/CRS Manual:***

- (1) *Additional map information and distribution thereof.*
- (2) *Additional outreach projects, tapping utility companies, among others, as distribution vehicles.*
- (3) *Expand the Floodplain Management Library to include the product of research undertaken in connection with the Floodplain Management Plan as well as all publications available locally and nationally.*
- (4) *Provide technical assistance and advice and discuss mitigation policy in connection with a program of public participation and involvement.*

## **11. Organizational, Managerial and Administrative Goals**

- a. The Goal is to make Floodplain Management a mainstream function in the organization, management and administration of Key Biscayne's municipal affairs.
- b. The collateral Goal is to spread (rather than concentrate in a separate department) the allocation of Floodplain Management responsibilities as broadly as possible within the Village of Key Biscayne Administrative structure in order to assure longer term continuity and full integration of Floodplain management functions into the operations of the Village.

- c. A Working Goal is to accept the National Flood Insurance Program/Community Rating System as the administrative framework within which to: (1) budget and plan Floodplain Management activities; and (2) monitor, evaluate and report progress on the implementation of the Floodplain Management Plan.

***The above Goals relate to the following Floodplain Management Hazards and Problems:***

- (1) The Village of Key Biscayne operates under a Council/Manager form of government. As a newly created independent community, Key Biscayne's administrative structure is extremely efficient. Its size and the fiscal conservatism of its elected Officials has turned economy in management of government an art form and therefore a matter of pride and achievement. However this has also placed pressure on the extent various municipal functions are staffed.*
- (2) Accordingly, the assumption of additional programs and activities cannot occur by merely adding new departments and/or staff. Instead, the additional burden will have to be absorbed within the existing structure, adding part-time staff supplement, volunteer forces and consultants as necessary, all operating under the leadership of the Village Manager and his key executives.*
- (3) While the administrative efficiency of such a management arrangement is fully consistent with the spirit of Key Biscayne's approach to government, additional financial requirements for these purposes would have to be considered on a reliable and on-going basis.*

***These Goals imply the consideration of the following possible Floodplain Management Activities identified in the NFIP/CRS Manual:***

*While none of the NFIP/CRS category or sub-category of flood management activities explicitly relate to the above*

*Goals, ALL OF THESE ACTUALLY DO RELATE, as a practical matter, since failure to deal vigorously with the matter of organization, management and administration would fatally flaw the ability to pursue the overall effort.*

*Accordingly, it is contemplated to address this matter as part of the Village budgeting process and to include the subject of floodplain management, as appropriate, in staff directive and other administrative procedures in place for the daily management of line departments.*

## VII. Review Possible Activities

### A. Context and Introduction

#### 1. Context

**This section (Section VII) of the Floodplain Management Plan Report, focuses on the REVIEW and EVALUATION of some 31 POSSIBLE FLOODPLAIN MANAGEMENT ACTIVITIES which have been organized into 6 GROUPS of ACTIVITIES.**

The activities and their grouping closely follow many used in connection with the Community Rating System (CRS). Accordingly, decisions regarding their implementation will have (beyond the benefits of dealing more effectively with floodplain hazards and problems) a substantial impact on Key Biscayne's CRS standing and, consequently, on the community's flood insurance rates.

The floodplain management activities will be evaluated on the basis of, among other criteria:

- The Phase I findings with respect to "floodplain hazards and problems"; and
- The Phase II "Goals".

As such, the Floodplain Management Plan work to-date needs to be reviewed and considered during the evaluation process since that material provides much of the premise for, and the framework within which, the Phase III work will be performed and the selected Action Plan projects will be implemented.

**The next section (Section VIII) of the Floodplain Management Plan Report covers the "Action Plans" and projects derived from those activities which have been selected as most appropriate and feasible as a result of the evaluation process.**

## 2. Introduction

### a) **Review Criteria**

Each of the 31 possible floodplain management activities have been reviewed, evaluated or otherwise addressed in the body of this report on the basis of the following seven (7) criteria:

- Extent of technical **appropriateness** in terms of floodplain hazard and problem.
- Extent of **support and consistency with floodplain management plan goals**.
- **Benefits in relation to costs:** Do the benefits exceed the costs of the activity? For the purpose of this report, the evaluation does not attempt a formal B-C analysis, but merely reviews the activities in terms of:
  - (a) Whether the projects they imply need to be subject to such analysis?
  - (b) If not, whether the benefits appear, (based on common sense, informal analysis, and empirical information) to exceed costs?
  - (c) Whether, if formal analysis appear necessary for proper evaluation, whether analysis is feasible and workable as a practical matter?
  - (d) How would a formal analysis be approached: i.e. when would it be slotted in the Action Plan timeline? Is it in the planning or execution phase of the program? How would it be financed?
- **Affordability:** Is the cost of the proposed activity affordable within the Village's current financial, administrative and legislative/political capacity?

- **Financeability:** Are sources of funds either available or obtainable to finance the execution and related on-going costs of the activity? The intent here is to determine whether potential sources exist rather than to secure actual commitments, a step which occurs at a later point in connection with Action Plan implementation steps.
- **Legality:** Does the activity comply with all existing or readily achievable Village, County, State and Federal laws and regulations, or are there laws and regulations that would tend to constrain a proposed activity?
- **Environmental Impact:** will the activity have a beneficial or negative impact on the environment or will there not be any impact (neutral impact)?

#### b) Approach to Selection of Recommended Activities

The approach used to identify the floodplain management activities to be implemented as part of the Action Plan is as follows:

- **Elimination** of those activities which either meet none or very few of the review criteria or where the answer to the questions raised in the criteria is either the negative or irrelevant.
- **Inclusion** of those activities which meet all or a great majority of the criteria or where the answer to the criteria questions is in the affirmative.
- **Deferral** for later inclusion in future action plans of the activities which meet a substantial number of the criteria, but which will require further study, including formal B-C analysis before making a determination.
- **Selection of high priority activities** which best meet the review criteria to be considered as part the 1998 Action Plan.

**c) Action Plans**

Action Plans are generally the central vehicle for the execution of the Floodplain Management Plan. As such, an Action Plan is contemplated for each year and each Action Plan will identify the projects and activities to be executed in the course of the year as well as reflect progress with respect to the projects and activities identified in prior year Action Plans. In this manner, the Floodplain Management Plan emerges as a dynamic document which will remain current and grow incrementally via an annual updating process, that will use Action Plans as the principal expression of progress.

The Action Plan which is included as Section VIII, covers the first Action Year of the Floodplain Management Plan. Subsequent Action Plans will be added to the Floodplain Management Plan by the anniversary of the approval of the prior year plan. The first year Action Plan will include:

- Activities deemed, as a result of the review and evaluation, to warrant high priority consideration; and,
- Activities which generally meet the review criteria and which lend themselves to execution on an opportunity basis.

Each Action Plan consists of projects and each project is presented in the Action Plan in accordance with the following outline:

- (1) Description of project
- (2) Goal(s) supported and advanced by project
- (3) Execution responsibility & Direction
- (4) Timeline and work program
- (5) Support framework
- (6) Budget & Financing

## **B. Review and Evaluation of Possible Floodplain Management Activities**

### **1. Inventory of Possible Activities**

As discussed in "Context and Introduction" (section A above), some 31 possible Floodplain Management Activities, organized in six (6) major groups have been considered. The following is a listing of these activities:

#### **Group 1 activities: Prevention, including:**

1. Planning and zoning
2. Open space preservation
3. Floodplain development regulations
4. Stormwater management
5. Drainage system maintenance
6. Dune and beach maintenance

#### **Group 2 activities: Property Protection, including:**

7. Relocation
8. Acquisition
9. Building elevation
10. Flood Proofing
11. Sewer back-up protection
12. Insurance

#### **Group 3 activities: Natural Resource Protection, including:**

13. Wetlands protection
14. Erosion and sediment control
15. Best management practices

#### **Group 4 activities: Emergency Services, including:**

16. Flood warning
17. Flood response
18. Critical facilities protection
19. Health and safety maintenance

#### **Group 5 activities: Structural Projects, including:**

20. Reservoirs
21. Levees/floodwalls/seawalls

22. Diversions
23. Channel modifications
24. Beach nourishment
25. Storm sewers

**Group 6 activities: Public Information, including:**

26. Map information
27. Outreach projects
28. Real estate disclosure
29. Library
30. Technical assistance
31. Environmental education

**2. Activities Eliminated From Consideration**

The following activities have been eliminated from consideration in connection with the Floodplain Management Plan. The reasons are discussed below.

**a) Group 2. Property Protection: Relocation and Acquisition**

These two activities, which involve moving buildings to higher ground or otherwise relocating buildings and acquiring real estate to achieve protection from flooding, storm surges and other high water hazards, have been eliminated because:

- Given the market values of Key Biscayne land, and the fact that the cost of any relocation would involve the acquisition of an appreciable amount of expensive land in a climate of steeply rising land prices, the aggregate costs of any relocation, including all direct and indirect structural relocation expenses, are likely to far exceed the benefits to be derived from this activity. In the final analysis, while the costs are likely to be prohibitive, the benefits, on the other hand, are limited essentially to savings resulting from the mitigation of structural damages only.
- In addition to land cost concerns, availability is probably an even more daunting problem. Land for this

purpose would be extremely difficult to find as the island is, for all practical purposes completely developed with too few isolated parcels to enable any kind of viable relocation or acquisition policy or program.

- Finally, given the relatively flat topography of Key Biscayne, it is far from clear whether different locations on the island would provide a substantially higher level of protection without the necessity of retrofitting, elevating or otherwise flood proofing the property. This type of activity can be accomplished just as effectively without relocation. In other words, this activity fails to meet at least four of the review criteria, including: “technical appropriateness”, “benefits in relation to cost”, “affordability” and “financeability”.

**b) Group 2. Property Protection: Sewer Back Up Protection**

This activity relates to stormwater overloading a combined sanitary and storm sewer, a problem which is particularly significant in areas where homes and properties are developed with basements.

- Since the storm drainage system on Key Biscayne is being developed as a new system, separate and apart from the Sanitary System, with fully controlled separation between the systems, this activity is not technically appropriate for the Floodplain Management Plan.
- Moreover, since the properties on Key Biscayne are normally developed without basements because of the high water table, sewer backup problems are generally not found in the community.

**c) Group 3. Natural resource protection: Wetlands Protection**

The protection of wetlands is an important floodplain management activity. However, it is not an activity which is technically applicable for Key Biscayne in view of the fact

that while the community borders on significant wetland preserves, it neither has, nor controls wetlands within its borders. Accordingly, this activity has been eliminated from consideration for evaluation or inclusion in the Floodplain Management Plan.

**d) Group 5. Structural Projects: Reservoirs/Levees/Floodwalls/Seawalls/Diversions/Channel Modifications**

Projects of this type are extremely unlikely to be considered for Key Biscayne, as they would fail to meet most of the review criteria. None are technically appropriate relating mostly to a riverine rather than a coastal floodplain; all involve a magnitude of costs that far exceed benefits; affordability and financeability would present major obstacles even if relevance of the projects were not at issue. Finally the negative impact, resulting from the scale of these types of project, on Key Biscayne's fragile environment would no doubt discourage their consideration.

**e) Group 6. Public Information: Real Estate Disclosures**

Careful consideration was given to this activity, as all too often the floodplain hazard advice which federally regulated lending institutions are required to convey to borrowers, occurs too late in the real estate transaction to be fully effective. However changes in the state laws and/or the practices of local real estate Boards involving an earlier advice of the hazard is a matter of extreme legal and political sensitivity to an extent that Key Biscayne has opted, for the present, to exclude for consideration in the CRS program. Accordingly this activity has been similarly excluded for consideration as part the Floodplain Management Plan.

