Doing More by Doing Less

A High Value Action Plan for Implementing Sustainable Flood Control

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May 3, 2006

Field Projects Draft Report • Department of Urban and Environmental Policy and Planning • Tufts University
Prepared for The Nature Conservancy • Project Liaison: Mark P. Smith
About the Project

BACKGROUND

Development decisions that put people in harm’s way of natural flooding disasters are also often responsible for destruction of our nation’s most ecologically rich habitat zones. Observing the nexus between habitat preservation and flood control, The Nature Conservancy (TNC) sought an analysis of federal flood control and mitigation policy. TNC proposed the project to assess how flood damage reduction focused on public safety could also promote their organizational mission.

The student team from the Urban and Environmental Policy and Planning program at Tufts University agreed to deliver a research report that would analyze existing policies and identify opportunities for TNC to influence reform.

Several key questions guided the research:

- What opportunities has Hurricane Katrina and the resulting devastation of New Orleans and the Gulf Coast provided for building political coalitions or reforming federal policies that would reduce vulnerability to floods while promoting habitat protection and restoration?
- What role can TNC play in the public deliberation over the rebuilding process, that would promote relevant objectives, such as protecting from development or moving development away from the most high-value, flood-prone coastal and river conservation areas?
- What role can improved planning (at the federal, regional and/or local level) play in pre-disaster mitigation, post-disaster recovery and routine development/zoning decisions to enhance public safety, prevent repetitive loss and preserve critical habitat?
- How can TNC identify the flood-prone regions that should be highest priority for its preservation/restoration efforts?

The goal of the project is to recommend actions for TNC in the development of improved flood control and mitigation policy at all levels of government and to highlight areas for targeted, high-value actions to serve as examples of best practices.
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Acknowledgments

The team would like to thank the dedicated staff of TNC, Nancy DeLamar, Erikkka Feller, Ted Illston, Kim Lutz, Sarah Newkirk, and Jeff Opperman. We’d like to especially thank Mark P. Smith, our client contact at TNC, for his advice and guidance throughout the project. Thanks to our Field Projects instructors, Rusty Russell and Molly Mead, as well as Sarah Reich and Audra Vernon, Field Projects Teaching Assistants.
Abstract


Development decisions that put people in harm’s way of natural flooding disasters are also often responsible for destruction of our nation’s most ecologically rich habitat zones. This report provides an analysis of current federal flood control policy, focusing on three integral programs: the National Flood Insurance Program, Hazard Mitigation Grant Program and the U.S. Army Corps of Engineers. At the conclusion of this analysis, the report recommends actions for The Nature Conservancy (TNC), to affect federal policies in order to enhance hazard mitigation and public safety, while also promoting its mission of preserving “high value” habitat. The report recommends improved coordination between the disparate agencies that administer flood control as well as improved integration of flood mitigation tools for land use planning at the regional and local level. Use of “non-structural” flood control techniques can often support flood mitigation by setting aside coastal wetlands and functioning floodplains as flood buffer zones, which also have multiple use values for recreation, open space and ecosystem services. The report recommends that TNC support restoration of the Water Resources Council at the federal level, as well as implementation of High Value Action Plans for flood mitigation and habitat preservation with regional and local partners.
# Table of Contents

Executive Summary 1  
Introduction 4  
Political Landscape 5  

Section I: National Flood Insurance Program - FEMA  
Why Examine NFIP? 7  
History of NFIP 8  
Failed Past. Promising Future? 10  
Making the Case 14  

Section II: Disaster Mitigation Program - FEMA  
Why Examine the Disaster Mitigation Programs? 16  
Explanation 16  
Analysis 19  
How and where can TNC be involved? 24  

Section III: U. S. Army Corps of Engineers  
The Corps’ Role 26  
Structural Versus Non-Structural Flood Control 28  
Making the Case for Corps Reform 36  

Conclusion 39  
Citation 42  
Bibliography 46
Appendix

1. Dauphin Island Case Study I
2. Willamette River Case Study III
3. Valmeyer, Illinois Case Study V
4. Mississippi River Case Study VIII
5. Charles River Case Study X
6. Fire Island Case Study XII
7. Table 1. Flood and stormwater storage location choices, benefits, and costs XIV
8. Excerpts from the Intergovernmental Panel on Climate Change—Special Report on The Regional Impacts of Climate Change: An Assessment of Vulnerability XV

Attachement

1. IRB XVII
2. MOU XVIII
The August 2005 flooding of New Orleans caused by Hurricane Katrina, raised public awareness about the catastrophic damages to human life, property and ecosystems that can result from the flooding of a major U.S. city. As activity to relieve human suffering from the disaster shifts to decision-making about the rebuilding of the Gulf Coast, a window of opportunity has opened to reevaluate the policies that affect the nation’s vulnerability to flooding.

The Nature Conservancy (TNC), a respected international environmental organization, has a unique opportunity to add its voice to the national debate about how best to avoid excessive flood-related damages. Simultaneously, TNC has a chance to further its mission to protect diverse ecosystems by supporting reform of flood management policy and taking targeted actions. The long-range survival of functioning ecosystems depends on the high river flows and coastal processes that people try to prevent in order to protect the homes, farms and businesses they have located in these vulnerable, hazard-prone areas.

Growing public concern about the effects of climate change provides added impetus for policymakers to analyze national flood management policy—sooner rather than later. According to the Intergovernmental Panel on Climate Change, rising sea level would provide a higher base for storm surges and increase the size of the “100-year floodplain” in the U.S.\(^1\) Increased frequency of more powerful storms and hurricanes may also result, exacerbating flood damages.\(^2\) With about half of the U.S. population living within 50 miles of the coast or Great Lakes, and more expected to move to this zone,\(^3\) rising sea level and related coastal erosion and flooding is likely to be an ongoing policy challenge in the decades ahead.

This report was produced by a team of four master’s students enrolled in a Field Projects: Planning and Practice course offered in the Department of Urban & Environmental Policy & Planning at Tufts University. The goal of the project was to provide an analysis of current federal policies encompassing flood control and mitigation, focusing on the National Flood Insurance Program, Hazard Mitigation Grant Program and the U.S. Army Corps of Engineers, and to outline opportunities for TNC to affect these policies in order to enhance hazard mitigation, promote environmental protection and ensure public safety.

The team has reached the following conclusions about the status of current policy:

- The U.S. federal government lacks a coherent, coordinated federal flood control and mitigation policy. Many agencies touch small pieces of the issue, but no single government body controls or administers all programs aimed at reducing flood risk. While piecemeal approaches can sometimes result in checks and balances between agencies, as a rule, we did not find that to
be so in this case. Rather, the result is a haphazard approach to flood control and mitigation, characterized by silo-thinking and bureaucracy, obstruction to reform and improvements, and challenges to local partners as they pursue projects and regional solutions to flood risk.

- **There exists a dangerous lack of integration between all levels of government efforts to control floods and reduce damages.** Of specific concern is the fact that federal agencies deal with flood control, insurance and mitigation, while local governments control almost all land use regulations, aspects of floodplain management, and other important development decisions. Such division can lead to clashing missions and goals and difficulty in coordinating policy.

- **As it is currently constituted, federal flood control policies and programs create a “moral hazard,” by promoting behavior that otherwise would be economically infeasible.** Current policies fail to promote wise use of floodplains and natural resources by providing incentives, rather than disincentives, for people to live and build in hazard-prone areas. Not only does this degrade these fragile environments, but it also places citizens at far greater risk than they normally would be.

- **Federal flood control agencies have been reluctant to fully integrate the best available science into policy decisions.** By failing to integrate current scientific understanding of natural hydrologic, geologic and coastal processes into floodplain and coastal management practices, policy makers have missed opportunities to protect the public and the environment, while saving scarce federal resources.

The team recommends a three-tier strategy that TNC can use to contribute to flood policy reform:

- Lobby for change through the legislative process;
- Pursue economic and land use planning tools and techniques that promote wise development;
- Collaborate with other organizations that may have different missions, but share common objectives with TNC.

These strategies will be spelled out in detail in the Recommendations section of each agency chapter. The report Conclusion also details the team’s main recommendation for TNC. The group recommends that TNC develop and implement a High Value Action Plan for the conservation of important ecosystems and the enhancement of public safety. The key elements of this proposal include:

- Integrating FEMA floodplain and coastal erosion-rate maps with TNC’s maps, used in the Conservation by Design program, to prioritize conservation of high-value habitat that would also reduce flood damages to the human built environment. The overlay of these maps would assist TNC in identifying potential areas for habitat conservation or restoration in regions that experience repetitive losses or high flood damages.
- TNC’s “High Value Action Plan” partnerships with local governments and stakeholders would promote better land use planning in floodplains and in coastal regions. Once appropriate areas
are identified, TNC’s role would be to facilitate preservation of habitat areas through land acquisition or conservation tools while collaborating with agencies receiving federal Pre-Disaster Mitigation funds.

Past disasters have contributed to the ongoing evolution of national flood control and mitigation policy. The objectives have changed from a traditional focus solely on structural approaches—building of dams, dikes and levees to contain rivers, or groins and coastal barriers to absorb wave energy and dissipate the effects of erosion—to more balanced, integrated projects that incorporate both structural and non-structural techniques. Non-structural flood control is broadly defined to include everything from public education and flood proofing of existing buildings, to buyouts of flood-prone property and wetland ecosystem restoration.

A major step in the process of building public support for nonstructural solutions to flood control is widespread acceptance that shoreline retreat is necessary. By periodically allowing nature to reclaim areas instead of fighting various natural processes, we recognize the limitations of engineered solutions. Retreat from the riverbank and shore, to create a buffer zone where natural functions are given primacy, requires recognition of the economic value of undeveloped areas.

Emerging flood policies have begun to value the natural functions of ecosystems. By absorbing unusually high river flows and coastal storm surge, these environments provide invaluable services. TNC’s work to “preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive,” are best fostered by encouraging the widespread adoption of these largely nonstructural policies. It is imperative that TNC act to take advantage of the current public consciousness about the Gulf Coast experience that is already fading with the passage of time and the onset of other national priorities.
Introduction

Government and public interest in flood control methods can be traced back to the mid 19th century. The damage caused by floods, be it to life, agricultural crops, or other property, has led governments to take a variety of actions to lessen the toll floods exact on populations. This report examines several of the most important policies, programs, and agencies of the United States federal government charged with carrying out federal flood control policy.

In the pages to follow, we seek to determine what the effect of specific programs and policies has been. Whether the program or policy is determined to have been successful or not, this report will analyze its effects and suggest recommendations for reform, improvement, or replication of practices. The lessons learned in this report are not exhaustive; rather, they provide a selective look into the state of our nation’s flood control efforts. In light of the horrific aftermath of Hurricane Katrina, and to a lesser extent Rita and Wilma, the importance of developing a coherent, effective, and efficient federal flood control policy could not be more obvious.

The majority of the report will focus on the flood control efforts of FEMA’s National Flood Insurance Program (NFIP), Hazard Mitigation Grants Program (HMGP) and the United States Army Corps of Engineers. Explanation of the programs and agencies’ stated goals and intentions will be followed by analysis of those goals, and to what degree they have or have not been achieved. At the conclusion of each section’s analysis, recommendations for TNC action regarding specific programs, policies, or the agency as a whole will be offered.

Our analysis is supplemented throughout the report by case studies from various regions throughout the nation. To the highest degree possible, case studies from different regions facing different flood control challenges have been chosen, so as to highlight the variety of issues facing federal, state, and local policymakers. These case studies are meant to serve a twofold purpose: (1) they show the consequences of federal flood control policy for patterns of human development and (2) they show how creative action, leadership, and collaboration can rectify some, if not all, of the shortcomings in current federal policy.

In sum, this report shows how federal flood control policy, especially in the past 40 years, has relied altogether too heavily on structural means for flood control. Federal flood control, prevention and mitigation programs have, at best, done little to protect, and at worst, exacerbated the destruction of scarce natural resources and fragile ecosystems. In so doing, they have incentivized unsafe development and threatened public safety, while sacrificing environmental protection.

Working with federal, state, regional, and local actors, TNC is in a prime position to effect change and reform of the nation’s flood control policy. Doing so will require a keen understanding of the political climate, largely shaped by Hurricane Katrina, and the many obstacles to developing a federal flood control policy that values the environment and public safety, instead of assuming that the two are mutually exclusive.
The silver lining of Hurricane Katrina’s dark cloud is the opportunity that emerged to reform federal flood control policy. Accompanying this opportunity is widespread desire for in-depth analysis of how a disaster that was so widely predicted could cause such staggering damage and destruction. As TNC and the Audubon Society concluded in their statement on post-Katrina recovery efforts,

While damage from Hurricanes Katrina and Rita would have been significant in any case, that damage and loss of life were intensified by historic loss of coastal wetlands, barrier islands, and oyster reefs. Now communities and the regional economy are even more exposed to the impacts of future hurricanes.5

While Katrina’s disaster has presented policymakers and advocates with a historic opportunity, it will not last forever. Coastal research experts Young and Pilkey have detailed the various constituencies vying to dominate the federal response debate and discussion. They include, but are not limited to:

- **Federal, state and local elected officials** who see a politically expedient opportunity to advocate for increased federal aid and who, without the best science available, believe their only choice is to rebuild in the previous footprint. Not all officials fall into this category, but they do constitute a majority.
- **Renourishment/Replenishment advocates**—namely, National Beach and Shore Preservation Association (NSBPA) and others who claim that beach renourishment and other physical solutions, funded by the federal government, are the only answer to prevent loss of life and property on the scale of that seen in the 2005 Hurricane season.

- **Shoreline retreat advocates** including Young and Pilkey, many traditional environmentalists, and limited government conservatives who argue that federal programs and policies, or inaction, have created the conditions that allow storms like Katrina, Rita, Camille and others to wreak havoc on shoreline communities. Only through a targeted, planned retreat could the footprint of these communities be reset.6

While the merits of each group can be argued, the events of Hurricane Katrina, growing scientific evidence of prolonged and more destructive hurricane seasons due to global warming, and political expedience now make reform of federal flood control policy a necessity. The TNC/Audubon joint statement sets the proper tone for these efforts, stating that it should be the goal of the federal government to “put in place the foundation for the long-term restoration of the natural assets that can be the foundation for a safe and sustainable future.”7 This principle should serve as the focal point for coalition building around reform.

With its long history of commitment to sound science, nonpartisanship, and creativity, TNC is in a unique position to drive debate on flood control reform. Among those who fall into the groups mentioned previously, TNC can serve as a balance to ideological poles. Bringing together limited government conservatives, such as the National Taxpayers Union, American Taxpayers for Commonsense, and others, who see the NFIP as a give away and the work of FEMA and USACE as “pork barrel” spending, and socially conscious environmental groups, TNC can help shape a more sound federal flood control policy in the 21st century.
Perhaps more importantly though, TNC’s focus on high value areas and ecoregional planning, which often stretches across political boundaries, brings perspective to the flood control policy debate. TNC’s 5-S Planning approach (systems, stresses, sources of stress, strategies, and success measures) is an example of the comprehensive, systems-based, scientifically supported approach to planning and conservation that can garner wide and deep support in the effort to promote public safety and environmental protection. This approach, along with other TNC strategies, can serve as models for regions and other actors with similar concerns about the intersection of development and flood control.

