

A Report by a Panel of the

**NATIONAL ACADEMY OF
PUBLIC ADMINISTRATION**

For the U. S. Congress and the U.S. Army Corps of Engineers

February 2007

**PRIORITIZING AMERICA'S WATER
RESOURCES INVESTMENTS:**

**Budget Reform for Civil Works Construction Projects
at the U.S. Army Corps of Engineers**

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The views expressed in this report are those of the Panel. They do not necessarily reflect the views of the Academy as an institution.

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FOREWORD

The nation's water resources are a fundamental part of its wealth, and lie at the heart of its economic, social and environmental well-being. The U.S. Army Corps of Engineers has played a major role in managing those resources for more than 200 years. However, concerns have been growing in some circles about how the Corps' projects are prioritized.

In the aftermath of Hurricanes Katrina and Rita, questions about the Corps' priorities grew more urgent. Congress asked the Academy to recommend better ways to prioritize its projects. The Academy Panel formed to take on this task soon recognized that the bigger question was how to make sure the right projects are proposed initially.

I congratulate the Academy Panel, under the excellent leadership of Chair Sean O'Keefe and Vice Chair Mortimer Downey, for preparing this insightful and innovative report. It goes well beyond the assigned task of assessing the criteria used to prioritize individual projects. Its key recommendation is to completely overhaul the current cost-share, project-sponsor driven budget process. The nation's safety, productivity and global competitiveness demand a much more thoughtful, inclusive and rigorously analytical process. This report spells out that process and shows how to achieve it over the next five years. The Corps recognizes the need to improve its planning and budgeting processes, and I commend them for actions already taken to do so. Yet success also will depend upon several important actions by the Congress and Administration, which this report identifies.

This report would not have been possible without the Corps' cooperation. Its very busy staff was always responsive to our questions, provided several special briefings to the Panel and facilitated the Panel's aerial tour of the New Orleans flood area, including current reconstruction and ecosystem restoration efforts. The Panel and staff accomplished an amazing amount of work in the eight short months allotted to this study. I commend them all.

A handwritten signature in black ink that reads "Howard M. Messner". The signature is written in a cursive, flowing style.

Howard M. Messner
President

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ACRONYMS

Academy	National Academy of Public Administration
ACF	Apalachicola-Chattahoochee-Flint
ASA/CW	Assistant Secretary for the Army for Civil Works
ASCE	American Society of Civil Engineers
C&SF	Central & Southern Florida Project
CERP	Comprehensive Everglades Restoration Plan
CI	Condition Index
CPRA	Coastal Protection and Restoration Authority
DHS	Department of Homeland Security
DOT	Department of Transportation
DRBC	Delaware River Basin Commission
EC	Engineering Circular
EM	Engineering Manual
EPA	Environmental Protection Agency
ER	Engineering Regulation
FDR	Flood Damage Reduction
FEMA	Federal Emergency Management Agency
FY	Fiscal Year
GAO	Government Accountability Office
GPRA	Government Performance and Results Act
IPET	Interagency Performance Evaluation Task Force
IWR	Army Engineer Institute for Water Resources
LACPR	Louisiana Coastal Protection and Restoration project
LRA	Louisiana Recovery Authority
MR&T	Mississippi River and Tributaries
MRC	Mississippi River Commission
NCHRP	National Cooperative Highway Research Program
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	Net Ecosystem Restoration
NRC	National Research Council
O&M	Operations and Management
OMB	Office of Management and Budget
P&G	Principles & Guidelines
PART	Program Assessment Rating Tool
PED	Pre-construction Engineering and Design
RBRC	Remaining-Benefits/Remaining-Costs
RED	Regional Economic Development
SFWMD	South Florida Water Management District
TRB	Transportation Research Board
TVA	Tennessee Valley Authority
USACE	U.S. Army Corps of Engineers
WRC	Water Resources Council
WRDA	Water Resources Development Act

PANEL MESSAGE

The nation's vast water resources are critical to its economic strength and to the well-being of all Americans. Our rivers and their surrounding ecosystems hold tremendous value as sources of recreation, wildlife, channels of commerce, hydropower, flood control and aesthetic pleasure. But, human activity has the potential to both enhance *and* diminish this value. The nation must use effective adaptive management strategies to protect these national treasures and at the same time use them to help meet the challenges of the 21st Century. These challenges include globalization, fierce competitive pressures, a compromised environment and a continually growing and shifting population.

The U.S. Army Corps of Engineers has played a major role in the nation's water management ever since the country was founded, and it is uniquely positioned to play a pivotal role in the next 100 years. But the model that has worked in the past is no longer appropriate. Efforts focused on controlling rivers and solving specific local and regional problems cannot effectively harness the potential of the nation's water resources to meet the significant challenges the nation faces. The Corps knows this.

The Corps is expanding its horizons. It is beginning to work in a broader context that recognizes risks, balances multiple objectives, focuses priorities on key agency missions, identifies and avoids unintended consequences, and more systematically plans on a time horizon longer than the annual budget cycle. But, these changes do not go far enough. More fundamental change is needed, change that the Corps cannot accomplish on its own. The Department of the Army, Office of Management and Budget (OMB), Congress, other federal agencies and the many state, local and private stakeholders all have important roles to play in better prioritizing the Corps' budget.

The Academy Panel responsible for this study had a fundamental assignment: to help the Corps better prioritize its funding decisions, especially with regard to construction. This task led initially to consideration of more and better articulated criteria within a more transparent budget process. This report evaluates those possibilities. As the Panel studied the Corps' budget process, however, larger questions emerged that bear on the future sustainability of the nation's water resources and related ecosystems, as well as on the nation's economic viability and social well being.

The answer to these questions should begin with a fundamental reassessment of national water resources needs, goals, and strategies. It should end with a substantially reshaped planning and budgeting process that is conducted across large river basins and nested watersheds and that relies on integrated, systems-based planning to determine budget priorities. This new approach is designed to position the Corps to take the lead, working with the states and many other direct stakeholders, in enhancing the stewardship of the nation's water resources well into the 21st century.

THE INITIAL REQUEST

When hurricane Katrina hit New Orleans in 2005, followed almost immediately by hurricane Rita, the resulting disaster set off reevaluations of many government programs. Included were several reevaluations of the Corps' role in these events. Most of the reevaluations focused on engineering and related failures of the New Orleans levee system, and the unintended ecological consequences of Corps navigation and flood control projects.

However, a more general evaluation requested by the House of Representatives Appropriations Subcommittee on Energy and Water Resources Development related to the whole Corps budget process. At the House's request, the Congress asked the Corps to engage the Academy to evaluate the criteria used by the Corps to prioritize the projects in its annual budget requests and to recommend improvements. This report is the Academy's response to that request.

The Subcommittee anticipated very large new financial demands for rebuilding the flood protection system around New Orleans. These new demands come on top of budget stresses caused by an already huge and growing backlog of authorized but unfunded Civil Works projects and an aging inventory of federal water resource infrastructure assets, assets that need constant maintaining and renewal. Given the increasingly tight federal budget situation, the Subcommittee anticipated a pressing need for an improved process for prioritizing Civil Works spending.

DEFICIENCIES IN THE PRESENT CORPS BUDGET PROCESS

As the Academy Panel examined the Corps' current budget process, it identified many deficiencies:

- The process focuses too narrowly on individual projects.
- The projects are proposed primarily by individual cost-share sponsors.
- Funding to completion is uncertain for many large, multi-year projects.
- Many more projects have been authorized than have been funded.
- The projects are difficult to put into the context of national goals, system performance or economic and environmental impacts. Many projects may not meet national goals and objectives.
- Prioritization relies too heavily on single factors—benefit-cost ratios for most projects, or life safety for dams and levees, or environmental factors for ecosystem restoration.
- The prioritization process is not transparent. At several points, within both the executive and legislative branches, the decision process is not sufficiently open or documented so that the public can readily understand the reasons for funding or not funding projects.

- Results are not always demonstrably consistent with established budget criteria or mission needs, may be inefficient in balancing funding needs and funding availability, and sometimes yield disappointing results.

The Panel explored options for using multiple criteria for prioritizing projects—including economic benefit-cost ratios, measures of risk, environmental quality, system planning and timely project completion—and the means to combine the measures into composite priority scores or grades. Other important criteria were considered—social equity, contribution to watershed goals, project management, and facility condition—which are worthy of further study. A project “dashboard” or scorecard should be used to graphically display project criteria to decision makers during the prioritization process and to improve transparency and thoroughness of deliberations.

Nonetheless, the Panel found that these multiple-criteria evaluation techniques for comparing the individual projects that individual project sponsors proposed would be unlikely to produce optimal system performance. Nor would they address the problem of authorized projects far outnumbering funded projects.

The key problem with funding prioritization is that it begins with an inventory of individually conceived projects, and then tries to make a system out of them. The Panel believes that beginning with strategic performance goals and related system designs provides a much stronger basis for identifying and prioritizing the most beneficial outcome-oriented projects. The success of a project that is part of a system can be measured by improvements in system performance, likely a national mission-oriented outcome measure. In contrast, the success of individually conceived projects is likely to be measured only as outputs—was each one completed as proposed within its approved budget?