**3. Activities which meet affirmatively all or a great majority of the review and evaluation criteria and which therefore suggest projects to be considered for inclusion in Action Plans.**

The following activities have been deemed to be generally consistent with the review criteria for the reasons summarized below:

**a) Group 1. Prevention: Planning and Zoning**

This activity relates to floodplain management by using comprehensive planning and zoning tools to assure the development of land within the floodplain, in a manner compatible with prevention and mitigation of flood damage resulting from hazards and problems within the floodplain. Since in the case of Key Biscayne the entire community is in the floodplain, the Village Master Plan and the Village Zoning Ordinance as a whole are the focus of this activity.

Appropriateness: Given that Key Biscayne experiences a high level of development and redevelopment activity and that, as a newly incorporated community its Master Plan and Zoning Ordinance are the subject of particular vigilance and constant fine-tuning, it is not only appropriate, but essential that floodplain management activities be dovetailed on an ongoing basis with planning and zoning work.

Consistency & support of Goals: Planning and Zoning activities share many of the “Overall Goals” proposed for the Floodplain Management Plan including:

- Consistency with “...the Village Master Plan, its codes and ordinances as well as other official Village documents...”;
- Reduction of “...vulnerability to flooding hazards from major rainfalls, hurricanes and related severe weather events.”;

- Mitigation of "...the extent and severity of the problem created by these hazards...";
- Prevention of "...additions to..." and ..."Reduction of ..." properties on FEMA's list of Repetitive Loss Properties;
- Improvement in the Village's standing in the Community Rating System;

With respect to the "Working Goals", Planning and Zoning measures can help advance the goals which relate to "Topography", "Storm Surges" and "Old Law Buildings" via the study and consideration of measures in the Village's codes, plans and ordinances that encourage development in the least vulnerable areas and preserve the more hazardous areas in a natural or undeveloped condition.

Benefits in Relation to Cost: No formal B-C Analysis appear required for the evaluation of this activity since no hard cost are involved in its implementation and the indirect costs are nominal.

It is possible however that B-C Analysis work may be required in connection with specific measures or projects which may be considered during the implementation of this activity.

Affordability: Planning and Zoning Activities which relate to the Floodplain Management are deemed affordable because:

- The level of expenditure involved is modest; and
- Implementation can occur as part of the Village's normal operations without discreet line-item identification in the Operating Budget.

Financeability: This criteria has been deemed to be not relevant, given that dedicated-source financing is neither

contemplated nor necessary in connection with the implementation of this activity.

Legality: In view of the fact that any measure which may emerge as a result of this activity will have to be legally validated before becoming effective, it stands to reason the consideration of this criterion will not be possible until specific projects or measures are identified, proposed and implemented.

Environmental Impact: Planning and Zoning activities related to floodplain management are generally consistent with environmental improvements, often encouraging and reinforcing the justification of programs and controls, such as open space preservation and related measures, that are generally considered supportive of the environment.

**b) Group 1. Prevention: Open Space Preservation**

Open Space Preservation is related to the Planning and Zoning activity in that both involve the management of land use. However this activity differs in that it seeks to achieve its objectives by transfer of properties, property rights, or property controls rather than obtaining such results through regulatory means. This activity recognizes that keeping the floodplain free from development is, in the final analysis, the best approach to preventing flood damage.

Accordingly, Action Plan Projects in connection with this activity can involve a wide range of measures including: public incentives; land swaps; and transactions of various kinds, in order to focus development outside flood-prone areas.

In this connection open space preservation concessions from private developers might be secured as part of a development approval process.

Similarly, preservation of public lands, controlled by other units of government, might be achieved in the context of a

comprehensive intergovernmental understanding and consensus of the common interests involved.

For Community Rating System (CRS) purposes, the term “Open Space” for Key Biscayne has been assumed to include not only the Village Green, the parcels of land to be conveyed to the Village by the large scale developments, and the open space appurtenant to the elementary school and the public library, but also and more significantly, Crandon Park and Bill Baggs Park.

The opportunities for increasing this amount of open space are extremely limited. For this reason the inclusion of this activity in the Floodplain Management Plan is marginal. Nevertheless the inclusion of this activity in an Action Plan is deemed appropriate in view of the fact that the potential exists to:

- Improve on the amount of Open Space, which qualifies for CRS credit **within the framework of the areas already identified above.**
- Identify opportunities for **additional open space areas**, with the quest for these opportunities representing particularly useful floodplain management Action Plan Projects.

Appropriateness: Beyond keeping development out of Special Flood Hazard areas, the accretion of undeveloped open space also serves to materially mitigate the damage caused by the high water table and poor soil permeability on Key Biscayne. Accordingly, this activity has been considered to be appropriate for inclusion in the Floodplain Management Plan.

Support and Consistency with Floodplain Management Plan Goals: Preservation of Open Space supports and is consistent with the following Overall Goals of the Plan:

- “Reduction of vulnerability to flooding hazard...”

- “Mitigation of the extent and severity of the problem...”

Benefit in Relation to Cost: Improving on the existing supply of Open Space and seeking opportunities for creating additional Open Space is clearly cost-effective if the nature of projects is limited to intergovernmental land transactions and related activities.

Costs could be substantial however, and require extensive B-C analysis, if the creation of additional Open Space could only be accomplished through the purchase of privately owned Key Biscayne Real estate. Accordingly, real estate acquisition is assumed to be precluded, at least, as a first Action Year Project.

Affordability: Given the above limitation on the scope of this activity, the activity is eminently affordable.

Financeability: The modest expenditures involved in this activity suggest that no special, or dedicated, sources of funds need to be committed for the work and that this activity can be carried out as part of normal Village operations.

Legality: Nothing in the body of laws, regulations and policies governing the activities of the Village of Key Biscayne, prevents or otherwise legally precludes exploring the feasibility of Projects suggested by this activity (other than the unlikely use of eminent domain powers)

The legal implications of such projects, however, would have to be analyzed as part of the due diligence that would be required for their consideration.

Environmental Impact: Cannot be determined until specific projects are defined. In general, however, typical actions under this activity will tend, by their very nature, to be beneficial to, and consistent with, environmental protection objectives.

c) **Group 1. Prevention: Floodplain Development Regulations**

Planning, Zoning and Open Space Preservation activities aim to keep damage-prone development *out* of hazardous or sensitive areas within the floodplain. Floodplain Development Regulations impose construction standards on what is allowed to be built *in* such areas. They protect buildings, roads and other projects from flood damage and prevent developments from aggravating the flood problem. The three most common types of floodplain regulations are subdivision ordinances, building codes and separate “stand alone” floodplain ordinances.

Key Biscayne development regulations include all three types of ordinances. As such the evaluation of this activity has been made on the basis of projects to fine-tune these ordinances:

- Beginning with a comprehensive review of these documents;
- Proceeding with analysis and research and the formulation of proposals on how the legislation and the regulations might be improved to meet (if not exceed) the state-of-the-art; and
- Ending with the necessary legislative action on the proposals.

Appropriateness: This activity has been deemed particularly relevant to the effectiveness of the Floodplain Management Plan since it is, in the final analysis, the standards for development, whether found in subdivision regulations, the building code or a flood ordinance, which exert the greatest influence on what gets built and on how what gets built impacts or is impacted by flood and related hazards.

Support and Consistency with Floodplain Management Plan Goals: Floodplain Development Regulations have been deemed to support many of the Overall Goals, including:

- Those involving reduction of vulnerability to flooding and related hazards;
- Prevention of additions to FEMA's repetitive loss property list; and
- Improvements in Key Biscayne standing in the Community Rating System.

With respect to the Working Goals of the Plan, Floodplain Development Regulation activities relate to virtually every goal involving land and building development and the administrative implications of such goals.

Benefits in Relation to Cost: No capital costs and only modest administrative expenses are involved in this activity. As such, given the very considerable benefits derived from the potential mitigation and reduction of, and vulnerability to flood and flood-related damages, this activity has been deemed to be extremely cost effective and one which can be eminently justified in terms of both the potential public and private economic dividends that could be realized.

Affordability: Key Biscayne has ample capacity within its own resources, to support this activity from a budgetary, administrative legislative and political standpoint, and to therefore include, on an ongoing basis, the implementation of Action Plan Projects related to this activity.

Financeability: Since this activity is expected to be financed through the General Fund under the Village's normal operations, without the need to identify a dedicated source of funds, the ability to finance the very modest outlays required for this activity is not likely to present any problems.

Legality: The undertaking of this activity does not present any legal problems. It should be noted, however, that the nature of regulatory legislation and enforcement measures is such that the possibility of legal challenges and controversy cannot be ignored.

Environmental Impact: Given that the emphasis of this activity is on the development standards for areas already targeted for development, rather than for land reserved as open space, or as natural preserves, the Floodplain Development Regulations activities and projects, will have probably little or no impact on the broader environment. To the extent that any impact does exist, the results should be beneficial.

**d) Group 1. Prevention: Stormwater Management**

This activity focuses on the management of stormwater run-offs. As such it involves the extent to which natural cover is replaced by paving and urban development, developments in areas adjoining the Village proper and the effectiveness of the community's drainage system.

As such, this activity addresses improvements like retention and detention basins, swales, storm water drainage systems and related facilities, as well as the regulatory standards and requirements to be followed in connection with large scale private and public development which are likely to impact the rate, volume, and disposition of stormwater run-offs.

In the case of Key Biscayne, this activity is controlled by the Village Building, Zoning and Planning Department, Miami-Dade County's Department of Environmental Resource Management (DERM), Miami-Dade County's Public Works Department and the South Florida Water Management District.

These agencies are guided by and, as appropriate, enforce, among other regulatory measures, the Village's Flood Ordinance, the State and County Building Codes and Ordinances and Miami-Dade County's Public Works Manual.

In the process they review plans for development, issue permits where required, inspect work in progress and otherwise assure that development occurs in a manner

consistent with stormwater management objectives and policies.

Additionally, the village has adopted a Stormwater Management Master Plan, pursuant to which a new storm drainage system has been designed and constructed. These new facilities are currently in operation and have already had a major impact in mitigating the effects of major rainstorms.

Future efforts may be focused on the management of swales and on continuing efforts to reduce paved areas and the volume, as well as rate, of stormwater run-offs. Fine tuning and improvements of the storm drainage system is also an activity, in fact one of critical importance, which is considered for implementation in connection with an Action Plan. However it is addressed as part of the Group 5 Activities "Structural Projects".

Appropriateness: This activity ranks among the highest in relevance and appropriateness in terms of addressing the hazards and problems of major rainstorms.

The projects implicit in this activity cover a wide range of potential improvements which, through public works, regulatory initiatives and management refinements, will result in measurable impact on the reduction of Key Biscayne vulnerability to damages resulting from major rainstorms.

Support and Consistency with Floodplain Management Plan Goals: This activity is consistent with, and materially supports, the Overall Goals which relate to:

- The reduction of Key Biscayne's vulnerability to flooding hazards and related weather events;
- The mitigation of the extent and severity of the problems created by the hazards;
- Prevention of additions to FEMA's list of Repetitive Loss Properties;

- Reduction of the number of such properties on said list;
- Improvements in the Village's standing in the Community Rating System (CRS); and
- Coordination at the Municipal, County, State and Federal levels of government.

With respect to the working goals, this activity is closely allied with the various aspects of floodplain management related to:

- The island's topographical features;
- Its soils characteristics; and
- Short and longer term flood protection against rainstorms.