A possible first step in taking a leadership role is addressing and acknowledging the major legislative proposals affecting flood control policy. Senators McCain and Feingold have introduced the “Water Resources and Planning Modernization Act of 2006” (S. 2288), which builds off of similar legislative proposals made in 107th, 108th and 109th Congresses. Thus far, the proposal has received widespread support from the environmental community (American Rivers, National Wildlife Federation, Sierra Club, etc.) and conservatives. Further analysis will be given to this proposal in the Army Corps section of the report, but acting and addressing thoughtful proposals, such as the McCain-Feingold, is an important first step to establishing the leadership role TNC is primed to play. Additionally, TNC, if it chooses to take this path, will want to address current efforts to reauthorize the Water Resources Development Act (WRDA) and proposals to create a Shoreline Retreat Advisory Commission (ShRAC), as advanced by the aforementioned Dr. Young. Within these proposals, TNC should specifically seek to integrate the 5-S planning approach into the federal water resource management and planning process. Further discussion of how TNC chooses to act and what it should advocate for will be covered in the pages to follow.

It is our belief, that the current political landscape is prime for TNC to take a leadership role in the reform of federal flood control policy. The lessons and images of Hurricane Katrina have created a national consensus for action and now that consensus is seeking direction. Thanks to its history of thoughtful analysis, creativity, and pragmatism, TNC is in a unique position to bring together constituencies of varying ideological persuasions in support of meaningful change.
Section 1
National Flood Insurance Program - FEMA

Why Examine NFIP?

FEMA is slated to make nearly $23 billion in flood insurance payments on damage claims from Hurricanes Katrina, Rita and Wilma alone. This staggering sum is more than all other payments made since the National Flood Insurance Act was signed into law in 1968, paving the way for the creation of the National Flood Insurance Program. While the payments made because of destruction done by these storms may be disproportionately large, it is quite clear that the trend in NFIP payments per year is an upward one. This trend is not a new revelation. The Government Accounting Office (GAO) has documented NFIP’s unstable financial footing eighteen times in the past 25 years. Congress has attempted major reforms or revisions of NFIP in the past, with varying degrees of success and all leaving the same lingering problems.

As such, NFIP has failed to achieve its stated objective to “reduce future flood losses through hazard identification, floodplain management (i.e. land use controls, building codes, local ordinances, etc.), and insurance protection.” At the same time, NFIP has failed to promote sustainable development of the most ecologically rich and diverse lands in the United States – our floodplains and wetlands. Instead, it has promoted and enabled unwise land use, risking public safety and destroying vital natural resources.

NFIP’s fiscal standing and its ability to achieve stated goals are directly related. Through subsidized insurance, based more on politics than on actual risk of floods, the program has created what economists refer to as a moral hazard. In other words, NFIP, instead of highlighting the risk of developing in these areas, has removed the risk from floodplain, wetland, and coastal development. Developers, landowners, cities and towns do not see NFIP payments as recognition that they are building in dangerous areas; rather they see the payments as a nuisance that assures them of complete compensation should the “100-year storm” strike.
Unlike nearly any other federal flood control policy or program, NFIP offers stakeholders an incredible opportunity to show the public the true cost of unwise development and management of floodplains, wetlands, and coastal regions. While in its current form NFIP buffers the public from the long-term cost of developing in flood-prone regions, with several key reforms the program could be altered to more accurately portray just what we, as a nation, lose when our wetlands erode and our floodplains and coastal regions become overdeveloped. However, before discussing the options for reform that are available, it is informative to examine the history of NFIP to develop complete understanding of the challenges faced in any attempt at reform.

**History of NFIP**

In response to flooding throughout the Midwest in the late 1940s, President Harry S. Truman requested appropriations for a national system of flood insurance in 1951. Congress did not act on President Truman’s request and it was not until 1956 that the Congress passed the Federal Flood Insurance Act of 1956, which established a pilot program for flood insurance to be administered by the Housing and Home Finance Agency. Despite authorizing federal flood insurance, Congress failed to ever appropriate funds to operate the program. It was not until a series of natural disasters in the mid-1960s that increased national interest in disaster relief reignited the debate over the feasibility of flood insurance.

The feasibility of federal flood insurance was a focal point of two federal studies released between 1965-1966. The most notable was the work of a special task force appointed by President Johnson, whose recommendations were submitted on August 10, 1966. Entitled, *A Report by the Task Force on Federal Flood Control Policy: A Unified National Program for Managing Flood Losses*, the report provided the rationale for flood insurance, warnings about mismanagement of the policy, and principles for successful federal flood control and floodplain management policies. The Task Force’s recommendation for a program of federal flood insurance was the most specific of its five findings, the rest of which focused on public education about the natural functions of floodplains and the coordination of floodplain development.

Perhaps most presciently, the Task Force stated, “Flood insurance is a tool that should be used expertly or not at all. Correctly applied it could promote the wise use of floodplains. Incorrectly applied, it could exacerbate the whole problem of flood losses.” Codified and authorized by the National Flood Insurance Act of 1968, the NFIP was established in the hopes that a “comprehensive risk management program (would):

1. reduce suffering and economic losses due to floods through the purchase of insurance,
2. promote state and local land use control to guide development away from flood-prone areas; and
3. reduce federal expenditures for disaster assistance and flood control.”

Unfortunately, this has not been the case. Suffering and economic losses due to flooding have persisted and grown, state and local land use control has not been guided away from flood areas, and federal expenditures for disaster assistance have grown enormously.

NFIP’s troubled past cannot be attributed to a lack of Congressional interest in reforming or reworking the program. Major revisions have been made to NFIP in 1973, 1977, 1994, in the wake of intense flooding in the Midwest, and in 2004, following what is now the second most damaging hurricane season in the history of the United States. Each of these overhauls has sought to address major recurring shortcomings in the program:
Repetitive Loss Properties (RLPs) – properties that sustain more than $1,000 in damage twice in a ten-year period. RLPs account for a total of 1% of policies nationwide, but 30% of amounts paid in claims. Between 1974 and March 2004, RLPs cost NFIP roughly $3 billion.16

Loose enforcement of local land use regulations - NFIP’s requirement that localities participating in the program adopt certain minimum land use regulations has been fought consistently by elected officials. J. Robert Hunter, former NFIP Administrator, cited pressures from Congress to not enforce minimal requirements or regulations, when setting insurance rates in testimony before the Senate Committee on Banking, Housing and Urban Affairs.17

Inability of program to be self sustaining – mandatory purchase requirement has either been ignored or has not been enforced with enough vigor. By failing to ensure that all who are at risk of flooding purchase insurance, the program fails to educate the public of the relative risks of flood damage and fails to engender an atmosphere of shared costs and sacrifice.

Dauphin Island Case Study

Dauphin Island is a barrier island in the Gulf of Mexico located a few miles off the Alabama coastline, 33 miles from Mobile and 130 miles east of New Orleans, LA. Approximately 14 miles long by 1.5 miles at its widest, Dauphin Island was used primarily as a port beginning in 1699. As time has passed this once pristine and deserted island has become a growing resort area with more than 1,500 homes stretched across its narrow landscape. During the 1980’s, Dauphin Island was identified as one of the US’s fastest growing communities, driven by an explosive demand for waterfront property. During the summer, the year-round populations of nearly 2,000 swells by more than 15,000 as visitors seek to enjoy the natural beauty of the island.

This growth has occurred despite the undeniable fact, that “Dauphin Island is one of the most vulnerable barrier islands in the nation.” Since 1979, the island has been hit severely by six hurricanes, causing repeated and severe damage to property and infrastructure. Nearly 500 homes have been lost and many more required extensive repairs in the aftermath of each storm. With hurricanes posing such a risk, it would seem remarkable that anyone would want to build on such a precarious piece of land.

The lack of reluctance is in large part due to the fact, that during the same period of time, homeowners have received more than $21 million to rebuild, courtesy of FEMA’s National Flood Insurance Program (NFIP). This program provides protection for property owners in flood-prone areas, such as Dauphin Island, and allows them to redevelop following devastating storms. In the wake of Katrina, which completely destroyed 300 homes, the long term sustainability of the island comes into question. In fact, according to Duke University coastal geologist Orrin H. Pilkey, http://cb4go.com/BeachTops/BeachesAlabamaDauphinIsland.htm

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“If there were ever a poster child for a barrier island that shouldn’t have been developed, it’s Dauphin Island.”

The very existence of Dauphin Island residences would not be possible without federal funding. In 1979 Hurricane Frederick destroyed the bridge from the mainland to the island. With federal funding, a new $38 million bridge to the island was built, along with $6.5 million in infrastructure improvements, totaling more than $90 million in current dollars. In conjunction with the tens of millions of dollars paid out through NFIP, the federal government has spent more than $100 million maintaining Dauphin Island during the last 25 years. Without this investment, much of the development on the island would not have occurred.

Dauphin Island’s continued reliance on federal funding places it in the middle of the growing debate surrounding at-risk coastal development following Katrina. At least 90% of the homes on the island are not full time residences, but vacation homes. Many homes are built upon pilings to account for the extremely low lying land and lack of protective sand dunes. Currently the beaches are an “apocalyptic scene of broken and vanished houses, downed power lines, flooded roads, buried cars and shallow quicksand.” The results of Katrina’s rampage will certainly add tens of millions to the federal tab.

Another large issue is that as a barrier island, Dauphin Island is extremely susceptible to erosion which can drastically change the makeup of the island. Experts contend that natural processes are contributing to a significant migration of the island to the north. Continued dredging of the nearby Mobile shipping channel has robbed the island of much needed sediment for its beaches. As a result, the island has become more susceptible to storms that will continue to erode sand starved beaches. Island residents have pushed the Corps to fund sand berms and beach nourishment programs, but according to Scott Douglas, a civil engineer, “Those FEMA berms have been called, correctly, ‘false hope for those who are beyond hope’. ” To illustrate his point, a $1.1 million FEMA sand berm constructed in 2005 vanished during Katrina.

The case of Dauphin Island is not an easy one, especially given the backdrop of Katrina. Is it practical to continue to invest and rebuild in an area where continued damage is inevitable? Identifying long term solutions that do not wash away in the next storm are necessary. In addition, both government officials and residents need to recognize that it is not cost effective to continue to build in some areas, nor is it sustainable. George Crozier, Director of the Dauphin Island Sea Lab research facility, makes an extremely relevant point that “The rush to rebuild is understandable. It’s basic human sympathy, but we have to build in a different way.”

Failed Past. Promising Future?

The goals of the National Flood Insurance Program, as stated by the President’s Task Force on Federal Flood Control Policy and the preamble of the National Flood Insurance Act of 1968, are lofty and far reaching, especially considering the federal government’s actual experience with flood insurance. The 40-year record of NFIP is one of unmet goals and continually lowered expectations. Analyzing NFIP shows that its many problems grow out of certain, shared, fundamental shortcomings in the program.
First, NFIP fails to meet its goals because it fails to follow general principles of insurance, specifically risk aversion and calculation. To qualify for flood insurance coverage, an individual must only live in a community which qualifies for flood insurance. Qualification is determined through FEMA’s flood mapping process. Unlike the practice in private insurance markets, the NFIP accepts all insurance applicants and is not selective in evaluating individual applicants for flood insurance coverage. There is not individual risk analysis to determine the likelihood of a future loss, and individual property loss experience is not used as a rating criterion.

The failure to perform individual risk analysis comes out of several different issues confronting NFIP. Primarily, the lack of analysis is due to the need for the program to increase its “market penetration.” In order to operate, or attempt to operate, in a self-sustaining manner, NFIP must increase the amount of premiums it sells each year. While market penetration in the early years of the program was somewhat successful, reaching nearly 2 million policies by the mid 1970s, penetration since, especially considering development patterns, has been much weaker.

Currently, there are about 5 million active NFIP policies. Most, but not all, of these policies are located within the 100-year floodplains. While one could surmise that this is not actually a lack of penetration, but rather a sign that the program is fostering wise use of floodplains, this is not the case. Of the 6.6 million buildings currently located in 100-year floodplains, more than 1/3 were built after NFIP maps and floodplain management regulations had been imposed. This poses a dual problem:

1. The 1/3 of structures built during the NFIP regime should not have been built. Their existence highlights the inability of NFIP to serve as a deterrent to unwise development.
2. The 2/3 of structures built prior to NFIP still fail to conform to codes and regulations, while accounting for mounting damage claims.

Additionally, the failure to perform individual risk analysis of NFIP-insured properties grows out of the federal-local relationship established by the National Flood Insurance Act of 1968. Communities that meet the minimum land use requirements established by NFIP are assured of coverage under NFIP. While this arrangement seems straightforward, the testimony of J. Robert Hunter, among others, shows that tension does persist. Although it may be impossible to remove politics from land use regulations, the federal government must continue to hold municipalities accountable in the face of increased flood damages.

A final example of NFIP’s failure to follow standard insurance practices is the continued existence of what are referred to as pre-FIRM (Flood Insurance Rate Maps) structures. Unlike all other NFIP-insured properties, pre-FIRM structures are insured at “subsidized rates” because they were constructed before their community adopted a FIRM or before NFIP began applying construction standards on December 31, 1974. Further, pre-FIRM structures are exempted from NFIP’s floodplain management requirements “unless they are substantially damaged or substantially improved, which triggers a requirement to rebuild to current construction and building code standards.” However, it is rare for these structures to be labeled “substantially damaged” from storms, as the power to label them as such is given to local officials who are loathe to see the owners forced to pay more than the full actuarial costs of their insurance.

The pre-FIRM dilemma is one that defies logic and reason. Subsidized rates for previously constructed homes and buildings made sense as a transition to more complete adoption of floodplain management regulations and requirements. Property owners, and especially homeowners, were treated fairly by the government, which wanted to avoid punishing them with a new regulation and policy that they could not have foreseen the creation of when purchas-
The federal government also acknowledged a desire to avoid punishing individuals who may not have fully understood the risks and costs of building in floodplains, wetlands, or coastal areas. It was thought that pre-FIRM structures would ultimately give way to substantial damage, leading to a true reflection of the cost of developments in environmentally sensitive, flood-prone areas. To some extent, this has been the case. According to FEMA, the subsidized rate for existing structures has dropped from 75 percent in 1978 to 28 percent in 2004.  

The second fundamental shortcoming of NFIP is the inability to enforce and promote effective floodplain management and land use regulation. The federal government itself has acknowledged the need for improved regulation of land use in flood-prone areas, by creating the Community Rating System (CRS). According to FEMA, CRS is “a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirement. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting three goals of the CRS: (1) reduce flood losses; (2) facilitate accurate insurance rating, and (3) promote awareness of flood insurance.” Such market-based incentive programs are innovative ways to spur improved floodplain management and land use regulation. However, these efforts are merely a start, as only 1,028 communities are participating in CRS, of the nearly 20,000 communities that participate in NFIP.

As mentioned before, of the 6.6 million buildings located on 100-year floodplains nationwide, more than 1/3 of those were constructed after NFIP came into being, and therefore, were not “grandfathered” into the program. The inability of NFIP to halt unwise development of floodplains, wetlands, and coastal areas is a fundamental shortcoming with enormous ramifications. Policymakers, regulators, and administrators have attempted to address this shortcoming in a variety of ways. One of the most common solutions is to expand the universe of insured properties. Proposals along these lines assume that increased market penetration will further public understanding of risk and decrease development in floodplains. Based on the track record of these proposals, it would seem that they serve to increase the universe of policyholders, alleviate some of the financial burden that NFIP is carrying, but fail to highlight the risk that individuals and communities face. Failure in this final aspect leaves federal floodplain management efforts in a sorry state.

Serving as the leader in a nationwide effort to reduce flood damages, NFIP is charged not only
with protecting life and property, but also with protecting the “natural and beneficial functions of floodplains.” NFIP attempts to accomplish this goal by establishing a set of floodplain management criteria that are then adopted by participating communities through local ordinances and applied within the special flood hazard areas (SFHAs). Technical assistance is provided by the federal government to state and local governments. Trade associations, such as the Association of State Floodplain Managers (ASFPM), and regional advocacy groups, such as the Coastal States Organization, also play an important role in assisting communities in developing appropriate requirements, regulations and ordinances.