To illustrate the difference, very few levees failed in New Orleans. However, the system’s weak links resulted in a massive “system failure.” Almost the whole city flooded. Post-Katrina evaluations found that the levees were a system in name only. System performance is what counted, not the performance of individual levees, most of which performed well. The Panel believes it is essential for the Corps to move toward a systems approach to provide greater consistency and optimal performance in prioritizing its Civil Works construction program.

CORPS RESPONSES

The aftermath of Katrina and Rita already has engaged the Corps in activities that have begun to move it toward risk-sensitive systems integration. Examples include the multiple studies of levee failures in New Orleans, a Congressional requirement for comprehensive Corps planning of Louisiana coastal restoration—to complement a State of Louisiana effort—and a Corps review of the conditions and risks associated with flood protection levees nationwide.

In August 2006, the Corps announced its “12 Actions for Change” strategy for moving toward a risk-centered systems integration approach. In addition, the Corps is modifying its budget

preparation process to base it more on enhanced multi-year watershed and river basin planning by its field units, to be carried out in consultation with stakeholders. These are important steps in the right direction. They should be encouraged.

MUCH WORK REMAINS TO BE DONE

The Corps' current budget process is not completely of its own making, and cannot be changed without the agreement of the Administration and Congress. Until 1986, the Corps had greater latitude to do broad river basin and watershed planning studies from which federally funded projects emerged. Since then, however, large-scale study funds have been very limited, and used primarily to justify specific projects proposed by individual cost-share sponsors. The Panel agrees that the cost-sharing principle is important to retain, but believes strongly that broad planning studies should be readily available to provide context and sounder justifications for projects. In general, individual projects should be conceived as integral elements of strategically developed system plans designed to meet outcome-oriented performance targets consistent with high priority Corps missions.

Corps budget priorities should be allocated among its missions and outcomes, rather than among individual projects. Project priorities should be linked to their importance in meeting system-wide performance targets most cost effectively as determined by alternatives analysis. Long-range system plans, with at least a 20-year time horizon, should be interagency and intergovernmental, as appropriate, to incorporate future needs, unique authorities and the resources of multiple stakeholders whose interests interact within a watershed or river basin. System plan implementation should be laid out in a multi-year sequence of specific projects—perhaps five years—consistent with reasonably anticipated revenues from all available sources, both federal and non federal. Priorities for Corps projects should be established in relationship to priorities for those sponsored or provided by other federal agencies, state and local governments and other cooperators within the watershed or river basin. Project accomplishments and system performance should be systematically tracked and fed into the planning process to adjust plans and project schedules and maintain progress. The U.S. Department of Transportation's regular Condition and Performance Report is a model that should be considered.

This collaborative planning process should be performed in the open to the greatest extent possible, and used to maintain maximum transparency and public accountability in budgeting and program performance. The Department of the Army, OMB, and Congress should place credence in the funding priorities arising from this process as much as possible in their budget decision making.

The backlog of authorized but unfunded Corps projects should be reduced through careful analysis of systems and projects during the new multi-party planning process. System performance should be the primary measure of project value and funding priorities within this fiscally constrained process. Projects that are not likely to be funded should be removed from plans until there is some reasonable expectation that they could or should be funded. Funded projects should be fully funded in useful increments to avoid inefficient stop-and-go construction activities.

PANEL RECOMMENDATIONS

To make this new budget process a reality, the Panel makes six recommendations that should be implemented as quickly as possible. They are listed below and more fully explained in Chapter 6.

1. Transition the Corps, step-by-step, to a strategic budget process supported by a performance-oriented and systems-based watershed management process.
 - Increase the number of factors used to analyze, plan, and prioritize Corps construction projects, and implement a scorecard or report card mechanism for considering these factors simultaneously and across business lines.
 - Revise Corps planning and budgeting guidance to emphasize collaborative watershed planning and consider multiple project selection factors.
 - Amend the Water Resources Development Act to fund broader planning studies and allow greater latitude for planning-based project initiation.
 - Develop five-year fiscally constrained “programs of projects” to implement long-range plans.
 - Revise the existing, outdated interagency planning guidance—*Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*—to incorporate strategic performance-based project selection.
 - Replace individual project earmarks with division-by-division appropriations scaled to meet the strategic performance priorities of those geographic areas as established by the collaborative planning process. Allocate adequate funding for the broad-based studies needed to support this multi-party planning process.
 - Support state water resources planning and intergovernmental river basin planning to guide the nation’s water resources investments and management.
2. Conduct periodic mission reviews of the Corps Civil Works Program similar to Quadrennial Defense Reviews.
3. Restructure the Corps’ strategic plan around key national outcome goals.
4. Establish a partnering approach with other federal agencies, state and local governments and other key stakeholders in order to develop strategic watershed and river basin plans as the basis for Corps implementation projects and budget priorities.
5. Ensure adequate operations and maintenance of all Corps-built facilities.

6. Implement the Water Resources Development Act ability-to-pay provisions to ensure equity among cost-share sponsors.

CHAPTER 1

INTRODUCTION

Even prior to Hurricane Katrina, the U.S. Army Corps of Engineers (Corps) faced criticism of its funding priorities, in New Orleans and elsewhere. For example, it was argued that a large amount of funding was directed to construction projects in Louisiana—especially New Orleans—but that much of it went to commercial navigation projects of questionable economic value. At the same time, questions were raised about how the Corps undertook the construction of flood protection for New Orleans. Now, in the wake of Katrina, the demands of building a flood protection system for that city promise to be enormous. These demands come on top of a huge and growing backlog of authorized construction projects and an aging water resources infrastructure. These facts translated into a pressing need for improved processes to prioritize projects for funding.

In response to these concerns, the House Appropriations Subcommittee for Energy and Water Resources Development requested that the Corps identify projects that deserved highest priority for funding. The Subcommittee initially called for a single, “top 10” list of flood and navigation projects. The Corps replied that the request was not feasible. The Subcommittee then asked for prioritized lists of projects in four areas: flood damage reduction, commercial navigation, dam safety and projects that could be completed within a fiscal year. The Corps responded with an unranked list of dam safety projects and multiple separate lists of both flood damage reduction and commercial navigation projects; each list was based on different criteria to prioritize projects.

The inability to obtain a single, prioritized list of projects, even within individual lines of business, led the Congress to seek the National Academy of Public Administration’s assistance. The FY 2006 conference report on Appropriations for Energy and Water Development directed the Corps to contract with the Academy to study and recommend factors that should be used to determine the allocation of limited resources for the construction of water resource projects.

STUDY TASKS

Following passage of the Corps’ FY 2006 appropriations, the Academy worked with the House Appropriations Subcommittee and the Corps to develop a study plan. The plan included the following tasks:

- Evaluate the remaining-benefits/remaining-costs (RBRC) ratio criterion and other criteria that the Corps uses to prioritize construction projects in the budget.
- Research and evaluate factors that other agencies use to prioritize construction projects.
- Develop a report that provides options and recommendations for priority ranking factors and possible tools for combining the priority rankings of construction projects across business lines.

It was agreed that the study would be completed in seven months and that the final report would be delivered by January 7, 2007. The delivery date was subsequently adjusted to February 28, 2007.

ACADEMY PANEL

A seven-member Panel—composed of six Academy Fellows and an independent expert on federal water resources programs—directed the study team’s work. Appendix A provides the Panel’s and staff biographies. Three meetings were held at which the Panel reviewed the study team’s research and work plans; discussed the study with Corps management and representatives of institutional stakeholders involved in potential reforms, including the Assistant Secretary of the Army for Civil Works (ASA/CW), the Office of Management and Budget (OMB) and the House and Senate Appropriations Subcommittees; reviewed draft reports; and developed its findings and recommendations. One meeting, held in Baton Rouge, Louisiana, allowed the Panel to take an aerial tour of the New Orleans region to observe hurricane damage and rebuilding efforts, and to receive briefings by the Corps and others on reconstruction, recovery and restoration planning and actions.

By direction of Panel Chair Sean O’Keefe, a small group of Panel members, led by Vice Chair Mortimer Downey, met with Corps officials during the study to obtain additional briefings from them and to discuss with them the Panel options that were under consideration.

DATA AND METHODS

This study examined broadly the Corps’ planning and budgeting activities, reviewed the experience of other water resource development agencies, and researched precedents for alternative approaches to prioritization. This research relied on a range of data and methods, as outlined below.

Review of Studies, Monographs and Reports

The study team reviewed reports issued by expert panels concerning the Corps specifically and water resources management generally; expert studies of the failures in flood protection during Hurricane Katrina; government reports by the Government Accountability Office and Congressional Research Service; case studies of local and regional water resource planning and management; and Corps project planning reports. A series of reports by the National Research Council (NRC) of the National Academies of Science was especially informative. These reports, issued in 2004, provide a wealth of information and analysis related to the Corps’ planning processes and the context in which they are carried out, as well as many recommendations that coincide with those that this Panel ultimately developed. A bibliography listing the studies, monographs and reports reviewed is provided in Appendix B.