Benefits in Relation to Cost: Action Plan projects which relate to the management of the regulatory framework in this activity are deemed to be eminently cost effective, paying major dividends in flood prevention and disaster mitigation at relatively small administrative and fundamentally non-capital costs.

On the other hand, Action Plan Projects such as improvements to the stormwater drainage system, the creation of retention basins, swales, or improvements mandated by the regulatory framework, which will involve varying levels of capital costs, will require some level of B-C analysis which will correspondingly vary in depth with the levels of costs involved in each such project.

In general the impact of this activity on the Floodplain Management Plan is of such importance that cost effectiveness has not been deemed a threshold issue in its evaluation for consideration as part of the plan.

Affordability: Not likely to emerge as a problem since the additional administrative costs of any non-capital project, suggested by this activity, would be modest. With respect to capital projects however, costs would have to be analyzed in terms of the financing of the individual projects. In all probability, if cost effectiveness can be demonstrated, the typical projects that are suggested under this activity appear affordable. Further supporting this premise is the fact that typical projects are apt to represent extensions of projects either recently completed or currently under way where the additional costs will tend to be clearly affordable when considered in relation to the total investment involved.

Financeability: The projects under this activity can be expected to be financed from the following potential sources:

- For projects related to the regulatory framework aspect of this activity, the funding would be derived from the operating budgets corresponding to the various governmental or public benefit entities involved in the management of the regulations.
- For capital projects, three potential funding sources exist, including:
  - (1) Direct Village financing out of its capital improvement budget if the level of funding is deemed modest and affordable;
  - (2) State or Federal Capital Loans and Grants to the extent that the projects meet eligibility and competitiveness criteria;
  - (3) User fees to the extent that such approach is feasible from the standpoint of benefit allocation, equity and political acceptance;
  - (4) Any combination of the above.

Legality: No particular legal issues or concerns appear to exist with respect to the implementation of the kind of projects suggested by this activity. Furthermore, as individual projects are implemented, each will be subject to separate extensive legal review.

Impact on the Environment: None of the projects suggested by this activity will have an adverse impact on the environment. To the extent that run-offs can be minimized, paved surfaces reduced, the storm drainage facilities improved and regulations made more effective, the impact of this activity on the environment is likely to be positive.

**e) Group 1. Prevention: Drainage System Maintenance**

Key Biscayne's storm drainage system includes the storm sewer system, its appurtenant gravity and injection wells, the various out-falls, pumps and related facilities and a system of surface drainage channels, swales, culverts, inlets and the like. The effectiveness of this system depends on its maintenance and the extent to which there is an on-going program to clean out blockages usually caused by overgrowth and debris.

The Key Biscayne Public Works Supervisor is responsible for all activities relating to the maintenance of the Village's Storm Drainage System, including, among other activities:

- Day to day responses to reports of problems;
- Enforcement of the Village's anti-litter & dumping regulations;
- Coordination with public agencies such as the County's Department of Environmental Resource Management (DERM), the State Department of Environmental Protection (DEP), and the South Florida Water Management District (SFWMD);

- Supervision of contract which the Village has entered into with the City of Miami and PELCO Corporation for the maintenance and repair of the Storm Drainage System, including maintenance of pump stations on a monthly basis and cleaning of inlets and weir/well structures on a biannual basis;
- Regular inspection of the system by the supervisor on a biannual basis.

Potential projects related to this activity will be focused on improved record-keeping, on a review of the maintenance and repair agreements with the City of Miami and PELCO and on increasing the level of support required for assuring excellence in the performance of this activity.

Appropriateness: This activity has been deemed an appropriate and timely one in view of the fact that the Village's storm drainage system is new and therefore at a point when it must transition from construction to normalized operations. In this connection, maintenance procedures will have to be reviewed and tested. Systems for monitoring performance, particularly in relation to weather events, will have to be created to permit effective evaluation and define potential areas for improvements.

It should also be noted that this activity is an extremely important factor in maintaining, as well as further improving, the Village's standing in the Community Rating System.

Support and Consistency with Floodplain Management Plan Goals: The relationship of this activity to the Overall and Working Goals of the Floodplain Management Plan are essentially the same as those discussed in connection with the "Stormwater Management" activity.

Benefits in Relation to Costs: Beyond capital costs, which are not a factor in this activity, the manpower and contractual expenses involved in the routine maintenance of the systems and facilities are relatively minor. As such, the type of

The “Building Elevation” activity involves raising vulnerable structures above the FEMA established Base Flood Elevation (BFE) which is calculated on the basis of 100-year recurring frequency flood levels.



Floodproofing... Do we really need it? (P.Kory)

For Key Biscayne, the BFE varies generally between 8 feet and 12 feet NGVD. Given street elevations of about 5 feet NGVD and sometimes less, therefore suggest that “old law” Key

Biscayne structures, which were allowed to be built only 13 inches above the crown of the road, would have to be raised quite substantially, roughly in the range of 5 feet to as much as 7 feet, to reach a safe point above the 100 year flood level.

The cost of this activity can be very substantial, particularly on Key Biscayne where virtually all buildings are constructed with frames and walls made of brick, concrete block or masonry materials. On the other hand, since most of the larger structures have been built above BFE under the new Code, the bulk of this activity is likely to be focused on buildings that are contemporary with the “Mackle Houses”. These buildings tend to be smaller and therefore less expensive to move in relative (i.e. \$/sf), if not absolute terms (i.e. total \$).

As indicated in the discussion of “Review Criteria”, a factor that will probably impact B-C and other economic analysis is the consideration of “**total rebuild**” alternative which, because of dramatically escalating Key Biscayne land values, may prove, in a great many cases, to be the choice of preference as a matter of judicious asset management.

The “Flood Proofing” Activity involves improvements to the building site and its immediate surrounds, such as flood walls, swales and berms designed to prevent floodwaters from reaching the building, as well as improvements within the building, such as coating with waterproofing compounds or plastic sheeting, shielding of openings and like measures to seal the building against floodwaters.

In general flood proofing will tend to be less expensive (particularly on Key Biscayne), than building elevation projects. However, most flood proofing measures are effective only in areas of infrequent, low velocity and shallow flooding. As such, flood proofing will not be effective with respect to storm surges that may accompany a hurricane, but could prove extremely useful in mitigating the effects of severe rainstorms to the extent that the storm drainage system capacity is exceeded by floodwaters.

Appropriateness: The combination of raising structures above flood levels, while undertaking flood proofing work represent a program of activities, which is appropriate for consideration in the action plan in that it responds in the most direct way to the flood hazards and problems characteristic of Key Biscayne properties.

The fact that the use of these techniques may have limited application (i.e. the availability of preferable alternatives to the cost of “Elevation” measures and the limitations of “Flood Proofing” measures, effective mostly against shallow flooding) should not be considered as a basis for rejecting them.

The appropriateness of these activities is particularly clear when they are focused on the problem of repetitive loss properties where these measures will represent probably the most effective mitigation approach, which, short of demolition and/or reconstruction, would appear workable.

Support and Consistency with Floodplain Management Plan Goal: “Elevation” and “Flood Proofing” activities and the

In both cases, the analysis would have to consider the alternative of demolition or total rebuilding to that of "elevation".

In view of the fact that a pro-forma B-C analysis of typical projects under this activity will be indispensable to achieve some degree of success in this effort, as well as sharpen and justify the tools required for its undertaking, it is proposed that such analysis be considered an Action Plan Project on a priority basis.

Affordability and Financeability:

- Elevation. The costs involved in raising "old law" structures from their current elevation to or above the Base Flood Elevation, i.e. 5 feet to 7 feet are considerable to a point where affordability and financeability concerns may present insurmountable obstacles for many of the target properties.

Two areas of cost must be considered:

- (1) One has to do with the direct structural costs involved in the vertical relocation process. Here the costs tend to be exacerbated by the fact that masonry, brick, concrete and CBS construction, as further reinforced by new building code requirements predominates on Key Biscayne;
- (2) The other deals with the indirect costs involved, including, among others: soft costs; landscaping and related site costs; code mandated improvements (as the cost of the project approaches 50% of the building's existing value); interior work; etc....

Based on these considerations, the TOTAL COSTS involved for elevating a typical structure, such as a three or four bedroom Mackle House could easily fall in the range of \$150,000 and, as such, begin to approach the full value of the existing structure. Even if mortgage financing can be secured

for the improvement, the added debt service burden may stretch affordability for the property owners. From the standpoint of financeability, for example, a cost increment of \$150,000 implies a need to demonstrate an increment in value in the range of over \$200,000...a difficult amount to justify, unless a lot of equity in the existing property has been built up or the property owners are able and prepared to infuse relatively large amounts of new equity in the property.

- **Flood Proofing:** The kind of improvements assumed under this activity range from relatively small projects such as minor swales, or a waterproofing treatment of interior walls and building openings, to large flood walls and other major site improvements. In either case, the costs are likely to be manageable and in most cases affordable particularly if the improvements are undertaken as part of larger remodeling or landscaping projects.

**Legality:** No legal impediments, other than normal code requirements, which may impact costs, appear to constrain the “Elevation” and “Flood Proofing” activities.

**Environmental Impact:** Since the type of projects assumed under these activities are confined mostly to individual single family homes and lots within the Village’s urban district, no impact on the environment as a result of this activity is anticipated.

#### **h) Group 2. Property Protection: Insurance**

The objective of this activity is to maximize the use of flood insurance as a property protection measure. Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. While most homeowner’s insurance policies do not cover a property for flood damage, an owner can insure a building with National Flood Insurance.

In this connection, Key Biscayne is a participant in good standing in the National Flood Insurance Program (NFIP). Furthermore, as an NFIP participant, the Village has applied

for classification in the Community Rating System, which helps determine the insurance rates. FEMA's decision on this matter is scheduled for April 1998.

In general, Village participation in these programs allows local insurance agents to sell a separate flood insurance policy under rules and rates set by FEMA.

Since most mortgage lenders currently require flood insurance, properties with mortgage loans will, in all probability, have flood insurance. This narrows down the general focus of this activity to properties with no mortgages and to properties, which for other reasons do not have flood insurance.

The thrust of this activity is to seek the identification of these properties and secure their protection by having their ownership purchase flood insurance policies.

Specific targets include ground floor apartments in flood-prone buildings and properties adjoining repetitive loss structures. In both these cases, there is a strong probability that these properties are not covered by flood insurance in view of the fact that there is a strong likelihood that they were affected by major weather events during the last five years or so, but there is no record of insurance claims having been filed.

Appropriateness: Given that the entire Village of Key Biscayne is in the floodplain and is designated by FEMA a "Special Flood Hazard Area" (SFHA), Zone AE, it stands to reason that Flood Insurance and projects promoting and extending the use of flood insurance must be included as eminently appropriate and integral elements of any property flood protection program.

Accordingly, this activity is not only relevant, it is an essential component of the Floodplain Management Plan and its program of activities as expressed in its Action Plans.

Support and Consistency with Floodplain Management Plan Goals: In terms of “Overall Goals”, Insurance and the extent to which properties are covered by flood insurance, support the goal “ ...to mitigate the extent and severity of the problems created by...(flooding) hazards...”.

With respect to the “Working Goals”, Insurance relates implicitly to the economic goals of the plan and to the goals regarding the dissemination of public information and public involvement.

Benefits in Relation to Cost: The Action Plan Projects contemplated under this activity, i.e. to identify uninsured properties and seek their involvement in the flood insurance program will not involve substantial outlays of public funds. At the same time, FEMA’s actuarial process amply documents that the benefits of insurance greatly outweigh premium costs as far as property owners are concerned. Accordingly, it is deemed that cost effectiveness is not, nor should be, a key determinant in the consideration of projects under this activity.