While NFIP “has implemented a number of tools and oversight systems to monitor and evaluate the quality of floodplain enforcement at the local community level” it has also consistently deferred to the local officials to make final determinations about particular land use regulations. This deferential stance has effectively stripped NFIP of its enforcement power. ASFPM went even further in their National Flood Programs in Review – 2000, claiming that “NFIP regulations essentially inform the nation where and how to build in a floodplain.” This critique speaks to yet another reason why NFIP has failed in its nationwide effort to reduce flood losses and slow, if not entirely halt, development of floodplains. In its initial formulation, NFIP was forced to determine what would serve as the base flood elevation (BFE), in order to set an insurance rate structure. The 100-year flood was selected. This selection doomed the program from the start, as “records show that 61 percent of flood losses are associated with catastrophic floods greater than the 100-year flood.” Establishing the 100-year flood as the BFE sent a message to local officials and residents that development outside the 100-year floodplain was safe and sound. This created dense development on the fringe of the 100-year floodplain. Development in this fringe is highly susceptible to catastrophic (i.e. beyond the 100-year floodplain) flooding and the damage done in these areas is generally even greater than that done in the floodplain, as the same regulations and management requirements do not apply to land uses in the fringe.

A final fundamental shortcoming of NFIP is its failure to educate and inform the public of the long-term benefits of floodplain management, hazard mitigation, and land use planning. As the lead agency for hazard mitigation, FEMA is responsible for informing the public of all options and tools at its disposal to reduce the risk of all disasters, but especially natural disasters. The images from the Gulf Coast reminded all Americans, and no doubt individuals and leaders throughout the world, of the damage that natural disasters can cause if nations, regions, and communities fail to understand the long-term effects of their development patterns and choices.

FEMA, and specifically NFIP, is in a position to educate and inform the public of the need for wise use of floodplains, their natural functions, and how these functions are an asset in planning for natural disasters. Hurricane Katrina, and to a lesser extent Rita, reopened the eyes of the American public to the need for a more effec-
tive, efficient, and equitable manner of mitigating disasters and hazards. With the proper leadership, dedicated coalition partners, and a renewed mission, NFIP could promote new development patterns that halt the destruction of floodplains and restore them to their natural state, while protecting the life and property of residents of these regions.

Making the Case

Surveying the many challenges facing the environment today, it might be easy for TNC to leave the workings of NFIP to another organization. However, failing to address NFIP would leave a gaping hole in TNC’s efforts to preserve ecologically important lands throughout the United States.

As we have argued, NFIP is the program that enables unwise use of floodplains and overdevelopment of wetlands and coastal areas. Whether it is through public perception that flood insurance is a safety net, and not a sign of risk, or by creating a moral hazard, through which the repercussions of communities’ development decisions are not directly born, NFIP has become a program that exacerbates the degradation of valuable natural resources, instead of promoting their sustainable use. In so doing, NFIP puts the lives and property of millions at risk, while eliminating essential pieces of the natural ecosystem whose natural function it is to mitigate flooding. Any effort to reform or recalibrate our nation’s federal flood control policy from one based on structurally engineered solutions to one based on nonstructural, natural solutions must deal actively to address NFIP. Failure to do so will leave any action plan incomplete and will allow communities and individuals to recreate the dangerous and counterproductive growth patterns of the past century.

Hurricane Katrina brought with it many horrible consequences; entire communities and regions were wiped out, families were torn apart, and important ecosystems were degraded beyond repair. And while Katrina will be remembered in the short run for the destruction it caused, with the proper actions, TNC can help assure that in the long run Katrina is remembered as the storm that led the United States to rethink its flood control policy, reset its footprint in floodplains, wetlands and coastal areas, and develop new, cost-effective, sustainable requirements for the management of flood-prone areas. Thus, if the initial question for TNC is, “why should we care about NFIP?” the follow up to that question is, “if NFIP is so important, what should TNC do to reform it?”

TNC can take immediate action to help reform NFIP to more accurately reflect the risks of unwise floodplain development and use, while highlighting the natural beneficial functions of floodplains, wetlands, and barrier islands/coastal areas.

(1) Enter into a MOU or working agreement with FEMA on efforts to mitigate RLPs affected by Hurricane Katrina on an ecoregional landscape scale. It is estimated that some 4,900 RLPs were
significantly damaged by Hurricane Katrina. While this compromises only 10% of the entire RLP universe, their symbolic significance is far greater. As highlighted in the discussion on FEMA’s mitigation grant programs, pilot programs and targeted efforts have been made in the past, specifically in the Flood Insurance Reform Act (FIRA) of 2004, to address these properties, mainly because of the financial burden they place on NFIP. TNC should enter into an agreement with FEMA where the Conservancy examines the ecoregions and landscapes of clustered RLPs and implements single area strategies based on the 5-S planning approach to promote conservation, public safety, and natural flood mitigation. Working with FEMA in a high-profile area will help TNC promote other such efforts throughout the country and serve as an example for possible increased Congressional support of such efforts or pilot programs in the future.

(2) Advocate for the inclusion of a sustainability component in NFIP’s Community Rating System (CRS) and make the CRS mandatory for all NFIP participants. CRS is currently voluntary, with only 1,028 NFIP communities (5% of all communities) participating. Those who do participate are provided with credits which reduce their insurance premiums based on activities which “reduce flood losses … and promote the awareness of flood insurance.”

(3) Advocate a phased-out elimination of flood insurance in high-value areas, landscapes and ecoregions. TNC should seek to develop a comprehensive high value/flood risk mapping system which identifies areas most likely to suffer widespread destruction in the case of a Katrina level flood. These areas should be targeted for action. The specific actions in each area will differ, but an outline for action is detailed in the conclusion of this report.

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Advocate a phased-out elimination of flood insurance in high-value areas, landscapes and ecoregions. TNC should seek to develop a comprehensive high value/flood risk mapping system which identifies areas most likely to suffer widespread destruction in the case of a Katrina level flood. These areas should be targeted for action. The specific actions in each area will differ, but an outline for action is detailed in the conclusion of this report.
Section 2
Disaster Mitigation Program - FEMA

Why Examine the Disaster Mitigation Programs?

Disaster Mitigation is defined as sustained action taken to reduce and eliminate the loss of lives and property from natural disasters and their effects and to seek a long-term solution. As the cost of federal disaster aid has exploded in the last decade, the federal government has sought a sustainable alternative to large disaster relief expenditures. However, federal expenditures are just a part of the real cost of disasters. The actual cost may be billions of dollars higher when expenses absorbed by state and local governments, businesses and individual victims are factored into the total. Because of the escalating costs – both accounted for by the federal government and not – FEMA’s various mitigation programs are increasingly discussed as affordable, sensible and proactive alternatives to past remedies.

This section explains and analyzes the major mitigation programs conducted by FEMA. In doing so, it also seeks to highlight tools that can be used by TNC, and by others, to promote sustainable mitigation efforts. Based on the analysis, we make recommendations to TNC to advocate for certain policies and take specific actions. Specifically, we highlight ways in which TNC can utilize mitigation programs to preserve areas that have a high chance of flooding and are also regarded as important habitat for a rich diversity of plants and animals.

Explanation

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, or the Stafford Act, is a 1988 amended version of the Disaster Relief Act of 1974. It authorizes the President to issue a major disaster declaration by delegating the Federal Emergency Management Agency (FEMA) to fast-track federal aid for individuals, households and the public.

In October 2000, Congress amended the Stafford Act by passing the Disaster Mitigation Act of 2000. This new legislation reinforces the importance of pre-disaster infrastructure mitigation planning to reduce disaster losses nationwide. Financial aid is appropriated to the Disaster Relief Fund (DRF) by Congress and administered by the Department of Homeland Security. In calendar year 2005, there were a total of 48 major disaster declarations. Thirty-two declarations specifically for hurricane, flooding, and tropical storms have been issued. Hurricane Katrina led...
to four declarations in Florida, Louisiana, Alabama, and Mississippi in 2005.  

**FEMA Mitigation Program**
The overall cost of federal disaster relief funding has grown significantly during the last decade. Between 1977 and 1989, FEMA’s disaster relief fund spent more than $7 billion, in FY 2001 dollars. However, for the next 12-year period, ending in 2001, FEMA’s disaster relief fund expenditures increased to $39 billion, again in FY 2001 dollars. A five-fold increase in the cost of disaster relief has led policymakers and planners to seek alternative remedies, especially proactive measures. As costs increase sharply, FEMA has proposed mitigation programs for sustained action to reduce future losses. Presently there are three major programs implemented by FEMA.

**Hazards Mitigation Grant Program (HMGP)**
Section 404 and 406 of the Stafford Act established the Hazard Mitigation Grant Program in 1988. HMGP is the major program operated by FEMA and the oldest. This program provides funding for state and local governments to implement hazard mitigation actions based on long-term solutions and potential savings after a major disaster declaration. The goal of HMGP is to prevent loss of lives and property due to disaster by establishing state or local hazard mitigation plans. State and local governments, Indian tribes or other tribal organizations, and certain private non-profit organizations can request funding for projects to protect either public or private property that meet certain minimum criteria. Individuals and businesses may not apply directly to the program but a community can apply on their behalf. To receive funding, applicants can apply through the State to get HMGP grants, regardless of the boundaries of the disaster declaration.

For HMGP projects, FEMA may fund up to 75 percent of the eligible costs with the remaining portion left for state or local officials to match. Under HMGP, mitigation projects are not limited to the addressed disaster declaration; however, the mitigation projects must be part of mitigation efforts for the disaster area. Each state and local government can allocate the funding regarding to the priority of applicants and program objectives. The types of projects that can be funded by the HMGP include, but are not limited to: structural retrofitting, acquisition and relocation of flood-prone structures, strengthening public infrastructure and facilities, development of standards to protect structures, and educational initiatives.

**Pre-Disaster Mitigation Program (PDM)**
As a result of HMGP’s success and realization of the need for a program to support mitigation activities before a disaster occurs, Section 203 of the Stafford Act authorized Pre-Disaster Mitigation (PDM) in 2000. This program was established to provide technical and financial assistance for comprehensive mitigation planning and implementation to states and local governments. The Governor of each state may recommend to the President five, or fewer, local governments to
receive assistance under this section to complement a comprehensive mitigation program for pre-identified, cost-effective measures. This is a national competitive program with no “base” amount guaranteed to each state but repetitive flood losses have been a high priority.

**Flood Mitigation Assistance (FMA) Program**

FEMA provides funding to assist states and communities to implement measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes and structures insurable by the National Flood Insurance Program (NFIP). The applicants are limited to communities participating in NFIP. There are three types of grants available: Planning, Projects, and Technical Assistance Grants. Funding for FMA is provided through the National Flood Insurance Fund. The PDM is reauthorized through 2007 within the Disaster Relief Act and continues to encourage communities to engage in cost-effective projects.

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**Willamette River Case Study**

The Willamette River in Oregon is the 13th largest river in the United States. Within the river basin live 2.5 million people, more than 70% of the state’s population. In addition there are more than 10 counties and 100 cities, including the city of Portland located within the basin. The river is unique in that in addition to being essential to the economic health of the state the river is home to 39 different plants and animals that inhabit the river and surrounding wetlands. Over the past 100 years, development and structural changes to the river have shrunk the overall area of the river from 40,000 to 20,000 square miles.

In 1998, the Willamette River Initiative was created by Governor John Kitzhaber to develop a “basin-wide strategy to protect and restore fish and wildlife habitat; increase populations of declining species; improve water quality and floodplain management – all while the basin population grows.” Previously, growth had taken place at the expense of the natural environment. In fact, “… By 1990, 42% of the Willamette Valley ecoregion had been converted from natural vegetation to agricultural use and 11% to cities, suburbs and rural home sites.” Now known as the Willamette Partnership since 1995, the initiative has evolved into a bi-partisan, multi-stakeholder organization with a mission to “increase the pace, scope, and effectiveness of conservation in the basin by creating a ‘marketplace’ in which buyers and sellers benefit from opportunities to make strategic investments in the highest priority habitats.”

As the Willamette Partnership has evolved, political support for this endeavor has remained strong. In 2004, Governor Ted Kulongski reaffirmed his support, stating in 2004 that “…Oregon’s future equals a sum of its children, its economy and its environment - and the Willamette River plays an important role in all three areas. It is a key environmental resource, providing fish and wildlife habitat. As a ‘working river,’ the Willamette is also the lifeblood of our economy in the Valley, supporting businesses, industries and communities. Finally, the Willamette contributes to the quality of life that Oregonians enjoy and it is part of the legacy we will leave for our children.” Governor Kulongski has outlined three overarching themes for the Willamette: repair, restore and recreate.
Doing more by Doing Less

The Willamette Partnership has identified several key strategies making it “…plausible to double the human population without sacrificing the integrity of our natural systems and their influence on the quality of life for future inhabitants of the basin.” With the population to experience strong growth, it will be imperative to utilize Oregon’s land use laws to manage both urban and rural housing development through clustering that allows for maintenance of natural habitat and wildlife use. Efforts should also be made to restore the Willamette River’s floodplains, recognizing the dynamic importance of these areas in controlling the natural ebb and flow of the river. This restoration will also allow riparian plants and animals to return and flourish in their natural habitats. Finally, all efforts should be made to begin limiting development of the Willamette’s 100 year flood plain and explore opportunities to relocate existing building and infrastructure elsewhere.

As these strategies are implemented, their importance becomes obvious. Some estimates expect that “…By 2050 an additional 1.7 million people are expected to live in the Willamette River Basin, bringing the total population to around four million. That’s equivalent to adding three more cities the size of Portland or 13 the size of Eugene.” This influx of people makes both short and long term planning a necessity. A large majority of this growth will take place in urban residential zones. The challenge is to effectively allow for population growth while creating effective land use strategies that allow social, economic and environmental needs to be met.

Analysis

Mitigation efforts are key in the effort to reduce future flood losses through long-term planning and proactive projects. This section will discuss important concepts behind the disaster mitigation program: the economic value of benefits and costs, hazard mitigation tools, and the current challenge of the federal mitigation policy. Based on these analyses, we can extract useful lessons from this program for use in flood mitigation, floodplain management, and conservation efforts.

Benefits and Costs Analysis

Cost - benefit analysis is an important tool in determining whether or not to implement a disaster mitigation program. Although the evaluation is intricate and complex, there are still many unaccounted costs and impacts. For instance, indirect costs or ripple-effects of actual damages to the society and economies are rarely addressed. There is a value in assessing an instructive cost-benefit comparison from the perspective of public policy.44

Two methods are utilized to determine the relative costs and benefits in mitigation measures: benefit-cost analysis and cost-effectiveness analysis.45 Benefit-cost analysis is used to determine all benefits and costs of a project in monetary terms. A net ratio of benefit to costs is computed to decide whether a project should be implemented or not. According to this calculation, a mitigation project is worthy of undertaking if the net benefit exceeds the net cost. The second method, cost-effectiveness analysis, evaluates how best to achieve a specific goal by spending a certain amount of money. This type of method does not necessarily measure benefits and costs in terms of dollars.

All the projects granted by the FEMA mitigation program must meet the basic criterion, that is, the benefit must exceed the cost of implementation. A report conducted by the Multi-hazard Mitigation Council assessed savings under the FEMA Hazard Mitigation Grant Program from 1993 to 2003.46 The grants examined were used to mitigate against flood, wind and earthquake. Other
hazards such as winter storm, terrorism and fire were outside the scope of this research. This report had three findings:

♦ High Benefit-Cost Ratios. Research found that a dollar spent on mitigation saves society an average of $4.
♦ Budgetary savings. Analysis showed that a dollar spent by the federal treasury on FEMA mitigation grants saves it $3.69.
♦ Benefits community. The Council found that mitigation grants lead to additional non-federally funded mitigation activities growing in the communities.