Review of Federal and Corps-specific Policy Documents

The study team reviewed federal and Corps policy documents concerning planning and budgeting. These documents included Civil Works strategic plans, regulations, Corps-issued Engineering Circulars and regulations, OMB's budget guidance, current multi-agency planning guidance for water resource projects, authorizing legislation and Presidential executive orders. The study team also reviewed budget and funding documents, such as the Corps budgets, project justification documents, Five Year Development Plans, President's budgets for FY 2006 and 2007, and Congressional appropriations documents.

Interviews with Corps Personnel and Key Stakeholders

The study team conducted interviews with Corps personnel, including top civilian management, business line and program managers, the strategic planning team, staff economists, and members of the U.S. Army Engineer Institute for Water Resources (IWR), the Corps' in-house think tank. Corps field staff members also were interviewed regarding specific regional planning activities. In addition, the team met with staff in the office of the ASA/CW, OMB and House and Senate Appropriations Subcommittees. Others contacted included representatives of selected river basin commissions, as well as a state official active in one of the Corps' ecosystem restoration efforts. Appendix C lists individuals contacted during the study.

Interviews with Other Federal Officials

The study team interviewed officials from two major federal water resources agencies: the Bureau of Reclamation and the Tennessee Valley Authority. As a result, the team determined that these agencies could not provide meaningful benchmarks for project prioritization, primarily because they were not undertaking any substantial new construction. Team members also met with a Department of Homeland Security (DHS) official to discuss the agency's approach to risk analysis and its application to the Corps' efforts.

Interviews with Other Experts

Several independent experts were contacted during the study. These included former Corps personnel, a senior researcher at NRC and members of a RAND project team actively working on risk analysis and decision processes related to coastal Louisiana recovery efforts.

“Thinkers Session”

The Academy brought together 45 stakeholders representing diverse perspectives on water resources issues for a one-day workshop in Washington, DC. Participants discussed limitations of the current budget process, recommended ways to improve it and suggested actions that could be taken to overcome obstacles to change. Appendix D provides a list of participants and a summary of the discussion.

REPORT OUTLINE

The Panel report is organized into six chapters. This chapter describes the origin, scope, and methods of the study.

Chapter 2 describes the changing and increasingly complex environment in which the Corps plans and prioritizes projects. It provides a brief history of how the Corps has evolved over the last 200 years, including its expanding mission. This history is complemented by a discussion of changing national values—like how the increased emphasis on environmental and social equity objectives led to an more demanding mission—and such changing circumstances as the increasing demands of operating and maintaining a vast, aging water resources infrastructure and focus on national security. The chapter also reviews the Corps’ evolving approach to planning, including early comprehensive watershed and river basin planning, more recent policy changes that narrowed the focus of planning and efforts to reinstitute a broader watershed approach.

Chapter 2 concludes with concerns raised about the Corps’ construction program and significant efforts underway to address them. These concerns include the failure to conduct systems-based watershed planning, narrow prioritization criteria not clearly linked to key mission goals and the lack of continuity in construction project implementation. The Corps has begun to revise its planning and budgeting approaches; for example, it is seeking to link budgeting decisions more closely to missions, planning for a longer time horizon and developing a systems- and risk-based planning approach.

Chapter 3 describes the Corps’ current budget process. It begins with an overview of the steps in the budget process, followed by a discussion of the sources of guidance that the Corps uses to prepare the budget and actual preparation by Corps districts and divisions. This field-level discussion includes a description of the range of data already collected that can be used to rank and budget projects, as well as the primary subset of criteria used to budget projects in each of the Corps’ three major business lines: flood damage reduction, navigation and ecosystem restoration. Also described is the process of making budget decisions among business lines at Corps headquarters. Because the current process is not transparent to external observers, it is difficult to understand how the criteria and guidance impact budget decisions. The final section presents an analysis of recent budgets and appropriations in order to explain how the existing criteria were applied.

Building on the Corps’ current improvement efforts, Chapters 4 and 5 describe three key stages of a strategy to more fundamentally reshape the agency’s approach to budgeting. When the strategy is fully implemented, the Corps’ budgeting priorities would be established through a fully integrated, systems-based, watershed-wide planning process.

Chapter 4 describes the first stage of the strategy, which is focused on improving the current budget process. It aims to better define the set of criteria that might be used to prioritize projects for funding, and to devise a more comprehensible, transparent method of applying these criteria to budget decisions, both within and across business lines. The criteria focus on five major factors: economic return, environmental return, human safety, timely project completion and consistency with a watershed plan. A “report card” concept is developed to grade projects on

each of the major criteria and provide a grade-point average for each project. Variations of this concept, including a “dashboard” approach, are discussed for ranking projects within and across business lines.

Chapter 5 reviews the definitions of “watershed” and describes the basic characteristics and steps of a watershed management approach. It then presents the second and third stages of the strategy for moving to a watershed management approach. The second stage—functional systems planning—focuses on limited, function-specific planning and uses project priorities designed to enhance system performance. The third and final stage represents a fully-realized, system-based, intergovernmental, multi-party watershed planning approach designed to be transparent and provide priorities for funding Corps projects in the context of what many other agencies, governments and organizations are doing. The remainder of the chapter reviews Corps and federal policies concerning watershed management and major constraints on its application. It reviews the Corps’ ongoing initiatives and limitations of those initiatives, noting that the Congress, OMB, the Department of the Army, and other stakeholders have a role in the Corps’ success or failure.

Chapter 6 presents the Panel’s findings and recommendations.

CHAPTER 2

BACKGROUND: ADAPTING TO CHANGING MISSIONS AND DEMANDS

The Corps has a proud history of over 200 years of service, improving and developing the nation's water resources. Over that time, changes in Congressional and Administration priorities have expanded and refocused its mission. Especially in the last 30 years, the context in which the Corps operates has become increasingly complex. The Corps faces new and competing missions, the need to use more sophisticated analytical techniques, multiplying regulatory mandates, new social and political realities, possible terrorist threats, requirements for stakeholder involvement, and an increasingly aging infrastructure. The Corps' ability to consider all of these factors appropriately as it plans and selects projects is at the heart of the questions addressed in the Academy's study.

The discussion below provides a brief history of the Corps' evolving missions and how the Corps has adapted to that evolution. One especially significant challenge has been in fulfilling its stated preference for planning and implementing programs with a watershed perspective. The discussion then turns to the influence the Corps' partners have on how it plans and budgets to carry out those missions. Finally, the discussion is brought up to date with a review of concerns about the Corps expressed by stakeholders in recent years as well as the Corps' current efforts to address those concerns.

THE EVOLVING CORPS MISSION

The Corps' history is a long one; its precursor organization erected its first projects during the Revolutionary War. But the Corps' Civil Works Program is generally cited as beginning in 1824 when Congress authorized surveys for roads and canals. Dating from that time, navigation has been a primary Corps mission. By the mid-1800s that role had expanded to flood control when, in 1850, Congress directed the Corps to engage in its first planning exercise, "to determine the most practical plan" to control flooding along the lower Mississippi River. (Clark and McCool, 1996; cited in NRC, *River Basins*, 2004)

Since then, the Corps' mission has continued to expand, along with the growing recognition that individual water resources projects may have multiple goals. In the late 1800s and early 1900s, regulatory responsibilities—first to control dumping of dredged material in the nation's waterways—and development of hydropower on the nation's rivers were added to the Corps' responsibilities. The multiple goals of hydropower projects were recognized, including navigation, power, and irrigation. The Great Mississippi Flood of 1927 also brought national attention to the multiple goals of Corps projects, specifically the relationship of navigation support and flood control and protection.

The Flood Control Act of 1936 again significantly expanded the Corps' mission to include dams and other water control projects, in support of a national flood control program. Significantly, this act also directed that benefit-cost analysis be used in the development of Corps flood control

projects. To answer concerns that the program would encourage “pork barrel” spending, Congress limited Corps participation in such projects to those in which “the benefits to whomsoever they may accrue are in excess of the estimated costs, and if the lives and social security of people are otherwise adversely affected.” Since that time, the Corps has become a leader in the application of benefit-cost analysis. And the benefit-cost ratio of individual projects remains a key factor in decisions concerning project selection and budget priority-setting.

Since 1944, the Corps has been authorized to provide or support outdoor recreation at its project sites. Also since 1944, the Corps has been authorized to sell surplus water; an authorization expanded in 1958 to include selling water storage capacity for municipal and industrial water supply. (Allen, 1996)

Changing National Values

In the past 30-40 years, national values have focused increasingly on issues related to environmental quality and social equity. These changing values have contributed to further changes in the Corps’ mission and altered its planning and decision-making processes.

Increased environmental focus

By the late 1960s, the growing national debate over the global environment—and the human impact on it—was informing the debate about Corps projects. Historic planning assumptions, focused solely on controlling water, were increasingly being questioned. (NRC, *New Opportunity*, 2004) In 1965, the Water Resources Planning Act codified the Corps’ role in environmental protection, requiring that federal objectives for water management be equally balanced between national economic development and environmental quality. (NRC, *New Directions*, 1999) Economics was no longer to be the sole driving force.