Moreover, and in the final analysis, a formal B-C analysis is not apt to have negative results nor would it provide, in any circumstance, a serious basis for dropping this activity for consideration as part of the Floodplain Management Plan.

Affordability: The nature of the Action Plan Projects to be undertaken in connection with this activity, is not likely to tax the financial or administrative capacity of the Village. As indicated above, the costs are very moderate, involving a minimum of staff time. Additionally, this is an activity which may lend itself to substantial volunteer involvement.

Financeability: No special financial or financing arrangements will be required to execute the projects contemplated under this activity. The work can be carried out entirely within the parameter of existing budgets and staffing. Accordingly this activity has been deemed to be eminently financeable.

Legality: No legal impediment appears to exist in constraining the execution of potential Action Year projects.

Environmental Impact: The execution of projects under this activity have, by their very nature, no impact on the environment.

i) **Group 3. Natural Resource Protection: Erosion and Sediment Control**



**Whoever has heard of erosion control? Here's what's left in a primitive floodplain. For Key Biscayne, lack of erosion control can damage the stormwater systems. (P. Kory)**

The objective of this activity is to reduce the amount of soil transported by stormwater runoff from bare land surfaces into the stormwater management system, where the material, if left unchecked, will clog and/or reduce the effectiveness of the stormwater management system. Large amounts

of silty sediments washed into a water body can reduce dissolved oxygen

levels and visibility. Erosion is most noticeable at construction sites after the land has been cleared but before vegetation is restored.

Most large-scale developments, as a condition of their drainage permit, are required to implement some sort of erosion and sediment control. These controls can consist of: placing hay bales around the perimeter of an inlet; grading the property so that drainage from the site flows into a constructed sump area to collect transported sediment; grading the site with mild slopes to encourage slower runoff and lower velocities; vegetating, even as a temporary

measure, bare land surfaces, especially in areas that tend to transfer runoff from the property; and/or placing floating turbidity barriers around the outfall into a water body.

Appropriateness: This activity is appropriate for inclusion in the action plan because the regulation and enforcement of erosion and sediment controls will offer protection to the Village's investment in the new stormwater drainage systems and reduce the maintenance costs of said systems.

Support and Consistency with Floodplain Management Plan Goals:

Benefits in Relation to Cost: The benefits to be gained through a program of erosion and sediment controls are reduced maintenance costs to the stormwater system, cleaner roadway gutters, less soil loss, and better stormwater quality.

Affordability: This activity will involve nominal costs by the Village, as the cost of implementing controls will be borne by the developer. The costs incurred by the Village will include staff costs to inspect construction sites to ensure erosion controls are in place. This responsibility will fall to the building inspector or Village engineer.

Financeability: No special financial or financing arrangements will be required to execute the projects contemplated under this activity. The work can be carried out entirely within the parameter of existing budgets and staffing. Accordingly this activity has been deemed to be eminently financeable.

Legality: No legal impediments, provided the inspector has been granted enforcement rights, appear to constrain this activity.

Environmental Impact: The results from this activity will have a beneficial environmental impact through cleaner stormwater runoff and the reduction of soil loss from construction sites.

**j) Group 3. Natural Resource Protection: Best Management Practices**

The objective of this activity is to reduce the non-point source pollutants that are carried by stormwaters. Point-source pollutants typically come from municipal and industrial wastewater systems not apt to be found on Key Biscayne. Non-point source pollutants typically include lawn fertilizers, pesticide, farm chemicals and oils from street surfaces.

Best Management Practices (BMPs) do not relate directly to flood prevention, protection or mitigation, however, it is clearly a floodplain management activity, particularly since the kinds of projects to be undertaken thereunder are likely to be considered in conjunction with such improvements as retention and detention basins, drainage-ways and other elements of new development projects. BMPs clean stormwater runoff by filtering the water or letting pollutants settle to the bottom of a basin before it is drained.

BMPs projects on Key Biscayne, for consideration in Action Plans will be focused mostly on the storm drainage system, including the construction of and the ongoing maintenance of measures such as retention/detention ponds, drainage wells, sumped inlets, and swales, as well as nonstructural measures such as street sweeping.

Appropriateness: To the extent that floodplain management activities encounter opportunities for the application of BMPs, it is incumbent to take advantage of such opportunity. To do otherwise would be considered irresponsible and shortsighted.

Support and Consistency with Floodplain Management Plan Goals: BMPs relate primarily to the "Overall Goals" of the Floodplain Management Plan by supporting the Village Master Plan and Key Biscayne's general "... aspirations for the welfare, safety and quality of life of its Citizens". BMPs do not explicitly relate to specific "Working Goals" but these measures are certainly consistent with the intent of many of these goals.

Benefits in Relation to Costs: While the costs of this activity can be readily established and budgeted, the benefits would be almost impossible to ascertain in term of these costs.

The benefits are, on one hand, immeasurably huge, relating to such broad goals as clean water and related improvements of the whole of the environment. Perceived in this manner, the benefits would appear to overwhelm any costs involved in this activity.

On the other hand, it is virtually impossible to trace these benefits to any specific measure or specific project undertaken as part of this activity. In fact the benefits are the result of BMPs by a wide array of public and private entities, active over large geographic areas of regional scale. As such the portion of the benefits from this activity attributable the activities of a single small community, may, after in-depth analysis, prove to be infinitesimally small.

In the final analysis however cost effectiveness is not deemed the determining factor in the consideration of this activity, which has implications on the public welfare far beyond the costs involved.

Affordability: The Village of Key Biscayne and the private entities involved with the execution of this activity have ample capacity to not only maintain but improve on the present level of operation.

Financeability: Since the measures under this activity are funded from general fund operating budgets, this activity has been deemed to be financeable. However, the SFWMD has offered limited matching grants to fund the construction of projects that enhance the quality and recharge of stormwater runoff.

Legality: No legal impediments appear to exist which would constrain the undertaking of this activity.

Environmental Impact: Because of its very nature, this activity exerts a strong positive impact on the environment.

**k) Group 4. Emergency Services: Flood Warning/Flood Response/Health and Safety Maintenance**

Emergency Services protect people during and after a flood. The three activities identified in the above title been considered and evaluated as a group since under the Key Biscayne organizational structure they all fall under the purview of the Fire Rescue Department.

More specifically, the Village of Key Biscayne covers and manages these services, under the direction and coordination of the Village Chief of Fire Rescue. The Village is a participant in the Miami-Dade County Emergency Management Plan and Response Organization. As a participant, whenever the need arises, the Village establishes an Emergency Operation Center at the Village Emergency Services Complex. The Village is also represented at the City of Miami Emergency Operation Center. This organizational structure provides close coordination and communication between all jurisdictions involved.

The policies and procedures for the Village's response to hurricanes and other major emergencies involving public notifications and evacuation, including flood conditions, are found in the "The Key Biscayne Fire Rescue Department Hurricane Operations Plan" (HOP).

Additionally, the Village is a signatory to the "Statewide Mutual Aid Agreement" which provides for State aid in disasters, including floods.

The policies and procedures embodied in these documents are under constant review and fine-tuning. This work carried out in conjunction with the network of cooperating units of government, including the City of Miami and Metro-Dade's Office of Emergency Management, represents the proposed floodplain management plan activities being evaluated for inclusion in Action Plans.

Appropriateness: The fact that Key Biscayne is a barrier island, dependent on the Rickenbacker Causeway as the only means of access and egress and the fact that evacuation of the island is usually necessary in the event of hurricanes and other disastrous events, suggest that the combination of three above activities are eminently appropriate for inclusion as Action Plan projects in the Floodplain Management Plan.

In this connection, "early warning" is, of course, critical and any improvements in this aspect of this group of activities would be a major factor in coping with the hazard.

Beyond "Early Warning", a swift, vigorous and well coordinated "response" to the emergency, is, of course essential. Such response includes a pre-set agenda of actions, including activation of the Emergency Operation Center, initiating the necessary emergency traffic control systems, ordering evacuation, shutting off power to threatened areas, and generally executing the measures called for in the Hurricane Operations Plan. Needless to say, any improvements in these actions represent projects appropriate for consideration as part of Action Plans.

Finally, also in connection with Emergency Services, is the activity which addresses the dangers to health and safety after a flood. For the purpose of this activity it is assumed that the measures involved in this activity deal with the management of the island during the evacuation period, including such projects as:

- Patrolling evacuated areas to prevent looting;
- Providing or assuring an adequate supply of safe drinking water;
- Clearing streets;
- Cleaning debris and garbage.

While of only limited relevance to the reality of a Village which has been totally evacuated, these types of projects are appropriate for inclusion in Action Plans in terms of the hazards confronting Key Biscayne. As such they should be part of an ongoing agenda of actions which the Village needs to maintain to achieve excellence in the protection of its residents and its assets.

Support and Consistency with Floodplain Management Plan Goals: In terms of its "Overall Goals" this activity relates to the goal "...to continually improve and maintain cutting-edge, state-of-the-art effectiveness of Key Biscayne's emergency preparedness and disaster response capacity". With respect to "Working Goals", this activity relates to the goals dealing with the Protection of the Rickenbacker Causeway (Key Biscayne access).

Benefits in Relation to Costs: The costs involved with this activity do not include physical changes to the Rickenbacker Causeway or the purchase of new equipment. It is assumed that the projects are generally confined to improvements of procedures, communication systems, organizational adjustments, and other measures to achieve better and earlier alert and response to emergencies. As such, the cost of such betterments will tend to be nominal and of little consequence in relation to the very substantial benefits to be derived from an enhancement in the delivery of Emergency Services.

Affordability: Inasmuch as this activity is already on-going and fully staffed, the question of affordability is narrowed to that of the costs of the improvements to existing systems, equipment and procedures. These additional costs are deemed to be nominal in relation to the Village's financial capacity.

Financeability: No discreet, or separately dedicated, source of funding, outside of Fire Rescue Department budget, is expected to be necessary to undertake projects under this activity.

Legality: No legal problems appear to exist with respect to the implementation of projects under this activity.

Environmental Impact: As no physical improvements are contemplated, projects to be undertaken in connection with this activity are not expected to have any impact on the environment.

**1) Group 5. Structural Projects: Storm Sewers**



**Lake and river front properties were common on Key Biscayne prior to construction of storm drainage system (Photo courtesy of Bob Bristol).**

An important element of Key Biscayne's floodplain management planning is the reduction of storage in the public right of way of stormwater runoffs which threaten adjoining properties as waters rise and inhibit the ability to move on Village streets.

The existing stormwater management systems on Key Biscayne are a combination of positive drainage systems and seepage (exfiltration) facilities. These systems were installed on a piecemeal basis to address minor localized flooding problems. Given Key Biscayne's high water table and low "head" (difference in elevation between the surface and water-table elevations), catch basins filled up with water at a fast rate and drained very slowly. As a system, the existing facilities were seriously inadequate.

To address this matter on a comprehensive basis, and to bring the Village into compliance with the National Pollutant Discharge Elimination System (NPDES) regulations, which require that municipalities adopt capital improvement plans for stormwater management, the Village of Key Biscayne adopted, in 1994, a Stormwater Master Plan.

The more specific purpose of this plan and the storm sewer system subsequently built pursuant to said plan, was (and is) to reduce, together with existing facilities, the incidence of flooding and improve the quality of stormwater discharged within the Village.

The maintenance aspects of the activities related to storm sewers have been considered under the Group 1 activity (“Prevention”) entitled: “Drainage System Maintenance”.