In the Council’s work, costs are defined as all resources used and benefits are the avoided losses that would have occurred if the mitigation activities were not implemented. The categories of costs include the cost of mitigation project and process activities (e.g., building retrofit, infrastructure improvement, buyouts, and education) and non-market cost (e.g., effects on wetlands or historical sites). The categories of benefits include direct damage of property and business, non-market damage, and society loss. This study shows a positive response of the federal mitigation grant program and the result encourages FEMA to implement the disaster mitigation program.

Many equations used by government agencies for calculating the benefits of flood mitigation primarily focus on flood-loss reduction but fail to regard the benefit of floodplain management as assets. The analysis here misses the important value of the natural storage function of floodplain and wetland. If the benefits and costs analysis includes the flood-loss reduction benefits as well as the natural values provided by environmental assets, the net profit of implementing the mitigation program would increase.

**Hazard Mitigation Tools**

Hazard mitigation can be implemented by using a variety of tools. Some of these tools can be utilized by the private sector while others can be used by both public and private actors. The following are just some of the tools of hazard mitigation in terms of flooding.

**Standard and Design**

The enforcement of building codes can ensure that structures are resistant to the impact of flooding disaster compared to others constructed without the limitation of building codes. The city of Mandeville in Louisiana is regarded as a successful example. Mandeville has been a member of NFIP since 1979 and was granted a mitigation program thanks to their participation in the program. Understanding the city’s vulnerability to hurricanes and flooding, officials raised its building standards to reduce the flood risk in their town. When Hurricane Katrina hit in August 2005, Mandeville, adjacent to New Orleans, stood strong because of the building regulations, which promote flooding mitigation.

Use of building codes or construction standards generally applies to new or substantially improved structures. As such, it is challenging to apply this tool to most existing structures in the high-risk floodplain.

**Land Use Planning**

Land use planning is most effective in areas that have not been developed, or have minimal investment in capital improvements. Through comprehensive and appropriate land use planning, society can avoid intensive development in flood-prone areas. This tool provides a significant opportunity to mitigate damages caused by natural hazards. For example, floodplains, steep slopes, and areas for wildlife habitat can be designated for open space uses while other less dangerous areas can be developed at a higher density by property owners.

**Mitigation Planning**

The Disaster Mitigation Act of 2000 includes a mitigation planning section. Hazard mitigation is regarded as a sustained action taken to eliminate a long-term risk to life and property from a haz-
ard event. Organizing resources, assessing risks, developing a mitigation plan, and implementing the plan are four steps of mitigation planning. This process places more emphasis on promoting sustainable, disaster-resistant communities by working with state, local, tribal and private-sector partners. Communities that wish to obtain funding from HMGP can apply to the state and get approved by FEMA. Mitigation planning provides a platform to promote collaboration of federal, state, and local governments with private organizations, which can build flood mitigation into their operating and strategic plans, while governments play leading roles.

**Structural Control**

Structural control, including levees, dams, banks, and canals, is commonly used to protect those areas with existing residential development in high-risk floodplains. Generally, structures function as intended and provide residents with reassurance that they are well protected. However, such tools have limitations when their “Design Capacity” is exceeded. The 1993 Midwest Floods and obviously, Katrina, have clearly demonstrated that structures can fail. These events are incentives to consider a broader range of approaches, such as the integration of non-structural approaches to build in greater levels of protection.

The Yolo Bypass near Sacramento, California, which allows the Sacramento River to inundate agricultural land, is an effective example of a non-structural approach. Combining levees with a bypass, or other non-structural mechanism, can improve flood protection for the city while fostering ecosystem objectives. Existing levees must be well designed and periodically inspected and repaired to protect property owners, but in some cases, protection can be strengthened and supplemented by non-structural approaches. Basing decisions on cost-effective analysis that counts all values, in the future, more structures may be replaced with non-structural approaches in appropriate situations.

**Acquisition and Relocation**

FEMA can identify properties in immediate danger of destruction and initiate a property acquisition program that relocates homes and businesses from the high-risk floodplain to avoid losses from a flooding disaster. However, the federal government is loathe to take up such a large financial burden, especially when such relocation efforts also require a public relations balancing act. Also, finding a receptive location to accept the transferring community is big challenge. Finally, relocation and acquisition efforts...
Valmeyer, Illinois Case Study

The residents of Valmeyer, Illinois settled their town in 1909 at the base of a scenic bluff about three miles from the main channel of the Mississippi River. Settlers arrived to work for the St. Louis Railroad and agriculture flourished, with bountiful crops nourished by the rich, river bottom soil.
Residents didn’t worry much about flooding until the spring of 1943, when floodwaters overtopped an agricultural levee and coursed through town. Graduation for the Valmeyer High School Class of 1943 was postponed because the school grounds were under three feet of water. Boats replaced cars on Main Street.

When the flood was over, life returned to normal. Residents cleaned up and moved back home. But a year later, and then again in 1947, the Mississippi rose to flow through the streets of Valmeyer. Eventually residents had enough. They gained the support of lawmakers to seek funding from the U.S. Army Corps of Engineers to build a levee along the western border of Monroe County to protect 60,000 acres of farmland and the village of Valmeyer. Completed in 1950, the levee “was touted as one of the best ever built” by the Corps.

High water caused some seepage in 1973, but the levee held strong. “The levee was doing its job, and with every day that passed, Valmeyer residents gained more confidence in the effectiveness of this earthen structure.”

Valmeyer adopted regulations in the early 1980s that made residents in the floodplain eligible to buy federal flood insurance in an amount at least equal to their outstanding mortgage. New buildings had to be built one foot higher than the base flood elevation (10 feet above-ground on stilts). New construction came to a halt and leaders wondered why their levee couldn’t be certified as adequate. A Corps study found it would be cost effective to raise the levee to meet 100-year flood standards, but the $8 million project cost proved insurmountable.

In the summer of 1993, the Mississippi again grew angry after a month of heavy rains. Boils began to develop along the levee and sandbag crews worked around the clock to shore up the structure as the river inched higher. On the morning of Aug. 1, 1993, a levee near Columbia, Illinois, breached, sending floodwaters rushing towards Valmeyer. “Although our levee had kept us dry for 43 years, that streak came to a painful end,” wrote Mayor Dennis Knobloch. “Members of the Valmeyer High School Class of 1943, who had to cancel their graduation ceremony, now had to postpone their fiftieth class reunion for the same reason.”

At the height of the flood, the main river channel left its banks, rising to 16 feet and covering four miles with swift-moving currents. Water remained in Valmeyer for more than two months and 90 percent of the village’s buildings were severely damaged.

When FEMA and Regional Planning Commission officials floated the idea of relocation, residents voted to try moving the village to higher ground. Aware that property owners were likely to disperse to neighboring towns, “it was the only way to ensure the survival of Valmeyer.” The county drew up five options for the future:

- Rebuild to pre-flood conditions;
- Selective rebuilding/buyout;
- Selective rebuilding/buyout/partial community relocation;
- Agricultural sector rebuilding/total community relocation, and
- Reversion of floodplain to wetlands/open space.

Residents selected the fourth option.
Town officials secured an option to buy a 500-acre farm located a mile and a half away and outside the floodplain at 400 feet higher than the original town site. Knobloch writes that the relocation would not have been possible without the financial assistance from state and federal sources, “but these funds came wrapped in plenty of red tape. More than twenty-five different federal, state, and local agencies participated in the review process following the initial environmental assessment of the relocation site.” Development plans had to be altered to accommodate a state natural area and the possible presence of the endangered Indiana Bat. Meanwhile, residents were living in an encampment of temporary trailers known as “FEMAVILLE.”

Finally, by April 1996, about 60 percent of Valmeyer’s 900 original residents were able to move into their new community. A Post Office, new school, town hall, senior citizens complex and 115 new homes were built.

Valmeyer was one of the few towns to successfully relocate after the 1993 floods. The mayor notes that citizen involvement was a key factor in the process. Seven different committees of more than 100 people met weekly to plan the rebuilding. Valmeyer was also the first community to benefit from the assistance of the Working Group on Sustainable Redevelopment, with funding from the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy. A team of experts met with residents to help them incorporate sustainable design into the new buildings.

Mayor Knobloch shared the following observations about the relocation:

- Conflicting policies and standards between the federal, state and local level “makes relocation a nightmare.”
- Time is of the essence. After a disaster, flood victims want to get back to normal as quickly as possible. Business owners were especially hard-hit because they lost their jobs as well as their homes. The largest employer, a graphics company, relocated, but only 25 percent of businesses made the move.
- It’s easier to convince people “that living in the shadow of a major waterway is a risk when they are standing knee-deep in flood water,” but it’s also more expensive for the government. Following a disaster, prices for labor and materials are high (so some businesses actually profit from the flurry of rebuilding).
- Many towns that were flooded in 1993 simply rebuilt in the floodplain rather than endure a protracted bureaucratic buy-out process—and today they remain vulnerable to damage, as well as being a federal liability.

How and where can TNC be involved?

The Disaster Mitigation Program is regarded as a useful technique to relieve the huge expenditure of federal disaster funds. FEMA, the lead agency in this field, is responsible for implementing the task of mitigation for seeking long-term solutions and potential future savings. Non-structural approaches seem to be a potential solution to mitigation of flooding hazards, especially when floodplains provide valuable functions and provide critical habitat for species. TNC’s mission, preservation of lands and water that support the diversity of life on Earth, could be supported through flood disaster mitigation projects.

Since FEMA implemented the disaster mitigation program nearly 15 years ago, however, the
program is not necessarily open to major change. There are some problematic processes within the program regarding policy. Additionally, there are potential challenges facing the program’s effectiveness in terms of benefit-cost analysis. Reducing the cost of federal disaster aid and achieving the conservation of floodplains, wetlands, and coastal and riparian areas are dual benefits of mitigation. Thus, TNC can take immediate action to encourage improvement of the program and implementation of comprehensive mitigation plans in flood-prone areas.

(1) **Raise concerns regarding the valuation of environmental assets and suggest that FEMA take these values into account in the benefits and costs analysis.** The benefit and cost analysis often neglects environmental functions which can provide a buffer for flooding and create rich habitat for diversity of life. Therefore, TNC can support the mitigation program as a tool to pursue more non-structural approaches while achieving future savings and a long-term solution to flood risks.

(2) **Integrate useful mitigation tools to form comprehensive plans to meet the different demands of each area regarding cost-effective analysis, and recommend that local and State government apply for mitigation grants.** Many kinds of tools can be utilized to implement the mitigation program in flooding. The traditional tool of structural control is regarded as problematic in certain situations such as when the “Design Capacity” is exceeded or weaker structures are not strengthened or retrofitted in time. Flood mitigation also needs to be complemented by other approaches while a long-term solution is sought. Non-structural approaches, which may require more land, can in some cases, enhance or, replace structural flood control. TNC can use their professional knowledge and mapping tools to identify floodplains with high-value conservation areas that also meet the mitigation targets of state or local governments. Land use planning, acquisition of properties and relocation of residents are useful mitigation strategies. TNC can work with state or local government to develop optimal and comprehensive plans for each flood-prone area. The collaboration of TNC, state, regional or local government, and the federal mitigation grant program would create more cost-effective plans.

(3) **Support the community level in efforts to implement mitigation planning and educate residents about the importance of natural assets and services.** Awareness of the risk of inhabiting the floodplain would help municipalities and regions to create the disaster-resistant community. Since communities are the first to be impacted from disasters, federal hazard mitigation invests in all sectors of communities, not just federal, state and local governments. TNC can indirectly support public and private organizations to proactively mitigate flood risks through education tools, such as publishing of flood-related articles. An important goal is to raise residents’ awareness of flood risks and engage residents in participation to create a disaster-resistant community. TNC may establish a network with other local and involved environmental groups and cooperate to lead communities to create their own plans and mechanisms for responding to the risk of flooding.
Section 3
U. S. Army Corps of Engineers

The Corps’ Role

The mission of the U.S. Army Corps of Engineers greatly expanded over the past century to include not only military support, but protection of civilian settlements and economic activity from flood damage. The Corps’ responsibilities include construction and management of flood control structures such as dams, dikes, levees and storm walls. They also dredge channels to keep rivers and coastal harbors safe for navigation. The Corps manages 383 reservoirs (for multiple purposes including flood control and water storage) and 8,500 miles of levees. Total Corps expenditures for flood control from 1928 through 2000 are estimated at $122 billion (in 2001 dollars). Yet flood damages in the U.S. have still increased and are approaching $6 billion a year.

An agency dominated by engineers, (though biologists, hydrologists and many other specialists comprise the staff of 34,950) the Corps’ traditional inclination was to find engineered, or structural, solutions to flood threats. As public criticism of the environmental damage caused by dams and levees has grown, the Corps has adopted improved environmental management practices. Like society, the Corps has begun to recognize the valuable role of ecosystem services provided by functioning rivers and floodplains, including flood attenuation, wetland recharge of groundwater and sediment transport. A 2002 Memorandum of Understanding between TNC’s Sustainable Rivers Program and the Corps for management of dam releases to support habitat, reflects this shift.

By adopting the goal, “strive to achieve environmental sustainability” in 2002 the Corps, implicitly, has broken with its traditional methods. The Corps’ new environmental sensitivity often conflicts with the tasks of restructuring and
hardening river banks, dredging channels, and building barricades against water. Conservation professionals have observed internal tension between the Corps’ Planning branch, which authorizes projects, and the Operations branch, which carries those projects out, and between the goals of ecosystem restoration and structural flood protection. While Corps leadership publicly advocates environmental principles, it appears that more sustainable practices are not yet fully embraced by all rank and file personnel or factored into daily decision-making and operations.64

In many locations, flood control structures cannot be abandoned due to the vulnerability of human development. But there are often opportunities to lessen the harm to fragile environments and the resulting effect on species by incorporating non-structural techniques such as restoring wetlands and floodplains to seasonal flooding, or using natural areas as flood buffers instead of armoring riverbanks. Many projects in the study pipeline for years were proposed under different criteria, and have yet to reflect this new thinking.65 Thus, while the Corps has become more receptive to natural, nonstructural efforts to control flooding, the promise of the non-structural paradigm has yet to be fully realized.

Mississippi River Case Study

An aorta for transport of goods from farms and industry in the mid-Western heart of the nation, the Mississippi River basin covers two-thirds of the continental U.S. Over the course of its 2,300-mile channel, the Mississippi serves as a prime example of how Corps policy and practice has hampered the ability of the natural environment to control floods at a great cost to the government while disrupting surrounding ecosystems. Ecological conditions that may have worsened the coastal damage caused by Hurricane Katrina are rooted in decisions made years ago and miles upstream. Installation of levees in tributaries can cause more flooding downstream as high flows are shunted down the main channel rather than allowing them to flatten out and be absorbed gradually by lowlands.

After flooding in 1927, the Corps built levees up and down the Mississippi. In 1957, the Army Corps locked the channel in place with the Old River Control Structure to create the Port of New Orleans. These actions intensified the river’s flow and accelerated the erosion of the delta at the southern tip of Louisiana. While damage from Katrina would have been devastating in any case, many believe that this erosion of barrier islands and coastal wetlands has made New Orleans more vulnerable to storms blowing in off the Gulf of Mexico.