During the 1970s and 80s, the Corps’ planning process became much more complex, as it implemented requirements in numerous laws and executive orders, such as the 1969 National Environmental Policy Act (NEPA) and the 1973 Endangered Species Act. The Corps is also the prime authority for issuing permits for grading, draining, developing, or otherwise altering the nation’s wetlands. These expanded demands also complicated the nature of planning because they drew many other agencies into the process, either in new or expanded roles. In addition to expanding the ongoing coordination with agencies such as the Bureau of Reclamation and the U.S. Fish and Wildlife Service, the Corps needed to work with other agencies, such as Environmental Protection Agency (EPA), the Council of Environmental Quality (CEQ), and the Federal Emergency Management Agency (FEMA). These new laws also specifically delineated a role for the courts in environmental issues, again complicating the Corps’ operating environment. (NRC, *New Directions*, 1999)

By the late 1970s, the Corps had articulated new environmental objectives, expanded public involvement in its planning, and brought new environmental expertise on board. (NRC, *New Directions*, 1999) New and increasingly intensive emphasis was placed on identifying potential environmental impacts of its construction projects through the NEPA process and on avoiding and or mitigating any such negative impacts.

In recent decades the evolution of national environmental goals has continued to reshape the Corps' mission. "Doing no harm" is no longer sufficient. Increasingly, the Corps is moving from the relatively limited goal of protecting the environment from negative impacts of its projects to a broader goal of restoring and sustaining it. In fact, environmental stewardship is now seen as one of the Corps' three primary missions, along with navigation and flood protection; environmental restoration is a growing part of the Corps' portfolio. A key concept of ecosystem analysis is that the response to any event cannot be examined in isolation; the cumulative effects of stressors must be examined. Evaluations of individual changes can severely underestimate the potential for environmental damage. But, historically, the Corps did exactly that, estimating the ecological impacts of incremental changes as projects were expanded. This type of piecemeal approach to environmental management, without a strong focus on cumulative effects, can result in a gradual degradation of the quality and quantity of habitats. Increasingly, the Corps has been charged, not only with correcting the environmental damage its projects have contributed to, but to consider environmental sustainability in all of its projects. And, it has undertaken ecosystem restoration efforts that are not authorized in conjunction with other, traditional, construction projects. (NRC, *River Basins*, 2004)

The Corps' 2000 *Planning Guidance Notebook* clearly states this evolved mission.

The Corps of Engineers incorporated ecosystem restoration as a project purpose within the Civil Works program in response to the increasing National emphasis on environmental restoration and preservation. Historically, Corps involvement in environmental issues focused on compliance with NEPA requirements related to flood protection, navigation, and other project purposes. The ecosystem restoration purpose shall be carried out in addition to activities related to NEPA compliance...Ecosystem restoration features shall be considered as single purpose projects or as part of multiple purpose projects....

This guidance states that, for ecosystem restoration projects, a plan that "reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective, shall be selected. This plan shall be identified as the National Ecosystem Restoration (NER) Plan."

So, the national thinking about how to address environmental issues has changed over time, and, with it, the Corps' mission. Expectations have moved from achieving water resources goals with little thought to environmental consequences, to avoiding negative impacts, to correcting damage, and, ultimately, to recognizing the potential to improve environmental sustainability in undertaking Corps projects.

And thinking is still evolving. The link between economic well-being and a healthy environment are becoming more evident. This realization leads to the conclusion that economic benefits should be included in the assessment of ecological values; that there are economic costs and benefits to ecosystem restoration projects (and to environmental impacts and mitigation efforts associated with other types of projects). Again, lessons from Katrina illuminate this discussion. Many believe that, absent the degradation of the wetlands prior to the storm, the storm's impact on the city and the further loss of wetlands would have been lessened. The economic losses,

including the opportunity costs in areas such as lost tourism, would have been less. As discussed in Chapter 4, Corps guidance does not consider these kinds of costs and impacts.

Emphasis on Social Equity¹

Over the years, the nation also has increasingly focused on social equity, seeking, among other things, to fairly distribute governmental services and goods among diverse populations. In 1994, President Clinton signed Executive Order 12898 on Environmental Justice.² The order expanded existing requirements by focusing on specific populations. Under the order, each federal agency must, to the extent practical, “...make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the U.S....” This executive order is based on civil rights legislation.

For many years before 1994, NEPA required analyses of a broad range of social and economic effects. However, to meet the intent of the executive order, expanded efforts are required. For example, EPA’s guidance on environmental justice indicates that planners may need to include more targeted and proactive efforts at community involvement and more sharply focused analyses—that assess not only the overall impacts, but the distribution of impacts demographically and geographically. The EPA guidance characterizes the ultimate impact of these more focused analyses, as follows, “...[T]he presence of disproportionately high and adverse effects may or may not necessarily change the final decision, but will change the focus of the analysis and may result in additional mitigation measures.” (EPA, 1998)

Corps actions, or inaction, can have profound affects on the populations around them. For example:

- Flood control can protect some communities, but not others, and could even increase the flood potential for some communities.
- Creation of reservoirs, locks, and other projects can force some home owners and businesses to give up land and relocate, possibly at an economic, community, or emotional cost.
- Projects can ensure a stable supply of water for some areas while others go underserved.
- Placement of particular structures can change aesthetics of an area, alter transportation corridors, and change the nature of affected communities.

History has shown that these types of negative impacts from governmental projects often fall more heavily on minorities and the poor, and that positive improvements may be less in some locations than in others. Planners must consider the direct risks or services to these populations

¹The Academy is committed to include social equity considerations in all of its management studies. See Appendix G for a more extensive discussion of the Corps’ implementation of environmental justice requirements.

² Many other legal requirements reinforce this concept, including several civil rights acts, NEPA, and the Clean Air and Clean Water Acts.

and identify potential disparities in alternative plans. To do so, they must ensure these populations, which are less likely to have the means to effectively participate in program planning, are brought into the process in a meaningful way. But planners must also consider the ability of these populations to deal with lower service levels or to recover from risk events. Minority and low-income populations are less likely to have the means and support to recover from disruptions created by project implementation or from floods or other dangers that could affect them absent governmental efforts.

Changing Circumstances

Aging infrastructure

Throughout its history, the Corps has focused heavily on building and improving water resources infrastructure—such as dams, levees, reservoirs, harbors, and navigation channels. Even the emerging ecosystem restoration mission includes construction (or demolition) of infrastructure in addition to other approaches, such as changing the operational schemes and schedules for existing water resources structures. But many of the Corps' projects are reaching, or have exceeded, their expected project life. Older structures require increasing levels of maintenance to assure that they can continue to function as they were intended and that they do not represent a serious threat to human life or safety. Increasingly, the Corps has needed to direct resources to operating and maintaining much of that infrastructure. In recent years, approximately half of its budget has been allocated to operations and maintenance.

The failure of the levees during Katrina highlight another quandary the Corps now faces. The levees were built over a long period of time, often to standards that, while accepted at the time of construction, are not considered adequate today. Moreover, the topography has changed significantly since many of the levees were built. Many levees were built with the expectation that surrounding wetlands would help provide flood protection. Much of these wetlands have since disappeared. Nationwide, the Corps faces a significant challenge in maintaining infrastructure designed for different times and different purposes.

So, the Corps is faced with continuing its traditional construction mission while adjusting to the increasing need to maintain that infrastructure, and—like other federal agencies with natural resource missions—to do so while seeking to define ecosystem restoration and develop policies and procedures in support of it. And, again like many other agencies, it is doing so in the face of declining staff and budgets.³ (NRC, *New Opportunity*, 2004)

Sponsor-maintained structures

Corps-built infrastructure that is operated by non-federal sponsors is also of concern. Though non-federal sponsors must demonstrate an ability to operate and maintain these structures before taking on that responsibility, as time goes by, maintenance may lapse. That was the case, for example, with the levees in the Sacramento-San Joaquin Delta. In that river basin, levees are maintained by local reclamation districts, with assistance from the state. But even with state

³ Corps officials estimate, for example, that the failure to adjust the Corps' appropriations for inflation has effectively denied the Corps approximately \$15 billion over the last ten years.

assistance, local districts—having limited resources due to the small tax base afforded by an agricultural area—have struggled to improve and maintain critical levees in the river delta. Levees in some areas suffer from instability, erosion, and seepage. A significant Corps-led effort is now underway to fix that problem, with \$90 million in federal funds authorized. (See case description in Appendix E for more information.) Likewise the levees in New Orleans had been locally maintained, and, in the view of many, inadequately so.

The Corps maintains some responsibility for inspecting the flood damage reduction structures it turns over to non-federal sponsors. Under existing policy, the frequency of inspections is based on the condition of the levee and inspection ratings, as well as on risk. For example, projects that protect urban areas, or ones in which failure would be catastrophic and result in loss of life, must be inspected annually, while others in rural areas with acceptable inspection ratings may be inspected only every two or three years. There are established procedures for follow up of any problems these inspections find, beginning with a notice to the sponsor of the needed repair, moving to notification of the state, and ultimately, in exceptional cases, to litigation.

But, at least in recent years, the Corps inspection efforts have been uneven. Corps inspections can vary from “fly-overs” to on-the-ground inspections. Except for dam safety, there is no dedicated program funding, and officials emphasized that the budget for the “inspection of completed works” program is variable and has shrunk over time.