This activity, focuses on the storm drainage facilities built under the Stormwater Management Plan including the following project(s) to be undertaken as part of the Floodplain Management Plan’s Action Plans:

- Evaluation of the performance of the newly built system;
- Design of program of improvements and fine-tuning measures for the system, to increase its level of performance in terms of flood protection for storm events with a recurrence frequency of 10, 25, 50, or 100 year intervals.
- B-C analysis of recommended improvements and measures.

Appropriateness: An effective storm drainage system is appropriate for consideration as part of the Floodplain Management Plan in that this activity addresses the hazard of rainstorms as well as the problem of repetitive loss properties. The fact that the effectiveness of the system has a direct and material mitigating impact on the extent to which Key Biscayne properties are vulnerable to rainstorm generated flooding events, further supports the appropriateness of including this activity in the Action Plans of the Floodplain Management Plan.

Support of and Consistency with Floodplain Management Plan Goals: The storm sewer activity relates to the following “Overall Goals”:

- “...Reduce vulnerability to flooding hazards from major rainfall...”
- “...Mitigate the extent and severity of the problem created by...” the hazards.
- “...Prevent any additions to the list of ‘Repetitive Loss Properties’...”
- “...Reduce the number of Repetitive Loss Properties...”

With respect to Working Goals the storm sewer activity supports in very material ways, and is consistent with, the goals involving “Reduction and Mitigation of Rainstorm Hazards and Problems”.

Benefits in Relation to Costs: Given the investment made to-date in the stormwater drainage system, the benefits to be derived from the fairly modest costs likely to be involved in further improving and fine-tuning the system, are expected to be very substantial in relative terms.

As a specific target, in this connection, the expectation is to effectively protect properties from rainstorms with a frequency recurrence interval of perhaps as much as 50 years compared to the 5-year design criterion used for the current system.

If such target were achieved, even an extremely conservative B-C approach limiting the savings to only the most vulnerable of the properties would show that the benefits, over time would far exceed the costs involved.

In any case once specific projects are defined in the Action Plan, formal B-C analysis will be undertaken, most likely in conjunction with the seeking of funding for the project.

Affordability: The Village of Key Biscayne has the financial capacity to undertake the kind of projects suggested by the fine-tuning and improvement of the storm drainage system. The types of projects involved (e.g. increasing the capacity of some of the injection well pumps) represent a minute proportion of the total investment which has already been proven to be affordable.

Financeability: The Village's new stormwater drainage system has been financed using the revenues generated from the Stormwater Management Utility (SMU). Under Florida law, a utility may fund capital improvement projects by issuing bonds that will be repaid by the revenue from an enterprise operation. The same process may be used to generate the capital needed for the implementation of this activity.

Alternatively, a number of Federal and State Hazard Mitigation Grant programs are, and continue to be, available for the kind of purposes suggested by this activity. With proper B-C Analysis and justification minimal problems are anticipated in qualifying for and securing grants.

Legality: No legal constraints appear to exist in pursuing the projects suggested by this activity.

Environmental Impact: The fine-tuning and improvement of the effectiveness of the storm drainage system has little or no impact on the environment and has therefore been considered environmentally neutral.

**m) Group 6. Public Information: Map Information**

The purpose of this activity is to help residents and businesses become more easily aware of potential flood hazards affecting their property through the Community's Flood Insurance Rate Map (FIRM). To the extent that this awareness exists,

residents and businesses can take steps to avoid problems and/or reduce their existing exposure to flooding. Real estate agents and house hunters can also find out if a property is flood prone and whether flood insurance may be required.

FIRM flood maps have a wealth of information about past and potential flood hazards. However they can be hard to obtain and not readily understandable by the general public.

On Key Biscayne, the Village's Building, Zoning and Planning Department assists the public by providing this map information including: flood zone designations, Community Number, Panel Number and Suffix, date of the FIRM Index, the base flood elevation in each zone and the elevation datum.

In addition to the FIRM, the Village has purchased and is using the Mapinfo Windows and MacIntosh GIS mapping system for the display and query of all parcels within the Village limits. The GIS base map was obtained from Florida Power and Light via a license and includes such parcel-level data as tax information, Base Flood Elevation (BFE), elevation of nearest public-way, building information, trees, water and storm-sewer information, as well as "depth of flood" information to the extent that such information is made available by FEMA.

The Village has also developed a district and team system that is tracked on the mapping system, for evaluating post-disaster damage assessment. Linked to this system is a county-wide street level system showing all hospitals, schools and other important points and routes in Miami-Dade County as well as housing locations for many of the Village employees.

Two Developments of Regional Impact (DRIs) on Key Biscayne ("Grand Bay" and "Ocean Club") have provided the Village with DXF format drawings of their infrastructure to be inputted into the Village GIS system. This system uses the 1983 US and Florida Eastern 1983 latitude/longitude coordinate system and transfers information via Arcview, Arcinfo via translators. Small building locations and surveys

are currently stored in the same computer that holds the Village GIS system and is retrievable via a database that searches for these scanned documents.

All permit, inspection and contractor information is accessible through a Cross Platform Filemaker Pro-database System. All of the above information is loaded into laptops via the network and is accessible in Village offices as well as in the field during emergencies.

The availability of map information has been publicized through a notice mailed to local lenders, real estate and insurance agents and via a public notice in the "Islander News"

Projects under this activity include:

- continuing to maintain and adding to the Village's data base, particularly with respect to data relating to the cost and characteristics of flood damage and to increase the accuracy of information about existing grades and building elevations; and
- continuing to publicize the availability of this service on an ongoing basis.

Appropriateness: Unawareness and lack of information regarding potential flood hazards, will tend to induce indifference and lack of preparedness, resulting in potentially disastrous problems in the face flooding events. For this reason, the availability and dissemination of information regarding flood hazards is appropriate as a Floodplain Management Plan activity.

Support and Consistency with Floodplain Management Plan Goals: This activity relates to the following "Overall Goals":

- "...assure incremental improvements of Key Biscayne's standing and classification in the Community Rating System (CRS)...";

- “...increase the continual dissemination of information...with respect to the existence of flood hazards...”

With respect to “Working Goals”, this activity relates directly to the goals identified under “Flood Data, Information and Analysis” and to the goal identified as “Public Information and Involvement”.

Benefits in Relation to Costs: In view of the fact that the maintenance of FIRM information, even with expanded range of data Key Biscayne maintains, is managed as part of the Village’s normal operations, suggest that no additional cost is involved in this activity. At the same time, the cost of disseminating the information, including the specialized mailings and the public notices involved has been deemed to be nominal.

Accordingly, any benefit (and there are many) will quickly overwhelm the negligible costs and this activity can be deemed eminently cost effective.

Affordability and Financeability: Given the nominal nature of the costs involved in this activity, these criteria are not relevant to the evaluation process.

Legality: There appear to be no legal constraints on the implementation of this activity.

Environmental Impact: This activity is not expected to impact the environment in any way and is therefore deemed environmentally neutral.

**n) Group 6. Public Information: Outreach Projects**

Awareness of flood hazard and what people can do about it is at the core of any comprehensive floodplain management program. The key challenge here is to achieve the broadest possible level of public awareness, on a continuous basis,

including the distribution of information on property protection measures.

Outreach projects are designed to meet this challenge locally with a program of newsletters, pamphlets, TV programs, flyers and posted information all explaining the kinds of flood hazards Key Biscayne properties face and educating the public on the actions recommended to deal with the hazards. In this connection, the program will address the following subjects, all involving some action (or reaction) from the public:

- Flood warnings;
- Evacuation means and destinations;
- Safety during flooded periods;
- Flood insurance;
- Property protection in terms of flood proofing and retrofitting measures;
- Permit requirements;
- Substantial property improvements (re: the 50% rule);
- Drainage maintenance; and
- Availability of flood information.

Two major factors in the effectiveness of outreach projects need to be borne in mind:

- The importance of creating a pattern of repetition of the key elements of the message in order to reinforce awareness at subconscious levels. For example the Red Cross has found that a warning needed to be repeated at least 18 times before it is seriously heeded ; and

- The need to target the audience by, tailoring the means of information dissemination, to the specific sectors of audience to be reached.

Current outreach projects implemented on Key Biscayne, include a newsletter mailed to all Village Residents twice a year discussing the topics identified above and advising residents of news items relating to floodplain management and related subjects.

Potential additional projects which may be considered as part of Action Plans, include such possibilities as: ads in the Islander News (a local weekly publication); the use of Miami-Dade Water and Sewer Department billings as a mean to distribute monthly or quarterly messages; targeted mailings to businesses and owners of repetitive loss properties; education programs for condominium building and commercial building managers; posting of "sound bite" type of information on public and other billboards; cable television advertising; and the like.

Appropriateness: This activity responds to one of the great problem areas of floodplain management, namely public and individual awareness of hazards and what to do about them before, during and after such major flooding events as heavy rainstorms, hurricanes and storm surges. Accordingly there should be no question that this activity is not only an appropriate but an essential one for inclusion in the Floodplain Management Plan.

Support of and Consistency with Floodplain Management Plan Goals: With respect to the "Overall Goals" this activity relates directly to the goal of increasing "...the continual dissemination of information on a repetitive basis with respect to the existence of flood hazards and the availability of measures to mitigate the problems presented by such hazards." This activity also relates to the Overall Goal assuring Key Biscayne's standing in the Community Rating System (CRS), including the incremental improvement in that standing. In this connection it should be noted that the

implementation of outreach projects will earn significant CRS points while the maintenance of the twice-a-year news letter serves to preserve Key Biscayne's current standing in the system.

With respect to "Working Goals", this activity relates to:

- The economic goals which include the securing of resources for the implementation of outreach projects; and
- The more specific "Public Information and Involvement" goal stated in step F of the Floodplain Management Plan.

Benefits in relation to Costs: The costs involved in projects under this activity are essentially "soft" in nature, including mostly production and mailing expenses. These costs can vary substantially with the level of quality in the design, and printing of the material and with the method of dissemination. In evaluating cost effectiveness, the working assumption in tackling projects under this activity, is that a better quality, more sophisticated or elaborate production, involving significantly higher costs, would probably not result in a comparable improvement of benefit. The same assumption, however may not be valid with respect to the dissemination of the material.

A formal B-C analysis for this activity would be extremely complicated particularly with respect to the quantification of Benefits. This aspect alone would represent a major research project. On the other hand an appropriate and manageable Action Year project under the Floodplain Management Plan might be to gain some general knowledge on the subject through wide ranging inquiries with agencies and individuals most apt to be familiar with the state-of-the-art in this area of knowledge.

Affordability and Financeability: Given the flexible and soft nature of the costs involved in projects under this activity, it is

possible to tailor the costs to the capacity of the Village's operating budget. Moreover, in the event it is desired to fund such projects via special or supplementary allocations, the strong financial condition of the Village and the popular nature of the activity would not represent significant obstacles to the undertaking and implementation of this activity.

Legality and Impact on Environment: None of the potential projects contemplated under this activity appear to be constrained by existing laws or regulations.

The impact of this activity on the environment can be deemed positive, in view of its educational component dealing with the dissemination of information about the "Natural and Beneficial Functions of Floodplains". For example the August 12, 1997 Newsletter refers to this subject with the following statement: "The undisturbed areas on Key Biscayne which exist in a natural state perform a number of beneficial functions with respect to the hazards of flooding. They moderate the amount of flooding, they retain flood waters, they reduce erosion and sedimentation damages, and they mitigate the effect of waves and storm surges from storms. Additionally, they provide habitat for fish and wildlife..."

**o) Group 6. Public Information: Library**

Beyond outreach projects which represent a proactive approach to public information, the Library activity is essentially passive in nature. While linked to the outreach activity by identifying its existence and availability, libraries are the obvious place for residents to seek information on flooding, flood protection and protecting natural resources. Libraries also have their own public information campaigns with displays, lectures and related projects undertaken in tandem with the community's program to raise public awareness and floodplain management education.