To make matters worse, Louisiana’s coastal wetlands are disappearing at the rate of 25-35 square miles per year and another 342,000 acres will be lost between now and the year 2050. About 30 percent of this loss is estimated to be due to natural processes and 70 percent due to human activity. According to the state of Louisiana, every 2.7 miles of coastal wetlands reduces storm surge by about a foot. Recognizing the economic, cultural and ecological assets of the region, the Corps has joined with federal and state agencies to launch the Louisiana Coastal Area Ecosystem Restoration Project. Environmental groups, scientists and local activists had also worried that the Mississippi River Gulf Outlet, a controversial navigation channel maintained by the Corps, would act as a “hurricane highway” and funnel storm surge into New Orleans. Modeling by the LSU Hurricane
Center in May 2005 had indicated that MRGO would amplify storm surge by 20 to 40 percent and some experts believe this effect contributed to the flooding of St. Bernard Parish and the Lower 9th Ward following Hurricane Katrina.

The Corps has been under political fire since Hurricane Katrina, defending its work in New Orleans, while racing to rebuild damaged levees with emergency appropriations. A Corps study to determine what would be necessary to build levees to withstand a Category 5 storm is due in fall 2007. Officially, the Corps maintains that the New Orleans flood control system was adequately built according to funding levels authorized by Congress.

New Orleans certainly will not be abandoned. In April 2006, the Bush administration proposed spending $2.5 billion (with a state share yet to be announced) to rebuild levees for much of the city to protect against a 100-year flood, a level that will require many homes to be rebuilt three feet above ground. Other experts, such as the Association of State Floodplain Managers recommend that urban areas should be protected at the 500-year flood level. As the rebuilding begins, the ongoing investment required to achieve adequate protection to avoid future storm damage raises questions about the city’s footprint:

- What parts of the city are realistically defensible from future storm surges, considering sea level rise and the potential for more powerful storms as a result of climate change?
- Are there sections of the city that should not be rebuilt in order to provide a larger buffer between human settlements and the Gulf?
- Can wetland restoration play a role in a redesigned flood control plan for the city?
- Should property owners in the most vulnerable areas, such as the more sparsely populated Plaquemines Parish, located on a narrow strip of land, be allowed to rebuild, or be bought out as part of a relocation program? How could such a program be operated in a fair and equitable manner?

Many political leaders appear hesitant to ask answers to these questions let alone ask the most important question: Is the cost of ongoing maintenance and rebuilding after repetitive losses worth the economic benefit from the ongoing land use that structural control buys?

**Structural Versus Non-Structural Flood Control**

The history of federal flood control policy has been driven by the goal to promote economic development through reclamation of “marginal lands,” such as floodplains for agriculture or development. The Flood Control Act of 1936 required benefits to outweigh costs in order for the federal government to participate in flood control improvements.\(^{66}\) Despite this historic emphasis on structural measures, the concept of non-structural flood control is not new. Rather, nonstructural methods, where no attempt is made to alter the elevation of floodwaters, have been recognized as complementary or alternative options to structural projects within the Corps since 1913.\(^ {67}\)

Non-structural methods include mitigation of flood risk by moving structures away from the shore or floodplain, raising buildings on stilts to better withstand floods, and protection of natural areas that allow floodwaters to disperse.\(^ {68}\)
Non-structural approaches necessitate a retreat of human development from the most vulnerable areas, to accommodate periodic riverbank overflows that course into wetlands and other low-lying landscapes. Ecosystem restoration often plays a large part in nonstructural projects because functioning wetlands are needed to absorb floodwaters.

On the coast, nonstructural approaches require avoiding permanent development on the beach or on eroding coastal bluffs, instead of trying to stop erosion from wave patterns and storms. In fact, Corps-built structures, such as groins, intended to “save beaches” or waterfront development by hardening the shore, may slow the process, but ultimately do not solve the problem. Experience often shows that groins built perpendicular to shore to stabilize the beach only move the erosion problem down the coast. The nonstructural approach assumes that the coast is a dynamic, ever-changing environment and that erosion is an ongoing process. Even without climate change, coastal erosion is expected to destroy one quarter of all homes within 500 feet of the coast within the next 50 to 60 years. However, climate change, and a shift in population toward the coasts, may be contributing to the rising damages caused by flooding. A recent Australian study estimated that global warming will cause sea levels to rise between 11 and 13 inches by 2100, causing increased coastal flooding and erosion.

The Corps and local partners are increasingly considering nonstructural flood control, though it is not possible in all circumstances. Currently, “non-structural measures are in planning or construction at more than 50 locations” around the country.

In many cases, non-structural components are part of a larger coordinated flood control system. For example, in Sacramento, California, the Yolo Bypass, a broad floodplain on the outskirts of the city, is managed to allow Sacramento River flood flows to inundate agricultural land and “has been very successful in handling high water events.” Fields, seasonal and permanent wetlands provide habitat for native wildlife and fish, including the federally listed Chinook salmon. Meanwhile, the Bypass generates phytoplankton, an important link in the food web of the San Francisco Estuary downstream.

Hamilton City is another dual-purpose flood control project near Chico, CA, where TNC is collaborating with the Corps and city to establish setback levees with riparian corridors along the upper Sacramento River to create flood buffer zones. The plan is intended to promote flood damage reduction and habitat restoration. It calls for the acquisition of 20,000 acres of flood-prone lands and existing habitat, re-vegetating native trees and plants and restoring the river’s connections to the floodplain. Home to 2,500 permanent residents, the area has been evacuated six times in the previous 20 years, and has a failing private levee built in 1905. Without TNC’s involvement, and $10 million in land acquisition donated by the local partners, the community would not be able to justify the federal investment. The project is intended to provide a 90 percent chance of passing a 75-year flood, an improvement from the current 1 in 10 chance of flooding in any given year. Authorization for the federal share is included in the Senate committee version of WRDA.
Why hasn’t the Corps more fully embraced non-structural projects as it pursues its new environmental mission? Several authors see as causes institutional resistance and bias against the value of ecosystem services in the economic analyses used to justify flood control projects. According to the National Research Council, which studied the Corps’ project planning analyses in 2004, “Past studies have shown that the benefit calculation procedures used by the Corps in its flood damage reduction projects—especially nonstructural projects—do not consistently capture the full range of benefits. These limitations may be discouraging the agency from greater involvement in these types of projects.” The NRC notes (quoting Moore and Moore, 1989) that, as opposed to structural projects, “…nonstructural measures kept people away from the water, rather than water away from the people. They employed unfamiliar and nontraditional activities like zoning and flood preparedness, which require personal involvement, and they called for individual sacrifice, such as paying for flood insurance.”

The 1974 WRDA required the Corps to consider non-structural measures on an equal footing with structural projects for flood damage reduction planning. Later versions of WRDA also directed the Corps to calculate benefits from non-structural damage reduction with methods similar to those used for calculating structural benefits. But Congressional and Administration direction is often conflicting, and project appropriations do not always materialize. Despite new Corps vision and goals to promote environmental sustainability, “Neither Congress nor the administration seems willing to address an apparent bias against non-structural projects in the economic accounting of costs and benefits.”

Currently, the Corps’ National Nonstructural/Flood Proofing Committee (NFPC) provides assistance to districts in how to formulate non-structural projects. As the chair of this committee, Larry S. Buss, Chief of the Hydrologic Engineering Branch of the Omaha district, observes, “the real excitement within the Corps relative to implementation of nonstructural flood damage reduction and realizing associated opportunities is occurring in the 21st century…The concept of “controlling” floods is past.” Buss continues:

One of the historical problems within the Corps in implementing nonstructural measures, especially floodplain buyouts/relocations, has been economic feasibility... By using ecosystem restoration and/or recreation as a new use of a floodplain that was previously occupied by flood-damageable structures, the ability to develop an economically feasible floodplain buyout/relocation project has been greatly enhanced. In addition, with this concept, communities that previously were averse to buyout/relocation because of tax base loss are now very interested...because the alternate ecosystem restoration and/or recreation use of the floodplain creates a very vibrant, attractive public area for community enhancement.

Charles River Case Study

For many, the city of Boston is defined by images of tall buildings overlooking the Charles River as it flows into Boston Harbor. The longest river in Massachusetts, the Charles begins in Hopkinton and flows 80 rambling miles to the sea while covering some 300 square miles. The river’s last nine miles are referred to as the Charles River Basin and is at its widest, approximately 2,000 feet, in front of the Massachusetts Institute of Technology. Flanked by Boston on its southern bank and the universities of Cambridge on its north, the Charles “…may be the best example anywhere of an urban river that has been radically reshaped and controlled in the service of the public.” This last sec-
tion of the river essentially “…provides the metropolitan area with a spectacular ‘water park’, its green banks publicly owned and its surface spangled with boats.” This outcome is the end result of a singular process that has created one of the most unique rivers in the country.

Throughout the middle parts of the 1900’s, Massachusetts endured heavy rains from a number of hurricanes causing deaths and extensive flooding damages in communities along the Charles. These disasters were the most severe in the lowest parts of the Charles closest to the coast. As a result of the repeated damages, the US Army Corps of Engineers conducted a study aimed at protecting the lives and property of the communities along the river.

Throughout the 1960’s, numerous plans for dams and pumping stations for the Charles River Basin were debated, but logistics and cost proved a major deterrent. In 1965, the US House of Representatives took notice and commissioned the New England division of the Corps to undertake a comprehensive study of the Charles River watershed. Eventually, in 1968 and 1972, the Corps settled on a two-part strategy. The first part provided a structural solution. With federal funding in place construction began in 1974 on a new Charles River Dam. Completed in 1978, the new Charles River Dam consisted of a pumping station and three separate locks to allow boat travel. The cost of the dam was $48 million dollars with another $25 million for other parts of the project. Upon completion, the pumping station became one of the strongest in the US. With six large pumps, the station has the capacity to regulate the water level throughout the basin, helping to prevent extensive flooding.

The second and extremely innovative aspect of this plan was non-structural. The Corps set out to develop a strategy that would utilize existing natural resources to mitigate any flood danger. This strategy was called Natural Valley Storage (NVS). This concept recognized that much of the flooding in the Charles River Basin was the result of runoff from riverfront communities. As a result, “Instead of building dams to create storage reservoirs, the Corps set out to prevent future floods by ensuring the natural reservoirs, the wetlands of the Charles Valley, would not be developed into fast-runoff places like Boston and Cambridge.” The Corps observed that during floods, the river would spread out into low lying, undeveloped areas, gradually returning the water to the mainstream as flooding abated.

According to further studies, if just forty percent of current of the Charles River wetlands were allowed to be developed, the river would require additional and significant structural flood control methods costing an estimated $100 million. In order to prevent development and maintain the natural state of the wetlands, the Corps proceeded to purchase more than 3,000 acres of land along the river as well as obtain easements on several thousands more acres that would prevent any development. The cost of this part of the project was $8.5 million, significantly less than any proposed structural solution.

The end result was the first and most successful nonstructural flood control project in the US. A combination of local planning and innovative thinking contributed to the creation of NVS. The Corps was able to effectively mitigate future flooding issues along the Charles by moving to preserve the natural state of the river in conjunction with some structural development in an extremely cost effective and environmentally friendly manner.
Doing more by Doing Less

Watershed Management Approach
The many challenges of inland and coastal flood control efforts have led policymakers and planners to look at water management issues in a more holistic manner. The Watershed Collaboration Era (1987-present) is characterized by collaborative, place-based management. Planning focuses on the inter-related processes affecting water quality, water supply and flood control between rivers and the lands that drain into them. Watershed approaches to national water management have important implications for how the Corps operates. Under section 101(a) of the Clean Water Act, the Corps is directed to “restore and maintain the chemical, physical and biological integrity of the nation’s waters.” However, the Corps itself acknowledges that this goal is increasingly difficult to achieve in watersheds where urbanization and agricultural activities are expanding.

Although the Corps has adopted several watershed research initiatives, the ecological aspects of watershed management do not seem to be fully integrated into operations. As the Corps’ own Environmental Lab has noted, “To a large extent, existing methods for assessing watersheds focus on site-specific characteristics, and fail to consider how factors operating at larger spatial scales influence watershed function and integrity.”

The Corps is attempting to incorporate better watershed models. For example, “The Multi-Scale Assessment of Watershed Integrity (MAWI)” is an initiative to gauge the health of “riparian ecosystems and their adjacent local drainages within a watershed using a suite of indicators representing both large-and small-scale attributes and processes that influence ecosystem integrity.” MAWI was developed in the Southwest, and the Corps is attempting to apply the approach in other regions.

Organized into eight divisions and 41 subordinate districts, the Corps maintains that divisions are defined by watersheds, not states. However, within the Mississippi Valley Division, New Orleans is one of six districts, while the rest of the lower Mississippi region is in the Vicksburg District. The massive scale of the Mississippi basin notwithstanding, this fragmented organizational structure can create impediments to accomplishing watershed restoration activities. The Corps offices that manage Mississippi tributaries are also different than those that manage the main stem.

Levees and Development
On the morning of Aug. 30, 2005, New Orleans residents awoke to disaster after breaches in the 17th St. Canal and Industrial Canal levees sent water surging into the Lower 9th Ward and other areas. Corps-maintained levees had protected the city from the Mississippi River and from Lake Pontchartrain to the north. As Hurricane Katrina passed, the level of the lake rose up to six feet causing breaches in the levees on the Lake side.

The failure of New Orleans’ levee system is just another in a long history of Corps projects in which engineered design was overpowered by natural forces. When structural flood control fails, devastating losses to life and property can result.

A hand-made sign in one of New Orleans’ devastated neighborhoods sums up the feeling of many residents: “Levee Failure Is Not an Option.” Levee failure may not be a desirable option, but it is a probable outcome. When the Corps of Engineers builds earthen-work levees or other structural flood control mechanisms, they design the structures to withstand specific conditions. For example, in New Orleans, the levees were built to withstand a Category 3 hurricane, not a Category 4 or 5 storm. Katrina was likely a Category 4 storm when it made landfall. The Corps maintains that the storm was more powerful than what the levees were engineered to withstand.

Corps officials understand the limitations of their works and accept that no structural remedy can provide 100 percent protection. However, the
public does not seem to acknowledge or understand this inherent risk. Professional terms and labels, such as the “100-year flood,” only further confuse public understanding.

What we have today is an extremely problematic interpretation of the term “100-year flood,” which is so mired in confusion across the entire flood-related industry that University of Arizona hydrologist Dr. Victor Baker has called it “the most spectacular failure of public communication for any scientific concept of our time.”

The term “100-year flood” means that there is a one percent chance that flooding will occur in any given year. However, many people mistakenly believe that if they were flooded out this year, then they are safe for the next 99, when in fact they have the same level of risk next year and every year.

The Corps’ usual public stance is that the decision about how much risk is tolerable is a community or government decision. Such a stance is dangerous when one acknowledges that many communities do not incorporate the inherent risk of allowing development in hazard-prone areas into their land use decision-making processes. By deferring to communities, the Corps contributes to the false security of residents in levee-protected areas. The relationship between flood control and land use planning decisions must be more clearly articulated if the Corps is to reduce flood damages and help promote sustainable use of natural resources. In many cases, structural flood control encourages development of hazard-prone areas. By preventing small-scale frequent flooding events, structures contribute to the view that flooding is unusual in the region. When the big storm occurs, as it inevitably will, the flood control system fails because it was not intended to protect against the extreme situation.

In New Orleans, the French Quarter was built on high ground and came through the post-Katrina flood relatively unscathed. In the last half century, many new neighborhoods have been built in low-lying areas closer to the levees. In California’s Central Valley, the Sacramento Bee reported that at least 115,000 new homes are in the pipeline for construction in the floodplains of six counties, including some areas protected by aging agricultural levees. Spurred by the realization that a Katrina-scale disaster could occur in California’s Sacramento-San Joaquin Delta, Gov. Schwarzenegger has made repair of these levees, which are vital to the water supply, a state priority.