But the Corps intends to place more emphasis on the inspection of structures turned over to non-federal sponsors. The Corps is undertaking an inventory of levees and floodwalls to create a baseline of knowledge about the condition of flood control structures under its responsibility. As described by a Corps official, once this baseline is established, the plan is to implement a three-tiered inspection process for both Corps-built and non-federal flood control structures. The first tier would encompass the current inspection process, focused on certifying that certain maintenance activities and other procedures are being performed by the sponsor. This tier might be undertaken every one or two years for example. The second tier, the technical evaluation, might be undertaken every three to seven years. The third tier, a comprehensive risk assessment, might be performed every ten years. Methods are currently being developed for this application.

Large and growing backlog of authorized projects

Congress has, over the years, authorized many more studies and projects than it has appropriated funds for. Estimates of the current backlog vary widely, depending on the definition used. If one takes the backlog to include all authorized, unfunded projects, Corps officials estimate its size at nearly \$60 billion. It is smaller, however, if one counts only those authorized, unfunded projects that are consistent with current Administration policy; in that case officials estimate the backlog at about \$8.5 billion.

When placed against the Corps’ less than \$2 billion annual construction budget, even the latter estimate suggests that it would take years to complete these projects, not including funding for on-going projects. And the backlog is likely to grow. For example, the WRDA 2006 bill (which received considerable attention in 2006, but was not passed before the end of the 109th Congress) included additional authorizations for studies and projects. On-going studies are also

likely to result in proposals for new projects for which Congressional authorization will be sought.

The existence of this backlog is problematic for several reasons. It constitutes a large pool of projects which can be funded without concern for either their relation to other projects or, more importantly, their relation to the broader issues and needs of the watershed in which they are located. They complicate the budgeting process and—given Congressional and local support for the unfunded projects—stand as an incentive to spread funding widely, over many projects, rather than to complete high priority projects already begun. And finally, these authorized, unfunded projects represent unmet expectations and frustration for the local and Congressional stakeholders who worked, often very hard, to secure their authorization.

The apparent “disconnect” between Congress and the Administration concerning what kinds of projects should be funded can also make it difficult for the Corps to plan beyond the current year. Existence of the congressionally authorized projects that do not meet Administration budgeting requirements can result in a cycle of the Corps not budgeting for them, but Congress appropriating funds anyway. The next year, however, in spite of the appropriation, the projects usually would not be included in the President’s budget request.

National security issues

Significantly increased attention to possible terrorist or other threats to Corps infrastructure is now required. The Corps is cooperating with DHS to develop and implement an assessment of key elements of that infrastructure under the DHS Critical Infrastructure Protection Program.

DHS has identified 13, often interrelated, sectors that serve as an organizational base for its efforts to assess and protect the nation’s infrastructure. Though specific definitions of these sectors have not yet been completed, the Corps has responsibilities related to four of them: transportation systems, water supply, energy, and dams. The “dams” sector is defined broadly to include, for example, locks and levees, hurricane protection structures, canals, and aqueducts.

With regard to dam safety, DHS is relying heavily on the Corps’ on-going, congressionally mandated, dam safety program. The dam safety community has made great strides in developing assessment approaches. But the types of threats considered by DHS relate to different sources of vulnerability (e.g., intentional damage by terrorists) than those (e.g., seepage) usually considered in dam safety assessments, or in risk assessments of other types of Corps projects. Additionally, design of new construction projects and major rehabilitation projects may now need to include structural and non-structural features that would reduce vulnerability to such intentional attacks.

Risk management, and its application by the Corps, is discussed more fully in Appendix F.

Changing Emphasis on Watershed Planning

The above discussion demonstrates that today, the Corps must plan and manage water resource projects in the context of multiple local objectives, multiple national goals, and multiple agencies. It must balance requirements for upkeep of existing facilities with expectations for

fulfilling emerging needs. And it must recognize potential long-term impacts over wide geographic areas. Increasingly the Corps and the engineering and academic communities have recognized that this planning needs to be done in the context of watersheds.

The term watershed is used here in a broad sense and can refer to river basins, watersheds within river basins, or coastal systems. The term watershed management, as used here, is intended to encompass the concepts of systems planning and management. Essentially, watershed management entails planning and implementing Corps (and other agency) efforts in the context of the geological and hydrological area that would influence, and be influenced by, those efforts. That context would include all the interrelated systems (natural and human), and planning would seek to balance the multiple objectives of all stakeholders as well as “unintended impacts” that could result.

As described below, the concept of watershed planning is not new to the Corps, though the emphasis placed on it in national policy has ebbed and flowed. Later chapters will more fully define this concept and will discuss current efforts and obstacles the Corps faces in implementing a watershed management approach.

Early watershed planning

As early as 1927, The River and Harbor Act authorized the Corps to undertake comprehensive surveys to formulate general plans for the most effective improvement of navigable rivers and their tributaries. Known as the “308 reports” these were the nation’s first comprehensive river basin plans and over the next 60 years many Corps projects had their origins in these studies. A report summarizing these reports included 1600 potential projects for flood control, navigation, irrigation, and hydropower, and served as the basis for the National Flood Control Program enacted in 1936. (Allen, 1996) The 308 report for the Tennessee River Basin provided the basis for developing the Tennessee Valley Authority (TVA). The Tennessee basin was the first to be studied with the purpose of designing a unified program and this was the first such program to be authorized. It effectively demonstrated the feasibility of such programs. But, while multiple positive impacts, especially economic impacts, have been attributed to the program, the TVA was not specifically charged with missions beyond water control. (White, 1957)

Federal-level interagency committees for coordinating development of river basins were active in many areas throughout the 1930s. Gradually, states began participating with the federal agencies in river basin planning. (McDowell, 1986) The 1940s saw the creation of the Federal Interagency River Basin Committee and, by 1950, five regional federal committees. At least in part, these committees were intended to reconcile the overlapping missions of the several federal agencies that by that time were charged with water resource roles.⁴ (NRC, *New Directions*, 1999)

Several national commissions and investigations in the 1950s and 60s illuminated the potential value of river basin planning for the nation’s water resources. (NRC, *New Directions*, 1999) In the 1950s and 60s “... [t]he idea of an optimum mix of technically supportable projects within one river basin formed an important component of the Corps’ culture.” (NRC, *River Basins*,

⁴ Chief among these other agencies was the Bureau of Reclamation, established in 1902.

2004) However, the broad-based planning concept met practical difficulties in the political arena. Congress was uneasy with the concept of allowing executive branch planners to select projects. Also, the Corps found that supporting Congressional initiatives helped protect its autonomy and appropriation levels. (NRC, *New Directions* (1999); *New Opportunity*, 2004))

A national policy supporting river basin planning

What NRC has termed the “high water mark” of federal commitment to integrated rational water resources planning came in 1965 with passage of the Water Resources Planning Act. (NRC *River Basins*, 2004) The Act established river basins as the planning focus for water resources in the U.S. Although traditional project-specific funding remained, this 1965 Act committed both Congress and the executive branch to a more broad-based, rational approach to water resources planning. (NRC, *New Directions* (1999); *New Opportunity*, 2004)

Title I of the Act created the executive-level Water Resources Council (WRC), bringing together the heads of seven agencies (later joined by EPA) to oversee planning for the nation’s water resources. Title II established a framework for creating, with agreement of affected states, joint federal-state river basin commissions.

WRC completed two national water assessments, and also worked, ultimately unsuccessfully, to develop guidelines for large-scale watershed planning. (NRC *River Basins*, 2004) One act that has had long-term national implications was the issuance of guidelines to be followed by federal agencies for planning specific water resources projects. WRC first issued principles and standards for water resource planning in 1973. Eventually these were replaced with WRC’s 1983 *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G); this document is still used today.⁵

Ultimately, seven (of a possible 18) Title II regional river basin commissions were formed in response to the 1965 act. (Schad and Schilling, 2002) They were formed to promote the coordination of federal and state water management agencies. (NRC, *New Directions*, 1999) These commissions had official state representation, and a fulltime, presidentially-appointed chairman. Each commission had a small staff to perform planning and coordinating functions, but they relied substantially on the work of federal agencies. (McDowell, 1986) The experience of the Delaware River Basin Commission (DRBC) demonstrates the benefits of having a formal organization with professional staff. (See Box 2-1.)

⁵ The P&G was published by the U.S. Water Resources Council, and signed by President Ronald Regan on March 10, 1983. The guidelines inform project planning by four agencies: the Corps, the Bureau of Reclamation, TVA, and the Natural Resources Conservation Service. The work of WRC was focused at three levels: the national assessments “level A;” watershed guidance “level B;” and specific projects “level C.” Guidance for watershed (level B) analyses was never issued.

Box 2-1: Organization and Staff Support Benefit Efforts in the Delaware River Basin

In 1961, New York, New Jersey, Delaware, and Pennsylvania, along with the federal government, signed the Delaware River Compact, which created for the first time, a regional body in which the federal government and a group of states joined together as equal partners to oversee a unified approach to managing a river system without regard to political boundaries.