The Key Biscayne Public Library has a section dedicated specifically to information on floodplain management and flood insurance including, more specifically:

**p) Group 6. Public Information: Technical Assistance**

This activity focuses on the provision of technical information and flood protection assistance by Key Biscayne Building, Zoning and Planning Officials and staff to property owners and residents on a one-on-one basis, both in the office at the Village Hall and at the resident's property.

These services are centered at office of the Village Building Official who shares the responsibility of performing the services under this activity with the Village Director of the Department of Building, Zoning and Planning and the CRS Coordinator.

Flood protection assistance services include:

- Providing available site-specific flood and flood-related data, such as floor elevations, data on historic flooding on Key Biscayne, or the immediate neighborhood, or similar information of relevance to the inquirer's property. To the extent that gaps in this information exist, Action Plan Projects will have to incrementally focus on closing such gaps;
- Providing names of contractors, engineers, consultants and other appropriate professionals, knowledgeable or experienced in flood proofing, elevation and retrofitting techniques and construction;
- Providing material on how to select a qualified contractor and what recourse is available if a contractor's performance is unsatisfactory;
- Making site visit to review flooding, drainage and sewer problems and providing one-on-one advice to property owners with respect to either an existing problem or a contemplated construction.

The availability of these services is publicized in the Islander News (Key Biscayne's local weekly) and is posted at the Village Hall and the public library.

Potential Action Plan Projects under this activity are focused on three areas:

- One area, as indicated above, is to incrementally collect information regarding individual properties;
- The second area, is to maintain the availability of the service, focusing on measures that will increase the range of services and information without further taxing the administrative capacity of the department;
- The third area involves maintaining and broadening the programs publicizing the availability of the service, particularly with respect to “repetitive loss” properties and the companies, professionals and individuals involved in the transfer of properties and construction activities.

Appropriateness: One of the problems in dealing with flooding hazards is to be able to acquire and convey the necessary technical data, knowledge and techniques that will produce appropriate action and response by property owners and residents to the hazard. Accordingly, this activity, designed to respond to this problem, is an appropriate one for inclusion in the Floodplain Management Plan.

Support of and consistency with Floodplain Management Plan Goals: In terms of “Overall Goals”, this activity relates to the goals of preventing additional repetitive loss properties and reducing the number of such properties currently on the FEMA list. Also, with respect to overall goals, this activity supports and is consistent with the goal “...to increase the continual dissemination of information on a repetitive basis with respect to the existence of flood hazards and the availability of measures to mitigate the problems presented by such hazards.

Key Biscayne's critical facilities are vulnerable to flooding and therefore to the kind of damage that could impair their proper function in the event of an emergency or disaster.

Most notably, the Police and Fire Administrative Building Complex, housing Key Biscayne's primary Emergency Operation Center, i.e. the nerve center of the Village's capacity for disaster response, is housed in temporary structures (converted trailers) in a flood-prone location below Base Flood Elevation.

The secondary EOC at the Sonesta Hotel, while at the BFE, is not protected against floods, storm surges or other events of 500 year recurring frequency intervals.

Similarly, the entire evacuation route system for Key Biscayne is flood-prone and below Base Flood Elevation (i.e. 100 year flood, not to mention the 500 year standard mandated by FEMA).

In view of these circumstances, it is essential that the Floodplain Management Plan addresses this matter on a high priority basis.

However, the solution to the above problems implies major new municipal facilities or large scale public works projects. Protection of EOCs might be achieved either through a perpetuation of temporary solutions, an approach that could be acceptable and represent a manageable longer term modus vivendi, given the fact that once the island is totally evacuated the need for emergency response and services is moot. At the other end of the potential activity spectrum, protection can be achieved through the construction of a new Police and Fire Headquarters, conceivably as part of a new Village Hall.

The latter approach would require, of course, not only an extensive and potentially complex public decision process but also a vigorous effort to secure site-and-funding sources beyond the Village's current budget and debt programs.

The protection of the Rickenbacker Causeway and the bridges that connect Key Biscayne to the mainland imply the need, now or in the future, of large scale public works. To undertake such ventures suggest even more daunting challenges, far beyond the scope of the Floodplain Management Plan. The area involved is largely outside the Village and outside Village jurisdictional control. Additionally, capital costs may be prohibitive and physical/functional feasibility may be issues as well.

For the purpose of the Floodplain Management Plan, therefore, the consideration of the "Critical Facilities" activity as part of the Action Plan, has been deferred until:

- A community consensus is achieved with respect to a new Police and Fire Department headquarters (whether or not as part of a new Village Hall or other municipal functions).
- There is a manifest interest on the part of the other units of government involved in the ownership, control and operation of the Rickenbacker Causeway to address the matter of its vulnerability to major flooding hazards.

In the meantime to stimulate and support any effort to address these matters, this activity has been recognized in the Action Plan by seeking an analysis of the benefits involved, for use in B-C analysis when projects relating to this activity are further defined.

**b) Group 5. Structural Projects: Beach Nourishment**

The importance of sand dunes and beaches in mitigating the impact of storm surges was discussed as part of the group 1 activities where the emphasis was on the Maintenance aspects of this activity. The Capital aspects of beach nourishment are discussed here, as part of the "Structural Projects" group of activities which include such projects as levees, flood-walls, sea-walls, reservoirs, storm sewers, diversions and channel

modifications. These types of projects generally involve construction of man-made structures to control water flow. They all tend to be large in scale and expensive.

In the case of Key Biscayne, an analysis of these types of projects indicates that only the consideration of storm sewers and beach nourishment meet the criterion of "appropriateness". The other types of projects are relevant mostly to riverine or destination port locales rather than to a natural coastal situation or community like Key Biscayne.

Given the fact that a new stormwater drainage system has been recently completed, the consideration of this activity as part of the Action Plan is appropriate in that it provides the opportunity, at relatively little additional cost, to measure the effectiveness of the as-built system (which appears to be performing better than design criteria) and to fine-tune it to realize an even greater level of effectiveness.

With respect to Beach Nourishment, the capital costs involved in this activity, based on preliminary estimates in the "Long Range Beach Nourishment Plan", amount to some \$2.3 Million, with replenishment estimated to be required every 7 to 10 years. It is assumed that at this magnitude of cost, financing would have to be secured from sources beyond what can be generated locally.

Accordingly, it is highly probable that cost effectiveness will be among the funding criteria that will have to be documented in order to obtain project financing, particularly from State and Federal Agencies. For this reason, the full review and evaluation of "Beach Nourishment" as an activity has been deferred until a formal B-C analysis is completed. As such, it is the B-C analysis work item, required as part of the funding application process, which becomes the thrust of this activity. Once full B-C information and analysis is available, it will then be possible to review this activity in terms of the remaining evaluation criteria.

**5. High Priority Activities to be considered for Action Plan Project Selection as part of the First Action Year (1998/1999).**

Based on the above review, the twenty (20) activities listed below have:

- Not been eliminated, by virtue of relevance, feasibility and appropriateness, for consideration as part of the Floodplain Management Plan;
- Been deemed to meet in (the affirmative) most or all of the evaluation criteria; and
- Not been deferred for potential future inclusion in the Floodplain Management Plan until further study and analysis provide a proper basis for evaluation.

Group 1 activities: **Prevention**, include:

1. Planning & Zoning
2. Open Space Preservation
3. Floodplain Development Regulations
4. Stormwater Management
5. Drainage System Maintenance
6. Dune and Beach Maintenance

Group 2 activities: **Property Protection**, include:

9. Building Elevation
10. Flood Proofing
12. Insurance

Group 3 activities: **Natural Resource Protection**, include:

14. Erosion and Sediment Control
15. Best Management Practices

Group 4 activities: **Emergency Services**, include:

16. Flood Warning
17. Flood Response
19. Heath and Safety Maintenance

Group 5 activities: **Structural Projects** include:

25. Storm Sewers

Group 6 activities: **Public Information**, include:

- 26. Map Information
- 27. Outreach Projects
- 29. Library
- 30. Technical Assistance
- 31. Environmental Education

Among these 20 activities, ten (10) represent on-going tasks involving essentially the maintenance of services, and records including the performance of activities mandated under the CRS program as a condition for preserving the Village's Classification. These activities, which have been deemed to be "grand-fathered" into the Floodplain Management Plan, inclusive of any betterment, are assumed to qualify for inclusion in the First Year Action Plan and all subsequent Action Year Plans.

These activities include:

- 5. Drainage System Maintenance
- 6. Dune and Beach Maintenance
- 15. Best Management Practices
- 16. Flood Warning
- 17. Flood Response
- 19. Health and Safety Maintenance
- 26. Map Information
- 27. Outreach Projects
- 29. Library
- 30. Technical Assistance

With respect to the remaining ten (10) activities, several Floodplain Management Projects have been identified for each activity. The Working Review Committee has been requested to rate those projects that best meet the selection criteria. Based on such rating, the projects will be prioritized and the top three or four with the highest rating will be included for implementation in the First Year Action.

These remaining activities include the following:

1. Planning & Zoning
2. Open Space Preservation
3. Floodplain Development Regulations
4. Stormwater Management
9. Building Elevation
10. Flood Proofing
12. Insurance
14. Erosion & Sediment Control
25. Storm Sewers
31. Environmental Education

The result of this rating will be inserted and made a part of this report after the Phase III Decision Meeting of the WRC.



**Part D: Draft an Action Plan**

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## PART D: Draft an Action Plan

### VIII. Draft an Action Plan

#### A. Introduction

The preceding Section VIII of the Floodplain Management Plan Report evaluates the various possible floodplain management activities which:

1. Have been identified as **Flood Hazards and Problems** for Key Biscayne in Phase I of the Report; and,
2. Appear **relevant and supportive to the Goals for the Plan** identified in Phase II of the Report.

The implementation of these activities is through the means of a web of **ONGOING TASKS, as well as shorter and longer term PROJECTS.**

It is proposed to update this Section of the Floodplain Management Plan Report every two years: (1) to reflect additions or deletions to the inventory of recurring TASKS and PROJECTS to be implemented as part of the Plan and (2) to provide status reports with respect to these activities.

It is further proposed, for purposes of manageability, to treat each of these **updates** (i.e. The "Action Plan" for any given year) as **separately bound stand-alone documents**. The "Floodplain Management Plan Document" and that the "Floodplain Management Plan Report", including all supporting materials will represent the fixed Policy Framework within which stand alone Action Plans, for individual years are created and justified. As such, while an update will not, in and by itself, represent an amendment of the plan, it is quite possible, that during a two-year period, a Plan Document Amendment may be required. In such circumstance, of course, such action would be reported in the update.

## B. On Going Tasks.

Section VIII identifies ten (10) activities which represent on going tasks involving generally the maintenance of the floodplain management activities typically mandated under the CRS program as conditions for preserving and/or improving the Village's standing in the Community Rating System.

Since activities under the Community Rating System (CRS) activities are generally compatible with Key Biscayne's Floodplain Management Plan, this system has been included and was taken into consideration in defining and structuring the "On-Going Tasks" listed below:

### 1. Drainage System Maintenance and Best Management Practices

These activities relate primarily to CRS activity 540. The Village Public Works Supervisor is responsible for:

- The maintenance of the Village Stormwater Drainage System. The activities involve such on-going tasks as patrolling island public ways and construction sites to inspect inlets, swales, pump stations and other facilities related to the system;
- The supervision and management of system's operating agreements with the City of Miami and PELCO Corp., covering the inspection, maintenance and repair of the system as a whole and the pump stations, respectively, assuring that inspections of the system and cleaning of inlets, weir and wells structures occur at least twice annually; and that maintenance on pump stations is performed on a monthly basis;
- Assuring effective response for day-to-day reports of problems throughout the island. This task requires effective coordination with all Village, Regional and State governmental entities and regulatory agencies, including,

among others: Miami-Dade Department of Environmental Resource Management (DERM); Miami-Dade Water And Sewer Department (MDWASD); State of Florida Department of Environmental Protection (DEP); and the South Florida Water Management District (SFWMD).