Water Resources Funding
Water resources funding is also being debated at the federal level. Competing House and Senate reauthorizations of WRDA are moving through the legislative process. This authorizing legislation details the status of many Corps projects, and illustrates how the agency is straddling structural and non-structural flood control. Notably, the authorization process is just the first hurdle for a Corps project. Congress must also appropriate funding for Corps Civil Works in yearly Energy and Water Appropriations legislation before a project can move forward.
Disagreement over how the Corps of Engineers should be reformed has stalled enactment of WRDA in recent years. The legislation has gone unauthorized since 2000. However, some observers believe the 2005 hurricane damage will spur Congress to action. Prior to the 2005 season, the House of Representatives voted 406-14 on July 14, 2005, to pass H.R. 2864, a $10 billion version of WRDA, which was nearly identical to the 2003 version. HR 2864 includes:

♦ Civil Works Program funding of more than 600 projects, among them 37 projects for flood damage reduction, navigation, hurricane and storm damage reduction and environmental restoration.
♦ Independent peer review of larger and more controversial studies.
♦ Establishment of a commission to investigate the nation’s river management and an advisory committee to review beach replenishment projects.

The Senate version of the bill (S. 728), totaling nearly $7 billion, has passed the Environment & Public Works Committee and is awaiting action by the full Senate.

A summary of H.R. 2864 notes that the bill “continues the Corps’ rapidly growing mission of environmental restoration by authorizing or modifying 164 projects and studies.” For example:

♦ Along with a controversial lock construction project on the Upper Mississippi and Illinois rivers, the House bill includes a companion $1.6 billion environmental restoration plan for the same region.
♦ The Corps is a partner in the Louisiana Coastal Area Ecosystem Restoration Project. WRDA includes $1.6 billion in funding for the Florida Everglades and Louisiana Coast wetlands restoration.
♦ The Senate version of the bill includes $78.9 million, along with 51.3 million non-federal share, for ecosystem restoration in the Ventura River Watershed in California, where the Matilija Dam has filled up with sediment (defeating its flood control and water storage purposes) and may be dismantled.
♦ The Senate version of the bill also includes $20 million in funds for the Upper Connecticut River ecosystem restoration including habitat protection, invasive species control, wetlands restoration and fish passage.

**Fire Island Case Study**

Fire Island is a barrier island located off the coast of Long Island, some 50 miles east of New York City. Barrier Islands are long narrow strips of sand that create islands, protecting inland areas from ocean waves and storms. This island is some 31 miles long and ranges from one-quarter to three-quarters of a mile wide. As a barrier island, Fire Island has a great benefit to Long Island, protecting Great South Bay. A significant breach in Fire Island would endanger more than 34,000 Long Island homes at an estimated value of $7.9 billion. According to Army Corps of Engineers estimates, winter storms pose a 20% chance of creating a breach that could cause damages of more than $41 million dollars to both Fire and Long Islands.

The major issue with Fire Island is erosion. As a barrier island, its natural function is to absorb wave impact, protecting the mainland from the full impact of strong storms and hurricanes. In its natural state, the unstable nature of barrier islands allows them to move and shift in the face of changing conditions, ensuring the survival of the island and its ecosystem. According to The Na-
ture Conservancy, “Wind, waves, tides, currents, and storms all shape and maintain coastal habitats. However, it is a common misperception that these forces are destructive and undesirable. In fact, over time, these dynamic processes actually work to rejuvenate the beaches and dunes, tidal wetlands, barrier islands and bays.” Unfortunately as sea level rises, the heavy development of Fire Island is hindering its ability to adapt.

As time has gone on, Fire Island has seen its beaches erode and an increasing number of homes are at risk. This increasing risk has created a debate between homeowners and the Fire Island National Seashore. At the center of this debate is a long promised Army Corps of Engineers project designed to bolster the islands beaches in order to withstand the forces of erosion and protect homes closest to the shore. Known as the Reformulation Project, the, “…authorized project provides for hurricane protection and beach erosion control along five reaches of the south shore of Long Island between Fire Island Inlet and Montauk Point, a distance of approximately 83 miles.” Originally initiated in 1980 with implementation studies currently ongoing, the projects intent would be to widen beaches, raise dunes, build up to 50 groins and allow for periodic beach renourishment to protect and maintain Fire Island’s rapidly changing coastline.

The reformulation project remains controversial due to the “decades long debate over whether it makes sense to continually rebuild the beaches on Fire Island or whether the shoreline of the barrier island should be allowed to take its natural course.” Land and homeowners see the project as necessary to protect their property against the sea. The Fire Island National Seashore, which has jurisdiction over coastal zoning as well as beaches and dunes, has objected to the rebuilding of storm damaged homes, but is unable to condemn these structures because it lacks sufficient funding to buy out homeowners.

With the reformulation project study scheduled to be completed in March of 2008 at a cost of $24 million, many local communities are attempting smaller scale interim beach renourishment projects in partnership with the Army Corps to address immediate needs. For example the Westhampton Interim project, a combination of structural erosion control as well as sand for beaches and dunes, was begun in 1997 and has cost a total of nearly $30 million to this date. While this project has certainly been beneficial to the Westhampton community, it illustrates the central debate faced by coastal communities and federal officials. As the price tag increases, how practical is it to encourage and support these coastal communities with federal funds? The long term sustainability of such efforts is uncertain and it is likely that alternative strategies need to be developed by the Army Corps and the local communities they partner with.

Katrina has opened a window of opportunity for many factions, and some see the Gulf Coast experience as a cautionary tale for the lack of infrastructure investment. Factions such as the American Shore and Beach Preservation Association and the National Waterways Conference (concerned with navigation and dredging projects) will be working to build support for more structural projects. Some legislative observers believe that legislators will see opportunity to pursue funding for projects in their own districts, which may work against a coordinated flood control policy.102
Making the Case for Corps Reform

Numerous authors have outlined problems with the Corps’ procedures for justifying projects and the process of project approval. Among the major criticisms are:

♦ Lack of scientific support for decision making.
♦ Inflated estimates of benefits to justify projects and lack of valuing of non-market goods such as ecosystem services.
♦ Too many “pork barrel” projects approved by Congress. ¹⁰³

As noted earlier, Senators McCain and Feingold have introduced S. 2288, the Water Resources Planning and Modernization Act of 2006, which builds off similar proposals in the 107th, 108th and 109th Congresses. Incorporating many recommendations from the National Research Council’s 2004 review of Corps policies, this legislation would establish a national policy for water resources reflecting priorities for navigation, flood damage reduction and ecosystem restoration. The bill would encourage Corps projects to “reduce the vulnerability of communities and critical infrastructure to flooding by seeking to avoid the unwise use of floodplains; minimize vulnerabilities when floodplains are used; and protect, restore and where necessary mitigate damages to natural systems that provide the first line of defense against flooding.” ¹⁰⁴

Groups that have announced support for the bill include Taxpayers for Common Sense Action, National Taxpayers Union, Citizens Against Government Waste, American Rivers, National Wildlife Federation, Earthjustice, Environmental Defense, Republicans for Environmental Protection, Sierra Club and World Wildlife Fund.

Corps Recommendations

TNC can take a variety of proactive initiatives to ensure that the Corps moves towards more sustainable methods of flood control.

♦ TNC should Support the Water Resources Planning and Modernization Act of 2006, proposed by Senators McCain and Feingold. While aspects of the bill are likely to generate opposition from industry and navigation interests, negotiation over its proposals may force the Corps to continue internalizing environmentally sustainable principles.
Doing more by Doing Less

♦ **TNC must build the case for the economic effectiveness of nonstructural flood control.** TNC can do this by supporting follow-up evaluation and assessment of non-structural pilot projects in order to provide evidence that non-structural approaches can be a real, viable and cost-effective solution to flood threats. For example, the Charles River project (see case study), one of the first non-structural projects, should be touted as a success story with skeptical Corps personnel. Another example is the “Living River” project in Napa County, California, “a blend of ecology and engineering,” in which voters approved a bond to pay for the local project share to provide 100-year protection against Napa River floods. The project includes re-establishment of floodplains and bypass channels (non-structural elements), as well as new levees and dikes to protect the downtown Napa area. For every $1 spent on flood protection, the project is expected to save Napa city residents $7 in property damage.105

♦ **TNC should support policy and practice by the Corps, as well as local government land use planners, that counts as assets, and promotes benefits of, the natural flood absorptive functions of floodplains.** While it may be troubling to put a price on natural resources, it is evident that without such an accounting method floodplains, wetlands, barrier islands and other important environments will be assumed to be of little, if any, value. Historically, Corps cost benefit analyses have been weighted against non-structural proposals, because ecosystem benefits were not counted. The McCain/Feingold bill would require the Corps to work with the National Academy of Sciences to update the Corps’ primary planning documents, the Principles & Guidelines, which have not been revised since 1983.106 Issues related to improved valuing of ecosystem services could be addressed through this legislation, as well as the idea that ecosystem services and habitat should be considered as an opportunity cost of structural projects.107 All flood agencies should be required to use the same cost benefit criteria.

♦ **Through the existing MOU, TNC should seek opportunities to reinforce the watershed management approach and basin-wide ecological thinking at the Corps.** By continuing to sponsor conferences and workshops for Corps personnel from both Operations and Planning, TNC could pro-
mote an ongoing dialogue with Corps engineers and scientists. Such a discussion would position TNC as a leader in the field while promoting new non-structural projects. TNC should pursue interaction with Corps research entities, such as the Environmental Lab and the Coastal Engineering Research Center to encourage development of a multi-disciplinary scientific underpinning for project decisions.108

In regions where different Corps offices manage different parts of the same watershed, such as in Louisiana, TNC should reinforce the importance of Corps inter-office communication and collaboration to remove bureaucratic impediments to river management and ecosystem projects by local partners.

♦ TNC should lobby for increased authorizations and appropriations for non-structural projects through the Water Resources Development Act. Establish a realistic initial goal for the percentage of WRDA funds dedicated to non-structural projects that foster ecosystem restoration in high-value habitat zones and gradually seek to increase this percentage relative to funds for traditional structural projects (for example 30 percent gradually increasing to 60 percent).

♦ TNC should support HR 2864, the House version of WRDA. Considered the more environmentally friendly of the two legislative proposals, the House version authorizes an important $1.218 billion for Coastal Louisiana Restoration and Protection. Seek inclusion of TNC projects from the Senate bill.

♦ TNC should continue to pursue non-structural partnerships with the Corps, including ecosystem restoration in both rivers and coastal wetlands. Utilize WRDA authorizations under Section 205 (Flood Damage Reduction Projects) for floodplain management plans, Section 206 (Aquatic Ecosystem Restoration) and Section 1135 (Project Modifications to Improve the Environment) for flow regimes to restore, improve or protect habitat for plants, fish and wildlife. Seek to remove barriers to success from the federal/local cost share formula (cancellation of federal funds, bureaucratic hurdles for local partners). Continue to pursue authorizing legislation for TNC’s Connecticut River pilot project that would allow NGOs (currently only governments are allowed) to enter into General Investigation cost-share agreements with the Corps, opening another avenue for Corps collaboration.109

♦ TNC should monitor the national debate regarding vulnerability to flooding disasters in areas protected by levees, and support proposals for a national assessment of levee infrastructure (which could be the responsibility of a restored Water Resources Council). In high-value habitat landscapes, such as the California Sacramento River Delta, TNC could seek opportunities to identify projects in which levees could be replaced with non-structural projects that would restore floodplain function as part of a coordinated flood control effort.
Conclusion

The disastrous effects of Hurricane Katrina, as stated previously, have provided a window of political opportunity for changing the way the US thinks about flood control policy. It is essential that the mistakes and shortcomings that have plagued the federal agencies involved be addressed so that the magnitude of damages and loss of life caused by such tragedies are not repeated. Given its history, mission, and unique place in the environmental community, The Nature Conservancy is well positioned to play an important role in taking action on the lessons learned from Katrina.

TNC should seek to assist the US government in developing a coordinated flood control and mitigation policy. Currently, there are a number of agencies involved in the different aspects of flood control and mitigation, but their coordination remains disjointed. Recognizing that each has their own area of expertise, TNC could help broker the development of a well coordinated and national strategy to resolve difficult questions and work towards comprehensive solutions through the following actions:

**Advocate for the reestablishment of the Water Resources Council:** The Water Resources Council was established by the Water Resources Planning Act of 1965. The Council was established to broaden the criteria for water resources projects to include the environmental and social concerns, benefits, and costs of projects. “In 1973, the Water Resources Council released Principles and Standards for water-resource development, which required that federal agencies take in to account national and regional economic development, environmental quality, and social effects in their planning.” 110 During his term, President Jimmy Carter emphasized the need for both economic development and environmental quality in water resources planning, establishing the dual goals as coequals. However, in an effort to reduce the size of government, the Reagan administration refused to appropriate funds for the Council, leading to its effective abolition in 1983. Since the disbanding of the Council, “there has been no central direction or coordination of water related activities by the federal government.” 111

The need for direction and coordination of water related activities, especially flood control efforts, is obvious. Haphazard policies and misguided planning helped create conditions that contributed to the devastation caused by Hurricanes Katrina and Rita. Reestablished and reinvigorated, the Council would serve as the organizing force for federal flood control and water resource policy. In this position, the Council would prioritize water resource projects, highlight high-value areas for potential restoration or non-structural projects, ensure the efficient allocation of federal resources, and promote pilot programs in areas of opportunity.

**Engage the Federal Emergency Management Association in a comprehensive mapping program:** TNC should integrate FEMA floodplain and coastal erosion-rate maps with its own maps used in the Conservation by Design program to prioritize conservation of high-value habitat that would also reduce flood damages. The overlay of these maps would assist TNC in identifying potential areas for land acquisition activities in regions that experience repetitive losses or high flood damages.

**Endorse the creation of a Shoreline Relocation Advisory Committee:** While testifying before Congress in the wake of Hurricane Katrina, Bob Young, a professor and geologist from West-
ern Carolina University, has proposed a unique solution for high-risk coastal areas. He called for a Shoreline Retreat Advisory Commission (ShRAC) that would have a mandate to identify specific areas that would no longer receive federal support through NFIP. This concept would be based on the Base Realignment and Closing Commission (BRAC) that is tasked with examining US Department of Defense facilities and identifying which bases should be closed. As envisioned by Young, the proposed ShRAC would be a non-political commission comprised of scientists and coastal experts. Young testified that the commission would meet, “…every five years to identify vulnerable shorelines that will be removed from all future federal assistance… In essence, Congress would be extending (the) Coastal Barrier Resource Act restrictions on federal subsidy of new development, flood insurance, and infrastructure rebuilding to shorelines that are already developed, but identifiably vulnerable.”

By encouraging federally mandated relocation, ShRAC would ensure that lives are saved, high-value environments are protected from further over development, and sound science, not politics, is the basis for all decisions.

Establish High Value Action Plans for coastal and floodplain areas: In partnership with the proposed comprehensive mapping program, TNC should collaborate with FEMA and the Army Corps to identify specific areas of repetitive loss properties and high risk floodplains as targets for high value action plans. By working regionally with various affected communities, TNC and its partners would be able to utilize pre-disaster mitigation techniques, specifically public outreach or awareness campaigns about the risks of building and living in hazard-prone areas. In conjunction with this outreach, TNC would work with state and local officials, planners and environmental experts to develop a specific plan for the region.
A central focus for TNC would be to identify existing natural habitat areas that could face development pressure as well as rural or sparsely populated regions that could contribute to non-structural flood protection. Following the identification of these areas, TNC would be able to adopt a prioritized plan for land acquisition in support of flood mitigation, fostering its goal to “conserve existing portfolios of functional conservation areas within and across eco-regions.”

Tools such as conservation easements, Transfer of Development Rights and development incentives (density bonuses awarded for construction in appropriate areas if development is avoided in flood-prone areas) could be used in order to preserve or restore habitat, and therefore mitigate flood and erosion risk.