The operation of the Commission itself is funded primarily by the signatory parties. The Commission is supported by a full-time professional staff, and has been fortunate to have executive directors who have remained for long periods of time. The Commission relies heavily on the staff for analysis in carrying out its emergency powers. Projects are funded by different mixes of federal, state, and local sponsors. Commission staff work to help identify the most likely source of funding (for example, the federal or state agency with the most directly linked mission) and, if necessary, to bring together multiple sources of local funding to meet cost-share requirements.

(See case description in Appendix E for more information.)

Though the legislation creating the WRC and the regional commissions was never repealed, the WRC staff was disbanded in the early 1980s. In part, WRC's detractors blamed it (and its guidance) for increasing the costs of, and delays in, Corps projects. (NRC, *New Directions*, 2004) The regional commissions were also disbanded. By this time the commissions covered about 40 percent of the nation.⁶ (McDowell, 1986) In part, regional planning was delayed because of the need to coordinate many legal requirements and stakeholders, such as the Corps 308 reports, coastal zone management, and increasing water quality statutes. (Kenney, 1995) Though many judged the regional commissions as only moderately successful (NRC, *New Directions*, 1999), at least one researcher concluded that they had begun to have some impact on the traditionally construction-oriented water resources planning efforts. (McDowell, 1986).

With the demise of WRC and the regional commissions came the curtailment of what had grown to be a substantial level of federally supported, detailed, water resources planning. (Schad and Schilling, 2002) With federal funding declining, policy-makers searched for ways to more effectively use the funds that were available. The implications of the subsequent 1986 cost-share provisions are discussed in more detail later in this chapter.

Recent Corps watershed planning efforts

As is clear from the preceding discussion, the benefits of watershed planning have long been recognized in the Corps.⁷ The demise of the WRC and regional commissions did not necessarily preclude the Corps from pursuing a watershed planning approach. In fact, the Corps' current strategic plan endorses the concepts of watershed planning, stating that integrated water

⁶ In most areas where they did not exist, the federal interagency committees established earlier continued to operate; in some places planning continued to be carried out by individual states and federal agencies.

⁷ In fact, Corps field offices are organized around river basins at least in part to facilitate planning on a watershed basis.

resources management facilitates the search for comprehensive and integrated solutions to achieve objectives set by all concerned parties, rather than concentrating on a single water use at one project site.

The Corps can point to several instances where such efforts have been undertaken. In a 2004 study, however, the NRC reported that, for the most part, where broad-based systems requirements have been addressed, it has been in response to specific Congressional authorizations or mandates, and these are most often mandates for ecosystem restoration. That report, *River Basins and Coastal Systems Planning within the U.S. Army Corps of Engineers*, summarizes several “watershed-based” Corps efforts. Among its conclusions is:

It is evident to this panel that the Corps, when given the authority and funding, is capable of multi-stakeholder, multi-objective planning projects that incorporate a diverse range of economic and environmental issues over the necessary spatial and temporal scales. Although it was not possible to prepare a “report card” quantitatively on the Corps’ performance in using integrated water resources planning, it was nonetheless evident that its application was less consistent than desired and that particular deficiencies and barriers exist that, if addressed, would allow the Corps to perform more consistently and effectively.

Recent Corps watershed-based efforts, as well as factors that work against such efforts, are discussed more fully below and in Chapter 5. Appendix E also provides brief descriptions of several of these efforts.

INFLUENCE OF NON-FEDERAL PARTNERS ON PROJECT ORIGINATION AND DESIGN

Local needs and impacts have always influenced Corps project planning and implementation, and a variety requirements for non-federal cost-sharing—for example in the form of land easements—have existed for many years in relation to Corps projects. However, a provision in the Water Resources Development Act (WRDA) of 1986 significantly increased that influence.

Increased Local Influence

Prior to 1986, project planning studies were funded fully by the federal government, and cost share requirements that existed for project implementation were often met through in-kind contributions, such as land. WRDA 1986 stipulated for the first time that non-federal sponsors must make actual cash contributions, and required such contributions for most Corps studies as well as projects. While the Act authorized full federal funding (up to \$100,000) for reconnaissance studies—to determine if a project was needed and if there was an appropriate federal (Corps) role—it required that non-federal sponsors fund 50 percent of the feasibility study—to identify and assess alternative proposals and recommend a preferred option. Non-federal cost share requirements are also established for implementation of each specific kind of project (dams, navigation, etc.). (NRC, *New Opportunity*, 2004)

At the time these provisions were passed, Congress was faced with significantly reduced funding available for the Corps. Advocates of the cost-share provisions expected them to allow federal funds to be spread among more projects and to be used more efficiently—assuming locals would only be willing and able to support truly worthy projects. The legislation created a framework for federal-non-federal partnerships. (NRC, *New Directions*, 1999) The necessity of having non-federal funding for studies and projects, and the corollary of having significant involvement by non-federal partners, are seen by many as accomplishing the key intensions of the provision. At the same time, the Corps has argued that the cost-share requirements make non-federal sponsors' concerns key, and increase the power of local sponsors and their Congressional representatives, especially in deciding the scope of studies and selecting project designs. (NRC, *New Opportunity*, 2004)

Project Origination and Design

The current process for origination and funding of projects has significant implications for how the Corps approaches its mission. A primary feature of the current process is the requirement for a non-federal cost-share contribution for most project planning studies as well as project implementation. The scope and design of specific studies and projects reflect the particular needs and resources of non-federal sponsors. This section provides a review of the principal features of the origination and funding process, presents summary data on project sponsor types and sponsorship structures, and project size, and how they vary by business line. The incentives that influence project design and scope are reviewed. Also discussed are the implications of limited study authority for the Corps' ability to plan for meeting infrastructure needs in a timely and cost-effective way.

Typically, projects originate with the authorization of a “reconnaissance” study. A reconnaissance study is a preliminary review undertaken by the Corps to make an initial determination of federal interest. Reconnaissance studies are fully federally funded. Once a determination of federal interest is made, the Corps works with the non-federal sponsor(s) to develop a cost-sharing agreement for a feasibility study. The non-federal sponsor(s) must commit to sharing half the cost of the feasibility study. The feasibility study provides the basis for seeking authorization for a construction project. Once the feasibility study is completed and submitted to Corps headquarters for approval, work may begin on a pre-construction engineering and design (PED) study.⁸ Twenty-five percent of the cost of the PED study is borne by the non-federal sponsor(s). However, once construction is started, the design costs are included in the total project cost, which must be shared by the non-federal sponsor(s) in accordance with the terms of the project cooperation agreement. A cooperation agreement with the non-federal sponsor(s) must be signed before an authorized construction project can proceed. Under the agreement, the non-federal sponsor(s) agree to share a given proportion of the project cost depending on the type of project. For instance, non-federal sponsors must share 35 percent of the cost for a flood damage reduction project.

The universe of non-federal sponsors includes state and local general purpose governments and their agencies, as well as special purpose government entities, such as levee districts and port authorities. Non-profits can also sponsor Corps projects. The structure of sponsorship also

⁸ PED studies are not required for Inland Waterways projects and Dam Safety projects.

varies. While most projects have a single sponsor, many have multiple sponsors that may include a mix of government entities. The majority of sponsors are local governments or agencies.

A summary analysis of the projects included in the FY 2007 Corps budget provides a snapshot of the range of sponsor types and sponsorship structures for studies and projects and how these vary across the Corps' three major business lines. A majority of studies and projects across the three major business lines are sponsored solely by local government entities. The flood damage reduction business line leads with 70 percent of studies and projects sponsored solely by local government entities, closely followed by the navigation business line in which 68 percent of studies and projects are sponsored solely by local government entities. Only 51 percent of ecosystem restoration studies and projects are sponsored solely by local government entities. Significant proportions of flood damage reduction and ecosystem restoration studies and projects have multiple non-federal sponsors, 37 percent and 20 percent respectively. In both cases, studies most often have multiple sponsors, 80 percent in the case of flood damage reduction and 71 percent in the case of ecosystem restoration. No navigation studies and only one navigation project have multiple sponsors. See Table 2-1 for details.