- Maintenance of reports and record evidencing the performance of the above activities.

These tasks, are currently, and will continue, to be funded as part of the Village General Fund, except for those tasks normally funded from the Village's Stormwater Utility fees.

## 2. Dune and Beach Maintenance

For the purpose of this Section of the Floodplain Management Plan Report, this activity has been deemed to relate to CRS Activity #420 - "Open Space Preservation".

The management of this open space, i.e. Key Biscayne's beaches, is a principal responsibility of the Assistant to the Village Manager who is also a member of, and Village liaison with, the "Village Beach Resources and Management Task Force" (BRM).

The tasks under this activities include such actions as: cleaning the beach face, removing trash and sea weeds, elimination of beach scarps, protection of sea turtle nesting, planting and other means of dune stabilization.

These actions are being, and will continue to be, performed by a combination of beachfront property owners, volunteers involved in civically organized events and Village personnel. The costs are either part of the Village's operating budget or the tasks are privately sponsored, either by beachfront property owners and/or civic organizations and/or interested individuals.

Dune and beach maintenance activities are expected to go on for a long time, with interest remaining a matter of high priority with residents, businesses and all government at all levels, because of

the importance of the beach to the economy, livability and safety of the community. The tasks, involved in this activity are likely to be given even further impetus when the contemplated beach nourishment project gets underway.

3. **Flood Warning, Flood Response; Health & Safety Maintenance**

The tasks to be performed under this group of activities, involving the emergency services provided by the Village of Key Biscayne before, during and after a flood producing major weather event relate to CRS Activity 610 "Flood Warning Program".

These tasks are described in substantial details in the "Key Biscayne Fire Rescue Department Hurricane Operations Plan" and related documents, such as the Miami-Dade County Emergency Management Plan and the Statewide Mutual Aid Agreement.

The Village of Key Biscayne Director of the Fire Rescue Department has the responsibility to implement, administer and generally manage these tasks. The on going performance of these tasks, including any incremental improvements in procedures, coordination, equipment and facilities is assured by virtue of the fact that the Department is among the first line echelon in the Village administration. Its funding is from the General Fund and is normally treated as a matter of highest priority in both the administrative and the legislative annual budgeting process.

4. **Map Information and Technical Assistance**

The tasks involved in these activities relate to: CRS Activities # 320 - "Map Information and # 360 - "Technical Assistance".

In substance, two sets of tasks are involved. One is focused on the **broadest possible dissemination of information**. The other seeks to assure that the **information is as complete and accurate as possible**.

Both sets of task are performed within the Village Department of Building, Zoning and Planning.

- The Director of Building, Zoning and Planning is, more particularly, responsible for incrementally enhancing the Village data base with more and more site-specific information;
- The Village Building Official's office, on the other hand, is responsible for making such information readily available, providing project and site specific technical assistance to residents, property owner, contractors, architects and others involved in property improvements or real estate transactions.

## **5. Outreach Projects and Library**

The tasks involved in these activities deal with the Village's efforts to reach the public and increase awareness of flooding hazards and problems as well as the measures available to mitigate these concerns. These task relate to: CRS Activities #340 "Outreach projects" and #350 "Flood Protection Library".

- Outreach tasks currently involve mailing, twice a year, prior to hurricane season, a newsletter to island residents dealing with the following topics:
  1. Local Flood Hazard
  2. Local Hazard Map
  3. Flood Warning System
  4. Flood Safety
  5. Flood Insurance
  6. Property Protection
  7. Permit Requirements
  8. Substantial Improvement Requirement
  9. Drainage Maintenance
  10. Beneficial Functions of Floodplains

While these outreach tasks are planned to be performed on an ongoing basis every year, they may be supplemented on an opportunity basis upon the occurrence of events that significantly impact the Village's position with respect to flood protection.

converted into living space the potential for flooding damage was materially increased. Raising the elevation of the converted space to or above the building elevation could help mitigate this problem at relatively little cost compared to major mitigation measures such as flood proofing or elevating the entire structure.

The project would involve:

- the identification of the properties involved;
- an analysis of the benefits and costs involved;
- a legal analysis to determine the best method for inducing the elimination of the problem;
- development of a program for implementing this improvement.

This project addresses and falls within the scope of the following Floodplain Management Plan Activities:

Floodplain development regulations;  
Elevation & Flood Proofing.

4. **Earth Shaping Master Plan.** This project involves:

- the development of topographical survey information with respect to the drainage basins within the Village that contain the most seriously flood prone properties;
- the design of changes in the existing topography, including, a system of swales among other earthworks, at selected locations within the drainage basins, to control the behavior of stormwaters, particularly in areas where surface drainage problems tend to exist; and,

- the development of an implementation program including the identification of potential funding sources, and a timelines for the incremental execution of this project.

This project addresses and falls within the scope of the following Floodplain Management Plan Activities:

Stormwater Management  
Flood proofing

5. **Demonstration Project**, involving the selection of one or more flood prone properties to be used as a demonstration for the application of “elevation”, “flood proofing” and other measures available for the mitigation of flood hazards and problems.

The demonstration will serve a number of purposes:

- it will test state-of-the-art technology, various methods for elevating buildings and various other flood proofing measures;
- it will provide a firm basis for measuring all of the costs involved;
- it will provide a physical model to which the public can relate when subjects such as retrofitting and flood proofing are discussed;
- it will represent a laboratory where other flood damage prevention measures can be illustrated; and,
- it will enable a benefit-cost analysis which will provide a well documented assessment of the measure’s cost effectiveness.

This project addresses and falls within the scope of the following Floodplain Management Plan activities:

Building Elevation

## Flood Proofing

6. **Economic Incentives.** This project involves the creation of a package of economic incentive to induce property owners to undertake such flood protection measures as elevating structures above the BFE, flood proofing improvements and the like. In this connection the following are examples of the kinds of means that might be considered for study, analysis, feasibility, etc:

- Low interests loans to help owners pay to elevate or rebuild structure;
- Deferral for a number of years, or forbearance, of ad-valorem tax increases which may be triggered by building elevation or flood proofing work;
- Zoning and other land utilization concessions off-setting the cost of the flood mitigation work with an opportunity for maximizing the value of the underlying land;
- Exemption of the property, insofar as the cost the mitigation work is concerned, from the 50% rule as it applies to the “substantial improvement” of the property.

This project addresses and falls within the scope of the following Floodplain Management Activities:

### Building Elevation and Flood Proofing

7. **Flood Insurance Research Project** This project will:

- Seek to determine the number and characteristics of properties which do not have flood insurance and the reasons therefor.
- culminate with an action program designed to increase the number of properties covered by the flood insurance and

with a local information program including brochures, pamphlets and the like designed to de-mystify the subject.

- review the validity of the BFE as reflected on the FIRM as well as the various flood insurance rates that distinguish, within the same flood zone, between properties below the BFE, that are flood prone and vulnerable to flooding hazards and those raised above the Base Flood Elevation which have taken mitigation action.

This project addresses and falls within the scope of the following Floodplain Management Plan Activities:

Insurance

**8. Erosion Control Hot Line and Response System.** This project involves:

- creating and implementing a discreet program of inspection, focused on construction sites, as well as public areas within the Village, to assure that policies and regulations with respect to erosion and sedimentation control are effectively followed.
- The program would be designed to operate in tandem with normal storm sewer maintenance activities and normal construction site inspection activity. The intent is to create a second, primarily volunteer-based, line of defense for the protection of storm water management facilities.

This project addresses and falls within the scope of the following Floodplain Management Plan Activities:

Erosion and Sediment Control.

9. **Storm Drainage System Upgrade.** This project consists of two distinct parts:

- **One is essentially an engineering and design analysis to determine:**
  - a. the “as-built” effectiveness of the system compared with the criteria governing its design;
  - b. its mitigation potentials in terms of protection against rainstorms and weather events of recurring frequency intervals of 25, 50 and 100 years;
  - c. the technical feasibility of achieving these potentials, in terms of capital and operating projects; and,
  - d. the justification for such projects in terms of Benefit-Cost Analysis geared to the eligibility criteria of potential funding agencies.
- **The other component is the implementation and execution of the projects defined by the first component.**

This project addresses and falls within the scope of the following Floodplain Management Plan activities:

Storm Sewers

10. **Environmental Forum.** This project involves the organization of an ongoing program of lectures and events, including field trips, as **necessary**, bringing the public together with speakers from the various agencies whose concerns straddle floodplain management and environmental issues. The lecture program would be supplemented with the production of publications, and, if affordable, a video promoting awareness of environmental issues such as beach erosion, non-point source pollution, hydrology/hydraulics, BMP benefits, and the like.

This project addresses and falls within the scope of the following Floodplain Management Activities:

## Environmental Education

**D. Selection of Action Plan Projects for Action Year 1998/1999.**

Focusing on the above ten (10) potential projects, members of the Working Review Committee and the members of the Village Administration involved in the planning process, notably the Director of Buildings, Zoning and Planning and the Chief of Fire Rescue, were asked to give priority ratings to each of the ten projects.

As shown on the Rating Summary Sheet, the following projects were ranked highest under the simple point system utilized for this purpose:

The project titled under Section C above: “**Comprehensive Review of Local Laws and Regulations**” was the number one choice by five out the nine voting members. All but one placed this project among their choice for the top three.

- The “**Storm Drainage System Upgrade**” project was the number 2 choice, with five of the nine members ranking this project among their top three choices.
- The number three choice was the project identified as: “**Earth Shaping Master Plan**” also with five of the nine members ranking this project among the top three.

The purpose of the ranking process is to keep the number of projects targeted for implementation within manageable bounds. It must be emphasized that it is **not to eliminate potential projects from future consideration.**

As such, the ranking serves to create a pipeline of projects, each at its own levels of implementation readiness. The extent of such readiness, in turn, is in part, determined by the project’s priority ranking. This approach to the management of the wide range of possible Floodplain Management Activities is expected to enable

Key Biscayne to effectively and vigorously respond in an orderly manner to opportunities, as they arise, for achieving Floodplain Management Plan goals.

Project	Priority (1-10)									Total Points	Rank
	DeLeon	Balbin	Cuevas	Flynn	Han	Niblock	White	Gilbert	Little		
A Comprehensive review of local laws and regulations	1	3	1	3	6	1	2	1	1	19	I
B Feasibility study for additional open space	2	5	8	7	5	3	9	9	6	54	V
C Elimination of converted garages	8	6	6	4	9	8	1	8	10	60	VIII
D Earth shaping master plan	6	1	2	6	1	10	4	2	9	41	III
E Demonstration project	10	4	7	5	10	9	8	3	2	58	VII
F Economic incentives	5	7	5	2	2	7	5	5	8	46	IV
G Flood insurance research project	7	8	3	9	3	5	6	6	7	54	V
H Erosion control hotline and response system	4	10	9	8	8	6	7	7	5	64	IX
I Storm drainage upgrade	3	2	4	1	7	2	3	4	4	30	II
J Environmental forum	9	9	10	10	4	4	10	10	3	69	X

**E. 1998/1999 Project Summaries.**

**1. Comprehensive Reviews of Local Laws and Regulations.**

**a) Description of Project.**

As indicated under Paragraph C.1 above in this Section VIII of the report, this project involves a comprehensive review of the Village Master Plan, appropriate building and zoning code provisions as well as all other laws and regulations which impact or are impacted by flood hazards and problems and potential hazard mitigation programs and policies under consideration.