It is essential that TNC work to promote awareness of the wide variety of tools available to promote appropriate and effective floodplain and coastal development emphasizing non-structural solutions, while still allowing for sensible and balanced development. In addition, while the TNC has traditionally operated on a more national level within the US, it is important that all levels of government work to become more integrated around flood control efforts. Many local decisions have tremendous ripple effects, and by working within certain flood plains and coastal zones, TNC would be able to facilitate the type of regional planning that is missing from many at-risk areas.

The challenges we face in developing sustainable federal flood control policy cannot be addressed with broad, sweeping strokes. Rather, they should be attacked with concentrated efforts. These efforts require reform of flood control policy at the federal level, and recognition of the regional nature of challenges at the local level. TNC is positioned to address both these challenges. While the latter will require TNC to work at a more micro level than its efforts to date, it is important to acknowledge that the majority of land use decisions, which will determine the success of federal efforts, are made at the local level.

Failure to address either the national or the regional challenges facing the United States, will lead to a less effective effort to develop sustainable federal flood control policies. However, taking steps at both levels will ensure that the lessons of Katrina go beyond emotionally charged instinctual reactions and grow into informed, factually-based opinion. It will also require that the policymakers and planners realize that the answer isn’t always to do more—sometimes it is to do less.
Citation

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42 Ibid 37
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56 Ibid 46
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Appendix 1

Dauphin Island Case Study

Dauphin Island is a barrier island in the Gulf of Mexico located a few miles off the Alabama coastline, 33 miles from Mobile and 130 miles east of New Orleans, LA. Approximately 14 miles long by 1.5 miles at its widest, Dauphin Island was used primarily as a port beginning in 1699. As time has passed this once pristine and deserted island has become a growing resort area with more than 1,500 homes stretched across its narrow landscape. During the 1980’s, Dauphin Island was identified as one of the US’s fastest growing communities, driven by an explosive demand for waterfront property. During the summer, the year-round populations of nearly 2,000 swells by more than 15,000 as visitors seek to enjoy the natural beauty of the island.

This growth has occurred despite the undeniable fact, that “Dauphin Island is one of the most vulnerable barrier islands in the nation.” Since 1979, the island has been hit severely by six hurricanes, causing repeated and severe damage to property and infrastructure. Nearly 500 homes have been lost and many more required extensive repairs in the aftermath of each storm. With hurricanes posing such a risk, it would seem remarkable that anyone would want to build on such a precarious piece of land.

The lack of reluctance is in large part due to the fact, that during the same period of time, homeowners have received more than $21 million to rebuild, courtesy of FEMA’s National Flood Insurance Program (NFIP). This program provides protection for property owners in flood-prone areas, such as Dauphin Island, and allows them to redevelop following devastating storms. In the wake of Katrina, which completely destroyed 300 homes, the long term sustainability of the island comes into question. In fact, according to Duke University coastal geologist Orrin H. Pilkey, “If there were ever a poster child for a barrier island that shouldn’t have been developed, it’s Dauphin Island.”

The very existence of Dauphin Island residences would not be possible without federal funding. In 1979 Hurricane Frederick destroyed the bridge from the mainland to the island. With federal funding, a new $38 million bridge to the island was built, along with $6.5 million in infrastructure improvements, totaling more than $90 million in current dollars. In conjunction with the tens of millions of dollars paid out through NFIP, the federal government has spent more than $100 million maintaining Dauphin Island during the last 25 years. Without this investment, much of the development on the island would not have occurred.

Dauphin Island’s continued reliance on federal funding places it in the middle of the growing debate surrounding at-risk coastal development following Katrina. At least 90% of the homes on the island are not full time residences, but vacation homes. Many homes are built upon pilings to account for the extremely low lying land and lack of protective sand dunes. Currently the beaches are an “apocalyptic scene of broken and vanished houses, downed power lines, flooded roads, buried cars and shallow quicksand.” The results of Katrina’s rampage will certainly add tens of millions to the federal tab.
Another large issue is that as a barrier island, Dauphin Island is extremely susceptible to erosion which can drastically change the makeup of the island. Experts contend that natural processes are contributing to a significant migration of the island to the north. Continued dredging of the nearby Mobile shipping channel has robbed the island of much needed sediment for its beaches. As a result, the island has become more susceptible to storms that will continue to erode sand starved beaches. Island residents have pushed the Corps to fund sand berms and beach nourishment programs, but according to Scott Douglas, a civil engineer, “Those FEMA berms have been called, correctly, ‘false hope for those who are beyond hope’.” To illustrate his point, a $1.1 million FEMA sand berm constructed in 2005 vanished during Katrina.

The case of Dauphin Island is not an easy one, especially given the backdrop of Katrina. Is it practical to continue to invest and rebuild in an area where continued damage is inevitable? Identifying long term solutions that do not wash away in the next storm are necessary. In addition, both government officials and residents need to recognize that it is not cost effective to continue to build in some areas, nor is it sustainable. George Crozier, Director of the Dauphin Island Sea Lab research facility, makes an extremely relevant point that “The rush to rebuild is understandable. It’s basic human sympathy, but we have to build in a different way.”

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6 Ibid.
9 Helvarg.
10 Mitchell.
11 Bouma.
12 Helvarg.
Appendix 2

Willamette River Case Study

The Willamette River in Oregon is the 13th largest river in the United States. Within the river basin live 2.5 million people, more than 70% of the state’s population. In addition there are more than 10 counties and 100 cities, including the city of Portland located within the basin. The river is unique in that in addition to being essential to the economic health of the state the river is home to 39 different plants and animals that inhabit the river and surrounding wetlands. Over the past 100 years, development and structural changes to the river have shrunk the overall area of the river from 40,000 to 20,000 square miles.  

In 1998, the Willamette River Initiative was created by Governor John Kitzhaber to develop a “basin-wide strategy to protect and restore fish and wildlife habitat; increase populations of declining species; improve water quality and floodplain management – all while the basin population grows.”  

Previously, growth had taken place at the expense of the natural environment. In fact, “…By 1990, 42% of the Willamette Valley ecoregion had been converted from natural vegetation to agricultural use and 11% to cities, suburbs and rural home sites.”  

Now known as the Willamette Partnership since 1995, the initiative has evolved into a bi-partisan, multi-stakeholder organization with a mission to “increase the pace, scope, and effectiveness of conservation in the basin by creating a ‘marketplace’ in which buyers and sellers benefit from opportunities to make strategic investments in the highest priority habitats.”

As the Willamette Partnership has evolved, political support for this endeavor has remained strong. In 2004, Governor Ted Kulongski reaffirmed his support, stating in 2004 that “…Oregon’s future equals a sum of its children, its economy and its environment - and the Willamette River plays an important role in all three areas. It is a key environmental resource, providing fish and wildlife habitat. As a ‘working river,’ the Willamette is also the lifeblood of our economy in the Valley, supporting businesses, industries and communities. Finally, the Willamette contributes to the quality of life that Oregonians enjoy and it is part of the legacy we will leave for our children.”  

Governor Kulongski has outlined three overarching themes for the Willamette: repair, restore and recreate.

The Willamette Partnership has identified several key strategies making it “…plausible to double the human population without sacrificing the integrity of our natural systems and their influence on the quality of life for future inhabitants of the basin.”  

With the population to experience strong growth, it will be imperative to utilize Oregon’s land use laws to manage both urban and rural housing development through clustering that allows for maintenance of natural habitat and wildlife use. Efforts should also be made to restore the Willamette River’s floodplains, recognizing the dynamic importance of these areas in controlling the natural ebb and flow of the river. This restoration will also allow riparian plants and animal to return and flourish in their natural habitats. Finally, all efforts should be made to begin limit development of the Willamette’s 100 year flood plain and explore opportunities to relocate existing building and infrastructure elsewhere.
As these strategies are implemented, their importance becomes obvious. Some estimates expect that “…By 2050 an additional 1.7 million people are expected to live in the Willamette River Basin, bringing the total population to around four million. That’s equivalent to adding three more cities the size of Portland or 13 the size of Eugene.” 8 This influx of people makes both short and long term planning a necessity. A large majority of this growth will take place in urban residential zones. The challenge is to effectively allow for population growth while creating effective land use strategies that allow social, economic and environmental needs to be met.

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6 Sinclair p 37.
7 Ibid
8 Willamette River Basin Explorer
Appendix 3

Valmeyer, Illinois Case Study

The residents of Valmeyer, Illinois settled their town in 1909 at the base of a scenic bluff about three miles from the main channel of the Mississippi River. Settlers arrived to work for the St. Louis Railroad and agriculture flourished, with bountiful crops nourished by the rich, river bottom soil. ¹

Residents didn’t worry much about flooding until the spring of 1943, when floodwaters overtopped an agricultural levee and coursed through town. Graduation for the Valmeyer High School Class of 1943 was postponed because the school grounds were under three feet of water. Boats replaced cars on Main Street. ²

When the flood was over, life returned to normal. Residents cleaned up and moved back home. But a year later, and then again in 1947, the Mississippi rose to flow through the streets of Valmeyer. Eventually residents had enough. They gained the support of lawmakers to seek funding from the U.S. Army Corps of Engineers to build a levee along the western border of Monroe County to protect 60,000 acres of farmland and the village of Valmeyer. Completed in 1950, the levee “was touted as one of the best ever built” by the Corps. ³

High water caused some seepage in 1973, but the levee held strong. “The levee was doing its job, and with every day that passed, Valmeyer residents gained more confidence in the effectiveness of this earthen structure.” ⁴

Valmeyer adopted regulations in the early 1980s that made residents in the floodplain eligible to buy federal flood insurance in an amount at least equal to their outstanding mortgage. New buildings had to be built one foot higher than the base flood elevation (10 feet above-ground on stilts). New construction came to a halt and leaders wondered why their levee couldn’t be certified as adequate. A Corps study found it would be cost effective to raise the levee to meet 100-year flood standards, but the $8 million project cost proved insurmountable. ⁵

In the summer of 1993, the Mississippi again grew angry after a month of heavy rains. Boils began to develop along the levee and sandbag crews worked around the clock to shore up the structure as the river inched higher. On the morning of Aug. 1, 1993, a levee near Columbia, Illinois, breached, sending floodwaters rushing towards Valmeyer. “Although our levee had kept us dry for 43 years, that streak came to a painful end,” wrote Mayor Dennis Knobloch. “Members of the Valmeyer High School Class of 1943, who had to cancel their graduation ceremony, now had to postpone their fiftieth class reunion for the same reason.” ⁶

At the height of the flood, the main river channel left its banks, rising to 16 feet and covering four miles with swift-moving currents. Water remained in Valmeyer for more than two months and 90 percent of the village’s buildings were severely damaged. ⁷
When FEMA and Regional Planning Commission officials floated the idea of relocation, residents voted to try moving the village to higher ground. Aware that property owners were likely to disperse to neighboring towns, “it was the only way to ensure the survival of Valmeyer.” The county drew up five options for the future:

- Rebuild to pre-flood conditions;
- Selective rebuilding/buyout;
- Selective rebuilding/buyout/partial community relocation;
- Agricultural sector rebuilding/total community relocation, and
- Reversion of floodplain to wetlands/open space.

Residents selected the fourth option.

Town officials secured an option to buy a 500-acre farm located a mile and a half away and outside the floodplain at 400 feet higher than the original town site. Knobloch writes that the relocation would not have been possible without the financial assistance from state and federal sources, “but these funds came wrapped in plenty of red tape. More than twenty-five different federal, state, and local agencies participated in the review process following the initial environmental assessment of the relocation site.”

Development plans had to be altered to accommodate a state natural area and the possible presence of the endangered Indiana Bat. Meanwhile, residents were living in an encampment of temporary trailers known as “FEMAVILLE.”

Finally, by April 1996, about 60 percent of Valmeyer’s 900 original residents were able to move into their new community. A Post Office, new school, town hall, senior citizens complex and 115 new homes were built.

Valmeyer was one of the few towns to successfully relocate after the 1993 floods. The mayor notes that citizen involvement was a key factor in the process. Seven different committees of more than 100 people met weekly to plan the rebuilding. Valmeyer was also the first community to benefit from the assistance of the Working Group on Sustainable Redevelopment, with funding from the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy. A team of experts met with residents to help them incorporate sustainable design into the new buildings.

Mayor Knobloch shared the following observations about the relocation:

- Conflicting policies and standards between the federal, state and local level “makes relocation a nightmare.”
- Time is of the essence. After a disaster, flood victims want to get back to normal as quickly as possible. Business owners were especially hard-hit because they lost their jobs as well as their homes. The largest employer, a graphics company, relocated, but only 25 percent of businesses made the move.
- It’s easier to convince people “that living in the shadow of a major waterway is a risk when they are standing knee-deep in flood water,” but it’s also more expensive for the government. Following a disaster, prices for labor and materials are high (so some businesses actually profit from the flurry of rebuilding).
• Many towns that were flooded in 1993 simply rebuilt in the floodplain rather than endure a protracted bureaucratic buy-out process—and today they remain vulnerable to damage, as well as being a federal liability.18

2 Ibid.
3 Ibid.
4 Ibid.
5 Knobloch, 42.
6 Ibid.
7 Ibid.
8 Ibid. 43.
10 Knobloch, 43-44.
11 Ibid.
12 Operation Fresh Start.
13 Knobloch, 43.
14 Operation Fresh Start.
15 Knobloch, 45.
16 Ibid. 44.
17 Ibid. 45.
18 Ibid.
Appendix 4

Mississippi River Case Study

An aorta for transport of goods from farms and industry in the mid-Western heart of the nation, the Mississippi River basin covers two-thirds of the continental U.S. Over the course of its 2,300-mile channel, the Mississippi serves as a prime example of how Corps policy and practice has hampered the ability of the natural environment to control floods at a great cost to the government while disrupting surrounding ecosystems. Ecological conditions that may have worsened the coastal damage caused by Hurricane Katrina are rooted in decisions made years ago and miles upstream. ¹ Installation of levees in tributaries can cause more flooding downstream as high flows are shunted down the main channel rather than allowing them to flatten out and be absorbed gradually by lowlands.

After flooding in 1927, the Corps built levees up and down the Mississippi. In 1957, the Army Corps locked the channel in place with the Old River Control Structure to create the Port of New Orleans. ² These actions intensified the river’s flow and accelerated the erosion of the delta at the southern tip of Louisiana. While damage from Katrina would have been devastating in any case, many believe that this erosion of barrier islands and coastal wetlands has made New Orleans more vulnerable to storms blowing in off the Gulf of Mexico.

To make matters worse, Louisiana’s coastal wetlands are disappearing at the rate of 25-35 square miles per year and another 342,000 acres will be lost between now and the year 2050. About 30 percent of this loss is estimated to be due to natural processes and 70 percent due to human activity. ³ According to the state of Louisiana, every 2.7 miles of coastal wetlands reduces storm surge by about a foot. Recognizing the economic, cultural and ecological assets of the region, the Corps has joined with federal and state agencies to launch the Louisiana Coastal Area Ecosystem Restoration Project. ⁴ Environmental groups, scientists and local activists had also worried that the Mississippi River Gulf Outlet, a controversial navigation channel maintained by the Corps, would act as a “hurricane highway” and funnel storm surge into New Orleans. Modeling by the LSU Hurricane Center in May 2005 had indicated that MRGO would amplify storm surge by 20 to 40 percent and some experts believe this effect contributed to the flooding of St. Bernard Parish and the Lower 9th Ward following Hurricane Katrina. ⁵

The Corps has been under political fire since Hurricane Katrina, defending its work in New Orleans, while racing to rebuild damaged levees with emergency appropriations. A Corps study to determine what would be necessary to build levees to withstand a Category 5 storm is due in fall 2007. Officially, the Corps maintains that the New Orleans flood control system was adequately built according to funding levels authorized by Congress. ⁶

New Orleans certainly will not be abandoned. In April 2006, the Bush administration proposed spending $2.5 billion (with a state share yet to be announced) to rebuild levees for much of the city to protect against a 100-year flood, a level that will require many homes to be rebuilt three feet above ground. ⁷ Other experts, such as the Association of State Floodplain Managers recommend that urban areas
should be protected at the 500-year flood level. As the rebuilding begins, the ongoing investment required to achieve adequate protection to avoid future storm damage raises questions about the city’s footprint:

- What parts of the city are realistically defensible from future storm surges, considering sea level rise and the potential for more powerful storms as a result of climate change?
- Are there sections of the city that should not be rebuilt in order to provide a larger buffer between human settlements and the Gulf?
- Can wetland restoration play a role in a redesigned flood control plan for the city?
- Should property owners in the most vulnerable areas, such as the more sparsely populated Plaquemines Parish, located on a narrow strip of land, be allowed to rebuild, or be bought out as part of a relocation program? How could such a program be operated in a fair and equitable manner?