Table 2-1. Description of Non-Federal Sponsors for Projects and Studies in the Corps' 2007 Budget Request (for three main business lines)

Studies	Construction Projects
<p>Flood Damage Reduction: 19 Studies; all cost-shared by non-federal sponsors</p> <p><u>Non-federally sponsored studies</u></p> <ul style="list-style-type: none"> • 8—Local general purpose government only • 1—local, special purpose government only • 3—mix of local government entities • 2—state/territory government only • 4—mix of state and local government • 1—no sponsor identified <p>8 projects with multiple sponsors</p>	<p>Flood Damage Reduction: 14 projects; 8 cost-shared by non-federal sponsors</p> <p><u>Non-federally sponsored projects</u></p> <ul style="list-style-type: none"> • 2—local general purpose government only • 4—local special purpose government only • 1—mix of local government entities • 1—state special purpose government only <p>2 projects with multiple non-federal sponsors</p> <p><u>Other projects</u></p> <ul style="list-style-type: none"> • 2 MR&T projects (cost-share significantly below current program requirements) • 4 dam safety/major rehabilitation projects (100% federal funding)
<p>Navigation: 7 studies; 6 cost-shared by non-federal sponsors</p> <p><u>Non-federally sponsored studies</u></p> <ul style="list-style-type: none"> • 1—Local general purpose government only • 3—Local special purpose government only • 2—State government only <p>No projects with multiple non-federal sponsors</p> <p><u>Other studies</u></p> <ul style="list-style-type: none"> • 1-- Inland Waterways Trust Fund* 	<p>Navigation: 20 projects; 10 cost-shared by non-federal sponsors</p> <p><u>Non-federally sponsored projects</u></p> <ul style="list-style-type: none"> • 2—local general purpose government only • 5—local special purpose government only • 3—state special purpose government only <p>1 project with multiple non-federal sponsors</p> <p><u>Other Projects</u></p> <ul style="list-style-type: none"> • 7—Inland Waterways Trust Fund* • 2—100% federal funding** • 1—Dam Safety (100% federal funding)
<p>Ecosystem Restoration: 30 studies; all cost-shared by non-federal sponsors</p> <p><u>Non-federally sponsored studies</u></p> <ul style="list-style-type: none"> • 9—local general purpose government only • 5—local special purpose government only • 2—mix of local government entities • 9—state, general purpose government only • 1—state, special purpose government only (Port Authority of NY and NJ) • 1—non-profit • 3—incomplete sponsor information <p>5 projects with multiple non-federal sponsors</p>	<p>Ecosystem Restoration: 6 projects; 5 cost-shared by non-federal sponsors</p> <p><u>Non-federally sponsored projects</u></p> <ul style="list-style-type: none"> • 2—local government (various, prospective, incomplete information) • 2—state general purpose governments only • 1—state special purpose governments only <p>2 projects with multiple non-federal sponsors</p> <p><u>Other projects</u></p> <ul style="list-style-type: none"> • 1—financed by public hydropower revenues

* Inland Waterways navigation studies and projects do not require non-federal sponsors. Fifty percent of these studies and projects is funded by the Inland Waterways Trust Fund, a federal trust fund financed by a fuel tax on waterway users.

** In the case of Montgomery Point Lock and Dam, the Congress waived cost-sharing by the Inland Waterways Trust Fund in favor of full funding by appropriations. The Mississippi River between the Ohio and Missouri Rivers project is classified as “regulating works.” The project was initially authorized in 1910.

Potentially fundable projects may originate with a request from a cost-share sponsor, a member of Congress, the Corps—based on a Corps-initiated study—or they can emerge from a collaborative planning process of some sort. The “projects” themselves may vary greatly in size and scope—from a simple project that could be completed in a single year, to a very large system of facilities that would need to be completed in segments over a period of several (or even many) years. A summary analysis of the FY 2007 Corps budget provides a snapshot of the range in size of studies and projects and how this varies across the Corps’ three major business lines.

Table 2-2. Range of Estimated Total Federal Cost* of Studies and Projects in Corps 2007 Budget Request (for three main business lines)

Studies	Projects
<p>Flood Damage Reduction</p> <p>\$300,000 - \$4million</p> <p>Range does not include an outlier: \$6.9 million for California Coastal Master Plan. The Plan encompasses the entire California coastline and is intended to inform possible regional projects and reduce the number of discrete local projects.</p>	<p>Flood Damage Reduction</p> <p>\$4.963 million - \$554 million</p> <p>Range does not include two outliers: two MR&T projects top the list by a wide margin.</p> <ul style="list-style-type: none"> • Channel Improvement—\$3.995 billion • Atchafalaya Basin Floodway—\$1.779 billion <p>These two projects account for 76 percent of the combined estimated federal cost of flood control projects in the 2007 budget request.</p>
<p>Navigation</p> <p>\$2.44 million - \$6.562 million</p>	<p>Navigation</p> <p>\$168,000 - \$1.924 billion</p> <p>Seven of the twenty projects are cost-shared by the Inland Waterways Trust Fund. These projects account for 52.47 percent of the combined total estimated federal cost of navigation projects in the 2007 budget.</p>
<p>Ecosystem Restoration</p> <p>\$175,000 - \$9.5 million</p> <p>Range does not include two outliers:</p> <ul style="list-style-type: none"> • Louisiana Coastal Area: Aquatic Ecosystem Restoration—\$123.15 million • Louisiana Coastal Area: Science and Technology Program—\$50 million 	<p>Ecosystem Restoration</p> <p>\$7.693 million - \$766.195 million</p> <p>Range does not include an outlier: South Florida Everglades Ecosystem Restoration—\$3.205 billion</p>

* Note: Estimated total federal cost refers to the total cost of completing the study or project, not simply the amount budgeted in fiscal year 2007.

One of the most significant impacts of the cost-share requirements is that they limit the scope of the Corps’ planning efforts and thereby the design of projects. The financial capacity and other needs of the sponsor have become important considerations in determining the characteristics of the planning study and the final proposal. Non-federal sponsors may be unwilling or unable to

support broad-based studies that go beyond issues directly related to the problem they are seeking to solve.⁹ The impact of the lack of local funding to undertake comprehensive studies may be demonstrated in the experience in the Sacramento-San Joaquin Delta. Absent sufficient authorization and a local sponsor, the Corps could not undertake such a study. Only recently, with levees already in bad repair and federal funding for projects already authorized, has a more comprehensive study been undertaken. (See Box 2-2.)

Box 2-2: Corps Comprehensive Study in the Sacramento-San Joaquin Delta Comes Only With Specific Congressional Direction

Over the years, the many miles of levees in the Sacramento-San Joaquin River Valley have deteriorated, resulting in negative effects on water quality, supply, and conveyance. The Corps made improvements to the levees in the Delta in the early 1960s when it constructed the Sacramento-San Joaquin River Flood Control Projects. Since then the Corps has undertaken limited studies in the Delta over the years with available funds. However, the Corps did not have the authorization to undertake a comprehensive study of the area. The main challenges have been a lack of sufficient economic justification and the lack of non-Federal cost-sharing partners with funds.

In 1994, twenty-five state and federal agencies signed an agreement to develop water quality standards and long-term strategies for addressing fish and wildlife, water supply reliability, levee stability and water quality needs. They began with the development of a comprehensive plan, which was completed in September of 1996. The Corps participated in the development of the program from its inception, providing technical expertise in levee system integrity and water resource planning.

But the need for more comprehensive review has been recognized. In 2004, the Congress directed the Corps to deliver a report that identifies and prioritizes potential levee stability projects in the Delta that could be carried out through 2010 with \$90 million in federal funds that have already been authorized. The Corps' 2006 report discusses the short-term strategy (through 2010) as well as a long-term strategy to be developed in the Sacramento-San Joaquin Delta Islands and Levees Feasibility Study. This additional study will assess existing and future flood risks in the Delta as well as ecosystem restoration, recreation, and water supply needs and develop a comprehensive plan for future Federal participation in the Delta.

(See case description in Appendix E for more information.)

⁹ Even when a project originates from a Corps planning study (without cost-share), a cost-share sponsor may need to be found before the project can proceed.

Likewise, sponsors are not always willing or able to support the project design the Corps recommends as providing the best protection or contributing most to national economic development.¹⁰ Policies specifically allow for a “locally preferred plan” to be recommended by field offices as the alternative to be constructed if requested by the non-federal sponsor. Concerns about providing the required contribution could be one reason for such a request. However, such plans need to be approved by the Secretary and must meet Administration policies for “high-priority outputs.”

Some factors can mitigate these impacts somewhat. For example, local sponsors that do not have adequate financial resources to sponsor a project on their own may partner with their state government to meet the Corps criteria for long-term financial participation. The data in Table 2-1 indicate that this is not the norm, however. More often, multiple local governments and/or agencies partner to provide the cost-share required.

With passage of the 1986 cost-share provisions, Congress took into consideration the needs of poor areas. It created a provision for flood damage control projects that allowed the Corps to reduce the non-federal cost share for those sponsors who did not have an “ability to pay.” One of the principles the Corps followed in developing the implementing regulations for this provision was that cost share reductions should be granted in only a limited number of cases of severe economic emergency. (ER 1165-2-121, 1989) In WRDA 2000, the ability-to-pay provision was expanded to other types of projects. However, implementing regulations for the 2000 provision have not been published. According to Corps officials, in practice, the provision seldom comes into play. This provision does not apply to sponsors’ ability to pay for operation and maintenance.

Implications for Systems-based, Watershed Planning

The nature and scope of feasibility studies have a determinative effect on the ultimate project proposed. There is little federal money budgeted to support studies independent of the particular concerns of a local sponsor. Reconnaissance studies, which are fully federally funded, are limited to \$100,000 and, consequently, support little more than a review of existing data and studies to make an initial determination of federal interest. Consequently, the requirement for non-federal sponsorship, along with sponsor desire to reduce costs, places a significant drag on the Corps’ ability to conduct systems-based planning.

The small project with a single cost-share sponsor might have low costs and be easily budgeted, but might yield low benefits—perhaps of questionable national significance. The Corps “study” required to justify it could be small and quickly prepared from pre-existing data and prior studies—but it might not have the breadth of scope or depth of analysis to provide assurances that its affects on other projects, related ecosystems, and human interactions have been adequately considered.