The end-product would be to gain a better understanding of the web of local laws, regulations and measures aimed at keeping flood damage-prone development OUT of hazardous and sensitive areas, while imposing standards on what is allowed to be built WITHIN such areas.

By organizing the laws and regulations into a more user-friendly format, a workable basis is created to review, replace, enhance and otherwise improve the regulatory aspects of floodplain management.

**b) Goals Supported and Advanced by Project.**

This project supports directly and is designed to advance:

“Overall Goal” #1 of the Floodplain Management Plan which is related to consistency with the Village’s Master Plan and its codes and ordinances;

“Overall Goal” # 6 which relates to improving the Village’s standing in the Community Rating System; and,

“Overall Goal” # 9 which calls for increase in the level of coordination “... at the Municipal, County, State and Federal levels of Government.”

With respect to "Working Goals" this project will support the creation of measures related to the existence of "old law" buildings, particularly those with converted garages.

Indirectly, this project may lead to the enhancement of laws and regulations designed to provide incentives, as well as disincentives for influencing resident actions with respect to the vulnerability of flood prone properties and their exposure to flood hazards and problems.

**c) Execution Responsibility and Direction.**

This project will be planned and executed under the direction of the Village Director of Buildings, Zoning and Planning.

**d) Timeline & Work Program.**

It is anticipated that this project will be initiated during the last quarter of 1998 and that completion of all technical work, up to the point of possible enactment of legislation, will be completed by the third quarter of 1999.

**e) Support Framework.**

The support framework for this project is similar to that which fostered the preparation of the Floodplain Management Plan.

Namely:

- The working Review Committee is expected to remain active as an entity, and provide an appropriate communication bridge between the technical team and civic concerns;
- The County and State Emergency Management support groups will continue to provide advisory support and a sounding board for proposed legislation;

- The Village Attorney, the CRS Coordinator, the Village Building Official and the Village Manager will provide the necessary technical and administrative support for the project.

**f) Budget and Financing.**

Generally, it is expected that the most likely source of financing for this project would be through a State or FEMA funded Grant for third party services, to be matched, in-kind with the value of Village Staff time and overhead expended on the project.

The amount of Grant funds for this project has been preliminarily estimated at \$40,000 to cover mostly legal research, legislation drafting expenses and other technical/professional services.

**2. Storm Drainage System Up-Grade**

**a) Description of Project.**

This project involves three stages of development:

- The first, is an engineering study designed to evaluate the mitigation effectiveness of the storm drainage system as it currently exists in terms of severe rainstorms and other flooding hazards found on Key Biscayne;
- The second, is the production of plans, supported as necessary with specifications, cost estimates and permitting data, at incremental levels of improvement to the system, corresponding to the levels of protection against flooding and weather events of recurring frequency intervals of 25, 50 and 100 years.

- The third, is the implementation and construction of the selected design, based on a sophisticated Benefit-Cost study establishing the optimum point of cost-effectiveness using FEMA criteria for this purpose.

**b) Goals Supported and Advanced by Project.**

In terms of the overall Goals Proposed for the Floodplain Management Plan, this project relates to the goals of reducing vulnerability to flooding hazards and to the goal of reducing the number of repetitive loss properties.

In terms of the proposed “Working Goals” this project responds directly to the shorter and longer term goals involving mitigation of major rainstorms of a “...greater than 25 year recurring frequency...” in the shorter term and “...greater than 100 year recurring frequency...” in the longer term.

**c) Execution Responsibility and Direction.**

The direction and responsibility for the execution of this project will be the Village Manager. The first stage of the work is expected to be out-sourced to an engineering firm experienced in stormwater management facilities, including sewers and related public improvements.

The second stage would continue this arrangement, adding the services of a contract manager to oversee and coordinate the work of the engineers.

The third stage will require the services of a full-time construction manager to supervise, on a daily basis, the work of a competitively selected contractor.

Throughout this process, the CRS Coordinator or another individual designated by the Village Manager, will be responsible to the Village Manager for the day-to-day management of project activities.

**d) Timeline and Work Program.**

The first stage of this project has been preliminarily scheduled to start during the fourth quarter of 1998. This would allow sufficient time to include the project within currently scheduled grant program cycles, while still permitting the completion of this first stage before the end of 1999. Stage II would be initiated at the beginning of 2000 and construction work should get underway before the end of 2000.

**e) Support Framework.**

The support framework for this project exists by virtue of the fact that Stages I and II of the project essentially extend of the 1993 stormwater master plan prepared by Williams, Hatfield and Stoner, Inc. to reflect the post-construction impact of the new storm drainage system.

This support framework, in other words, includes the data base from the 1993 master plan, the performance records of the system as it currently exists and major additional data sources available through the South Florida Water Management District, the National Oceanic and Atmospheric Administration (NOAA).

Additionally, the help of entities such as the State Department of Environmental Protection (DEP), the State Department of Community Affairs (DCA) and the County's Department of Environmental Resource Management (DERM) will be enlisted, among others, in connection with the performance of the work under this project.

**f) Budget and Financing.**

In view of the fact that Stages II and III must be based on the Stage I findings, budget and financing considerations for this project, are addressed in this Action Plan only in terms of the Stage I work.

This work, given the large volume of available material may not require more than about \$30,000 which may be secured from State or other community grant sources which tend to become available to municipalities periodically.

Similar sources may be available for the Stage II work. With respect to Stage III, which will clearly involve much larger expenditures, mostly of capital nature, the availability of State or FEMA Hazard Mitigation Grant (HMG) will be researched, including the possibility of coupling such grants with local, enterprise fund-based forms of financing. (i.e. the stormwater utility).

### **3. Earth Shaping Master Plan.**

#### **a) Description of the Project.**

This project relates to the management of stormwaters, guiding runoff into the storm sewers and away from otherwise flood prone properties. By manipulating the Key Biscayne topography, particularly in areas where surface drainage is a problem this project will significantly enhance the effectiveness of the storm sewer system and act as an important flood proofing element for individual properties by helping to ward floodwaters away from buildings.

As was indicated in the analysis of the Village flood hazards in Section V of this Report, "...the progression of development on the island has created depressional areas which tend to collect water during storm ... Most of the repetitive loss properties are located in the vicinity of these low points."

As part of the official "Stormwater Management" and "Flood Proofing" Activities in the Floodplain Management Plan, this project would include the design (on a drainage basin by drainage basin basis) of a network of retention or detention basins, swales and topographical changes, all defined within

the framework of a landscaping Master Plan, to be implemented and constructed incrementally as public incentives, public and private resources become available.

**b) Goals Supported and Advanced by this Project.**

In terms of the Floodplain Management Plan overall goals, this project supports the following goals:

- Mitigation of the extent and severity of problems created by major rainfalls, hurricanes and related severe weather events;
- Prevention of additions to, and reductions from, the list of repetitive loss properties on Key Biscayne;
- Improvement of Key Biscayne's standing in the Community Rating System.

In terms of "Working Goals", this project relates directly and specifically to Goal 3: "Topography" where the working goal is "...(1) to reduce the low points of Key Biscayne's topography in each of the drainage basins in order to encourage the flow of stormwater away from structures and toward streets where storm drainage system facilities are concentrated; and, (2) to eliminate or modify surfaces that would otherwise drain toward these low points.

The statement of "Working Goal 3" goes on to point out that:

- "... in the short run, the goal is to address, on a priority basis, the topography of those drainage basins containing the most vulnerable properties, including the greatest number of repetitive loss properties i.e. Drainage Basins: 3,9 and E (in the Stormwater Master Plan), which contain about 80% (25 of 32) of the repetitive loss properties."... and,

- "... in the longer run, the goal is to address the remaining drainage basins and seek modifications of the topography of Key Biscayne, within manageable parameters, with the intent of eliminating, insofar as possible, features which impede the proper flow, channelization and absorption of storm water in ALL parts of the island."

**c) Execution Responsibility and Direction.**

During the launching and early design stages of the project, execution responsibility and direction will be concentrated in the office of the Village Manager.

Once the project is defined at a "conceptual" level of detail, the Village Manager, drawing on a pre-selected pool of technical and engineering support, will select one or more multi-disciplinary team(s) involving civil engineering, architectural, landscape design and legal skills to perform all pre-construction activities.

These teams would be operating under the supervision of a qualified Project Manager specifically appointed for this purpose by the Village Manager.

After completion of plans, the project manager will be responsible for all arrangements related to the construction of project components.

**d) Timeline and Work Program.**

The project is contemplated for execution in four stages:

- The first stage involves the preparation of a preliminary project scope and design at a conceptual level of detail. This stage of the project will involve, among other tasks:

- (1) a breakdown of the project into manageable sub-projects, based on drainage basin characteristics, degree of vulnerability to flooding, special opportunities that may exist etc;
  - (2) selection of Immediate Priority Projects and discussion of conceptual proposals with residents in the drainage basins where these projects are located;
  - (3) the preparation of a financing plan, including "parameter" cost estimates and funding source identification;
  - (4) development schedule and staging plan;
  - (5) preparation of interim activity program for the longer terms elements of the project.
- The second stage is essentially the pre-construction stage involving such tasks as the design of Immediate Priority projects and the preparation of plans, specifications, engineering and permitting work for these Projects, as well as the formalization of the financing.
  - The third stage involves project construction activities, which may, in turn, require sub-stages, depending upon program and coordination issue that may be encountered during the pre-construction stage.
  - The fourth stage involves the implementation of an action program for the longer term elements of the project, enabling the Village to take advantage of opportunities as they may occur.

In terms of timeline, Stage 1 will require about 6 months to execute beginning during the first quarter of 1999 and ending by year end. Stage 2 is assumed to require 9 months, suggesting a construction start early in 2001. Completion of

the higher priority projects can thus be expected during 2002. It is expected that by that time, depending on the experience and funding availability, a start of at least one longer term element of the project will be underway.

**e) Support Framework.**

Since the Village of Key Biscayne was created, approximately 5 years ago, it has demonstrated a remarkable capacity for undertaking a wide range of public improvements, including among others: a major central park ("The Village Green") new street lights, a new storm sewer system, new sidewalks and "Traffic Calming" improvements. A sanitary sewer system for a limited number properties not served by a public sewer today is also under consideration and a new Village Hall is under discussion.

This intensive level of activity has served to prepare the Village to plan, design and undertake the kind of development activity suggested by this type of project. Basically the execution machinery is in place and can be placed in motion as soon as financing becomes available for an initial element of the project.

**f) Budget and Financing.**

Based on an approximation of labor and material for comparable projects, involving substantial earthmoving, a parameter estimate of \$ 600,000 has been estimated as a safe budget number for a typical drainage area.

Translated to the 10 drainage areas analyzed in the Stormwater Master Plan, therefore suggests a budget magnitude of about \$6 Million for the entire island and about \$1,800,000 for the three drainage areas to be treated on a high priority basis. To the extent that some of these costs involve private landscaping and related projects, the possibility of a cost sharing program with directly affected property owners

whose properties would be enhanced as a result of the improvements, should not be overlooked.

Therefore, assuming an 80% public cost basis to be expended over a ten year period, suggest a net cost of about \$500,000 per drainage basin, which would have to be secured from such sources as Hazard Mitigation Grant Programs, usually funded through a combination of State and Federal (FEMA) moneys.