Many political leaders appear hesitant to ask answers to these questions let alone ask the most important question: Is the cost of ongoing maintenance and rebuilding after repetitive losses worth the economic benefit from the ongoing land use that structural control buys?

9 Whoriskey and Hau
Appendix 5

Charles River Case Study

For many, the city of Boston is defined by images of tall buildings overlooking the Charles River as it flows into Boston Harbor. The longest river in Massachusetts, the Charles begins in Hopkinton and flows 80 rambling miles to the sea while covering some 300 square miles. The river’s last nine miles are referred to as the Charles River Basin and is at its widest, approximately 2,000 feet, in front of the Massachusetts Institute of Technology. Flanked by Boston on its southern bank and the universities of Cambridge on its north, the Charles “…may be the best example anywhere of an urban river that has been radically reshaped and controlled in the service of the public.” This last section of the river essentially “…provides the metropolitan area with a spectacular ‘water park’, its green banks publicly owned and its surface spangled with boats.” This outcome is the end result of a singular process that has created one of the most unique rivers in the country.

Throughout the middle parts of the 1900’s, Massachusetts endured heavy rains from a number of hurricanes causing deaths and extensive flooding damages in communities along the Charles. These disasters were the most severe in the lowest parts of the Charles closest to the coast. As a result of the repeated damages, the US Army Corps of Engineers conducted a study aimed at protecting the lives and property of the communities along the river.

Throughout the 1960’s, numerous plans for dams and pumping stations for the Charles River Basin were debated, but logistics and cost proved a major deterrent. In 1965, the US House of Representatives took notice and commissioned the New England division of the Corps to undertake a comprehensive study of the Charles River watershed. Eventually, in 1968 and 1972, the Corps settled on a two-part strategy. The first part provided a structural solution. With federal funding in place construction began in 1974 on a new Charles River Dam. Completed in 1978, the new Charles River Dam consisted of a pumping station and three separate locks to allow boat travel. The cost of the damn was $48 million dollars with another $25 million for other parts of the project. Upon completion, the pumping station became one of the strongest in the US. With six large pumps, the station has the capacity to regulate the water level throughout the basin, helping to prevent extensive flooding.

The second and extremely innovative aspect of this plan was non-structural. The Corps set out to develop a strategy that would utilize existing natural resources to mitigate any flood danger. This strategy was called Natural Valley Storage (NVS). This concept recognized that much of the flooding in the Charles River Basin was the result of runoff from riverfront communities. As a result, “Instead of building dams to create storage reservoirs, the Corps set out to prevent future floods by ensuring the natural reservoirs, the wetlands of the Charles Valley, would not be developed into fast-runoff places like Boston and Cambridge.” The Corps observed that during floods, the river would spread out into low lying, undeveloped areas, gradually returning the water to the mainstream as flooding abated.
According to further studies, if just forty percent of current of the Charles River wetlands were allowed to be developed, the river would require additional and significant structural flood control methods costing an estimated $100 million. In order to prevent development and maintain the natural state of the wetlands, the Corps proceeded to purchase more than 3,000 acres of land along the river as well as obtain easements on several thousands more acres that would prevent any development. The cost of this part of the project was $8.5 million, significantly less than any proposed structural solution.  

The end result was the first and most successful nonstructural flood control project in the US. A combination of local planning and innovative thinking contributed to the creation of NVS. The Corps was able to effectively mitigate future flooding issues along the Charles by moving to preserve the natural state of the river in conjunction with some structural development in an extremely cost effective and environmentally friendly manner.

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3 Ibid 4
5 Hall, 69-72
6 Hall, 74
7 Hall, 74-75
Appendix 6

Fire Island Case Study

Fire Island is a barrier island located off the coast of Long Island, some 50 miles east of New York City. Barrier Islands are long narrow strips of sand that create islands, protecting inland areas from ocean waves and storms. This island is some 31 miles long and ranges from one-quarter to three-quarters of a mile wide. As a barrier island, Fire Island has a great benefit to Long Island, protecting Great South Bay. A significant breach in Fire Island would endanger more than 34,000 Long Island homes at an estimated value of $7.9 billion. According to Army Corps of Engineers estimates, winter storms pose a 20% chance of creating a breach that could cause damages of more than $41 million dollars to both Fire and Long Islands. ¹

The major issue with Fire Island is erosion. As a barrier island, its natural function is to absorb wave impact, protecting the mainland from the full impact of strong storms and hurricanes. In its natural state, the unstable nature of barrier islands allows them to move and shift in the face of changing conditions, ensuring the survival of the island and its ecosystem. According to The Nature Conservancy, “Wind, waves, tides, currents, and storms all shape and maintain coastal habitats. However, it is a common misperception that these forces are destructive and undesirable. In fact, over time, these dynamic processes actually work to rejuvenate the beaches and dunes, tidal wetlands, barrier islands and bays.” ² Unfortunately as sea level rises, the heavy development of Fire Island is hindering its ability to adapt.

As time has gone on, Fire Island has seen its beaches erode and an increasing number of homes are at risk. This increasing risk has created a debate between homeowners and the Fire Island National Seashore. At the center of this debate is a long promised Army Corps of Engineers project designed to bolster the islands beaches in order to withstand the forces of erosion and protect homes closest to the shore. Known as the Reformulation Project, the, “…authorized project provides for hurricane protection and beach erosion control along five reaches of the south shore of Long Island between Fire Island Inlet and Montauk Point, a distance of approximately 83 miles.” ³ Originally initiated in 1980 with implementation studies currently ongoing, the projects intent would be to widen beaches, raise dunes, build up to 50 groins and allow for periodic beach renourishment to protect and maintain Fire Island’s rapidly changing coastline. ⁴

The reformulation project remains controversial due to the “decades long debate over whether it makes sense to continually rebuild the beaches on Fire Island or whether the shoreline of the barrier island should be allowed to take its natural course.” ⁵ Land and homeowners see the project as necessary to protect their property against the sea. The Fire Island National Seashore, which has jurisdiction over coastal zoning as well as beaches and dunes, has objected to the rebuilding of storm damaged homes, but is unable to condemn these structures because it lacks sufficient funding to buy out homeowners. ⁶
With the reformulation project study scheduled to be completed in March of 2008 at a cost of $24 million, many local communities are attempting smaller scale interim beach renourishment projects in partnership with the Army Corps to address immediate needs. For example the Westhampton Interim project, a combination of structural erosion control as well as sand for beaches and dunes, was begun in 1997 and has cost a total of nearly $30 million dollars to this date. While this project has certainly been beneficial to the Westhampton community, it illustrates the central debate faced by coastal communities and federal officials. As the price tag increases, how practical is it to encourage and support these coastal communities with federal funds? The long term sustainability of such efforts is uncertain and it is likely that alternative strategies need to be developed by the Army Corps and the local communities they partner with.

4 Ibid
6 Ibid
### Table 1. Flood and stormwater storage location choices, benefits, and costs

<table>
<thead>
<tr>
<th>Location of storage</th>
<th>Type of storage</th>
<th>Benefits</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Or-Site</td>
<td>Swale</td>
<td>Slows flow of runoff. Increases infiltration into the soil.</td>
<td>Added cost to each development site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Filters pollutants from nonpoint sources.</td>
<td>Costs borne by property owner or developer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreases sediments.</td>
<td>Multiple uses of land can lead to wise use of floodplain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Controls erosion.</td>
<td>Density transfers can maintain owner value.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stores runoff (0.7 acre-feet per 1,000 linear feet in typical 30-foot-wide swale).</td>
<td></td>
</tr>
<tr>
<td>Detention</td>
<td></td>
<td>Holds stormwater during flood events.</td>
<td>Added cost to each development site.</td>
</tr>
<tr>
<td>Basin or Retention</td>
<td></td>
<td>Attenuates downstream flood peaks.</td>
<td>Costs borne by property owner or developer.</td>
</tr>
<tr>
<td>Pond</td>
<td></td>
<td>Basin (usually dry) can be used for recreation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pond (usually wet) is a permanent site amenity.</td>
<td></td>
</tr>
<tr>
<td>Regional (upstream</td>
<td>Dam or</td>
<td>Holds flood and stormwater upstream of developed land.</td>
<td>A dam permanently alters stream ecology.</td>
</tr>
<tr>
<td>storage)</td>
<td>Engineered</td>
<td></td>
<td>Development still subject to catastrophic losses.</td>
</tr>
<tr>
<td></td>
<td>Reservoir</td>
<td></td>
<td>Large municipal outlay borne by all taxpayers.</td>
</tr>
<tr>
<td>Regional (downstream</td>
<td>Floodwalls</td>
<td>Protects urban development areas located behind the structure from a</td>
<td>Confines the cross section of the floodway and eliminates the fringe storage area.</td>
</tr>
<tr>
<td>storage)</td>
<td>or Levee</td>
<td>design flood (typically the 100-year event).</td>
<td>Development still subject to catastrophic losses.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveys floodwater rapidly away from protected area.</td>
<td>Raises flood stages, flows, and velocity of downstream waterway.</td>
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<td></td>
<td></td>
<td></td>
<td>Relocates storage to downstream properties.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Imposes increased damages or higher flood protection costs on downstream owners.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveys floodwater rapidly away from development sites.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helps alleviate flooding of adjacent parcels from a design flood flow.</td>
<td></td>
</tr>
<tr>
<td>Channel Improvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preserved</td>
<td>Natural</td>
<td>Stores floodwater and stormwater runoff in the fringe.</td>
<td>Only open space uses allowed.</td>
</tr>
<tr>
<td>Floodplain or Wetland</td>
<td>Landscape</td>
<td>Passes flood flows in the floodway.</td>
<td>Costs borne by owner/developer unless compensated for by public acquisition or easement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deep-rooted vegetation increases permeability and water holding capacity of the soil.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abates nonpoint sources of pollution by filtration.</td>
<td>Multiple uses of land can lead to wise use of floodplain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduces sediment loading into stream.</td>
<td>Density transfers can maintain owner value.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recharges groundwater aquifers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mitigates adverse downstream flood flows, peaks, and velocities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mitigates flood losses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maintains aquatic and related wildlife habitat.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can be used for recreation.</td>
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</tr>
</tbody>
</table>

Appendix 8

Excerpts from the Intergovernmental Panel on Climate Change—Special Report on The Regional Impacts of Climate Change: An Assessment of Vulnerability.
Ch. 8, North Americaa

“...Increases in hydrological variability (larger floods and longer droughts) are likely to result in increased sediment loading and erosion, degraded shorelines, reductions in water quality, reduced water supply for dilution of point-source water pollutants and assimilation of waste heat loads, and reduced stability of aquatic ecosystems.

Projected changes in snowfall and snowmelt—as well as suggested increases in warm-period rainfall intensity—could shift the periodicity of the flood regime in North America, possibly stressing the adequacy of dams, culverts, levees, storm drains, and other flood prevention infrastructures. The impacts of flooding are likely to be largest in arid regions, where riparian vegetation is sparse; in agricultural areas during winter, when soils are more exposed; and in urban areas with more impervious surfaces. Increases in hydrological variability may reduce productivity and biodiversity in streams and rivers and have large impacts on water resources management in North America, with increased expenditures for flood management. Increases in water temperature and reduced flows in streams and rivers may result in lower dissolved oxygen concentrations, particularly in summer low-flow periods in low- and mid-latitude areas.”

“Coastal Systems (Section 8.3.7). The implications of rising sea level are well understood, in part because sea level has been rising relative to the land along most of the coast of North America for thousands of years. Some coastal areas in the region will experience greater increases in sea level than others. Adaptation to rising seas is possible, but it comes at ecological, economic, and social costs.

In the next century, rising sea level could inundate approximately 50% of North American coastal wetlands and a significant portion of dry land areas that currently are less than 50 cm above sea level. In some areas, wetlands and estuarine beaches may be squeezed between advancing seas and engineering structures. A 50-cm rise in sea level would cause a net loss of 17-43% of U.S. coastal wetlands, even if no additional bulkheads or dikes are erected to prevent new wetland creation as formerly dry lands are inundated. Furthermore, in the United States, 8,500-19,000 km² of dry land are within 50 cm of high tide, 5,700-15,800 km² of which currently are undeveloped. Several states in the United States have enacted regulations to adapt to climate change by prohibiting structures that block the landward migration of wetlands and beaches. The mid-Atlantic, south Atlantic, and Gulf coasts are likely to lose large areas of wetlands if sea-level rise accelerates.

Coastal areas in the Arctic and extreme North Atlantic and Pacific are less vulnerable, except where sea ice and/or permafrost currently is present at the shoreline. Recent modeling suggests that projected increases in ocean fetches as a result of decreases in the period and extent of sea-ice cover could in-
crease wave heights by 16-40% and therefore increase coastal erosion during the open-water season. Maximum coastal erosion rates are expected to continue in those areas where permafrost contains considerable pore, wedge, or massive ice or where the permafrost shoreline is exposed to the sea.

*Rising sea level is likely to increase flooding of low-lying coastal areas and associated human settlements and infrastructure.* Higher sea levels would provide a higher base for storm surges; a 1-m rise would enable a 15-year storm to flood many areas that today are flooded only by a 100-year storm. Sea-level rises of 30 cm and 90 cm would increase the size of the 100-year floodplain in the United States from its 1990 estimate of 50,500 km$^2$ to 59,500 km$^2$ and 69,900 km$^2$, respectively. Assuming that current development trends continue, flood damages incurred by a representative property subject to sea-level rise are projected to increase by 36-58% for a 30-cm rise and by 102-200% for a 90-cm rise. In Canada, Charlottetown, Prince Edward Island appears to be especially vulnerable, with some of the highest-valued property in the downtown core and significant parts of the sewage systems at risk.

*Saltwater is likely to intrude further inland and upstream.* Higher sea level enables saltwater to penetrate farther upstream in rivers and estuaries. In low-lying areas such as river deltas, saltwater intrusion could contaminate drinking water and reduce the productivity of agricultural lands.”  

TUFTS UNIVERSITY

TO: Benjamin Downing, Jonathan Greeley, Ching Yu Chou, Elizabeth Hayden

This letter is your official notification that your research project

The Nature Conservancy (TNC): Picking up the Pieces – The Lessons of Katrina for Hazard Mitigation, Environmental Protection and Public Safety

(Protocol # 0602013)

is exempt from further IRB review for the following reason:

2. Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior UNLESS the information is recorded in a manner in which the subject can be identified AND disclosure would place the subject at risk of criminal or civil liability or be damaging to financial standing, employability, or reputation. This does not apply where the subjects are children except where it involves passive observation of public behavior.

No written consent documentation is required.

Please be sure to print a copy of this notification for your files.

Helen A. Page
IRB Administrator

February 28, 2006

Date of Email Notification

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