¹⁰ In some cases other federal programs work against Corps priorities. For example, non-federal sponsors may only be willing to fund protections against the “100-year flood” because that is the standard needed to obtain coverage under the National Flood Insurance Program, even though the Corps analysis indicates a higher level of protection is economically warranted. (NRC, *New Opportunity*, 2004)

The larger, more complex project might require multiple cost-share sponsors to cover the high costs, take much longer to launch, and require budgeting in a multi-year sequence of segments; but it might yield significantly more benefits. The Corps study required to justify it might need to be specially funded and could, itself, take multiple years to be developed, adopted, and approved by the Corps. Relatively few large studies of this nature have been funded in recent years.

A large Corps watershed (or river basin) planning study might generate project proposals on its own, or might simply respond to an external request, or might do some of each. In any case, it would be expected that this type of study would be more comprehensive and might produce more fully justified projects than the average small, project-specific study. Projects generated this way would be more likely to be products of systems planning and systems integration. If watershed-based, they would be likely to be sensitive to all the needs of the watershed, rather than being focused only on a single function or goal—in isolation from other affected functions and goals. Watershed-based planning is increasingly becoming important to reaching multiple-agency, multiple-program, and intergovernmental goals for clean water, clean air, efficient and clean transportation, clean energy, healthy ecosystems, and more. But the underlying studies can be costly and non-federal sponsors may not see the relevance to their own needs. As discussed above, to the extent these types of studies have occurred, they almost always receive specific Congressional authorization and funding. In fact, three efforts the Corps often points to as important on-going watershed efforts were specifically authorized and funded by Congressional initiatives.¹¹

CONCERNS ABOUT PRIORITIZATION IN THE CORPS' CONSTRUCTION PROGRAM

Hurricane Katrina has brought renewed attention to how the Corps sets priorities and implements them. Stakeholders have expressed two overarching concerns. First, questions have been raised about the apparently limited range of criteria considered as well as about the application of one criterion in particular, the RBRC ratio. Second, stakeholders are frustrated by the lack of transparency in the budget process. The basis for budget decisions is not clearly understood. Another concern is how to balance investments in construction and maintenance in light of the large and growing demands of maintaining a vast and aging infrastructure. Finally, there is concern over how priorities are implemented. Concerns about criteria, methods, trade-offs between construction and O&M, and implementation are each addressed in the sections below.

Limited Set of Selection Criteria

One area of criticism is the Corps' use of benefit-cost analysis as the primary criterion in evaluating and ranking construction projects. Most recently, critics have focused on the Corps' use of a particular benefit-cost measure, the RBRC ratio, which was introduced as a primary ranking criterion for the FY 2005 budget. Other criticisms include: inadequate consideration of

¹¹ See Appendix E for a description of the Louisiana Coastal Restoration and Protection project, Everglades restoration, and the Sacramento/San Joaquin River Basin study.

human safety and other risks, environmental costs and benefits, and social equity considerations, as well as the often narrow focus of studies and projects and the lengthy and uncertain progress of projects.¹²

Over-emphasis on benefit-cost analysis and RBRC ratios

For many years, the Corps has included some form of benefit-cost analysis as a key factor in project prioritization. The reliance on benefit-cost measures to prioritize projects has been a source of consternation for many stakeholders concerned that other important factors, such as risk to human safety, environmental damage, and social equity considerations, are not given sufficient weight in budget decisions. More recently, the Corps adopted the RBRC ratio as its benefit-cost measure for ranking and budgeting projects.¹³ The use of the RBRC ratio has raised issues of its own. For instance, stakeholders have contended that peculiarities in the behavior of the RBRC ratio can lead to volatility in the ranking of projects and thereby inconsistent funding and difficulty in completing projects. Issues related to primary reliance on benefit-cost measures and the RBRC ratio in particular are discussed in more detail later in this section and in Chapter 4.

A related issue is the funding strategy that the RBRC ratio has been used to execute. Beginning in fiscal year 2006, the Administration began setting threshold values of the RBRC ratio to guide decisions about what projects were included in the budget. An RBRC ratio of 3.0 (and in some cases 4.0) was established as the cut-off for including projects (except ecosystem restoration projects) in the budget request. Projects below the ratio would be added to the budget only if they addressed significant risk to human safety. The goal of this change was to improve performance by concentrating funding in a smaller number of relatively high-pay off projects. This strategy runs counter to the traditional practice of the Corps of distributing the budget across a broader array of projects. Alternative funding strategies are discussed in more detail in Chapter 4.

Insufficient consideration of human safety and other risks

Katrina highlighted concerns that the Corps does not adequately consider potential risk to human life in its prioritization of projects. This has been attributed in part to the Corps' primary reliance on benefit-cost analyses for evaluating flood control projects and the guidelines for applying the benefit-cost analyses. For example, in calculating benefit-cost for flood damage reduction projects, current Corps policies do not allow for the monetization of life and injury. Benefit-cost analyses focus, instead, on estimating the benefit of property damages prevented.¹⁴ Since at least FY 2006, the Corps has accounted for risk to human safety through a separate process: projects that address what is judged to be a significant risk to human safety may be proposed for funding

¹² The NRC's 2004 study, *Analytical Methods and Approaches for Water Resources Project Planning*, is the most recent and authoritative examination of the criteria and methods used by the Corps to evaluate and rank water resources construction projects. The study focused its evaluation on the guidance documents that inform Corps practice. These are the federal 1983 P&G and the Corps' *Planning Guidance Notebook* (2000).

¹³ The intent of the RBRC ratio is to focus attention on the impact of future budgeting decisions and discourage consideration of sunk costs that may lead decision makers to "throw good money after bad."

¹⁴ Some consideration is given also to business income losses and emergency response costs.

even if they do not meet the threshold RBRC ratio. However, it is not immediately clear to outsiders how this policy is implemented.

Some critics also believe that the Corps' practice of benefit-cost analysis is biased against non-structural alternatives to construction that might best increase human safety. The Corps' regulatory planning guidance requires it to consider non-structural alternatives (e.g., measures such as relocating structures out of the floodplain, flood-proofing or elevating buildings, and warning/evacuation systems) to achieve flood damage reduction goals. However, the 1983 federal P&G that governs Corps planning studies do not provide for the Corps to claim as benefits flood damages reduced by the relocation of structures from the floodplain. The relocation of structures must be justified largely by off-site and non-market benefits.¹⁵ Even if property damages prevented were claimed, the benefits of increased human safety would not be directly accounted for in the benefit-cost analysis.

Some also question whether, and how, the Corps explicitly incorporates other forms of risk into its decision-making processes. A variety of risks underlie project design and selection. Planners must estimate the probability and nature of the types of events that pose risks, for example, the risks of natural disasters, structural or functional failures of existing infrastructure, and the recently emphasized risk of terrorist acts against the high priority structures built and/or maintained by the Corps. Another aspect of risk assessment is estimating the likely human, economic, and social impact of those events. And with each of those estimates there is a level of uncertainty; uncertainty is common in most analyses, especially those relating to natural processes.

As discussed later in this chapter, the Corps has recognized the need to more fully assess risk in its planning. It may be farthest along with this effort in the work it is doing on coastal Louisiana. (See Box 2-3.)

¹⁵ Offsite benefits might include the reduction of peak flows and flood damages downstream beyond the boundaries of the project site. An increase in wildlife habitat following the removal of development from a flood plain would be an example of a non-market benefit.

Box 2-3: Corps is Developing a New Approach to Risk Assessment for Work in Coastal Louisiana.

Corps documents describing the extensive efforts ongoing in coastal Louisiana indicate that the Corps is moving beyond the relatively well-developed national economic development analysis to risk-based models of storm damage and risk to human life and property. The risk decision framework will include information on

- “Residual” risks. These are risks that result from events that exceed the design of the risk reduction approach; risks that cannot be reduced to zero. These risks may result from exposure of people, property, infrastructure, the ecosystem, the local economy, and social and cultural aspects of the region.
- “Non-structural” measures. These measures could include education, evacuation procedures, flood proofing, elevation, and relocation. They can supplement hurricane risk reduction measures and allow for greater project design flexibility. Accomplishing these measures is beyond the authority of the Corps, and could require action by the state and/or local governments.

(See case description in Appendix E for more information.)

Environmental benefits and costs

The Corps also has been criticized for not placing environmental considerations on a par with economic factors in its evaluation of construction projects. This tendency mirrors the heavy focus on economic development in the 1983 P&G. (Carter, January 2006)

Significant environmental analysis is often undertaken to implement NEPA requirements, and, as noted above, the Corps has included guidance for selecting ecosystem projects (and projects with combined economic and ecosystem goals) in the planning guidance. Still, an NRC report found that the Corps lags behind other federal agencies, such as the EPA and the National Oceanic and Atmospheric Administration, in the adoption of environmental evaluation techniques. This lag is identified as a deficiency in the Corps’ analyses of primarily economic projects (i.e., commercial navigation and hydropower), but also in the ability of the Corps to undertake effective analyses of ecosystem restoration projects which now comprise one its three main mission areas. Corps management is aware of this deficiency and has supported the efforts of its Institute of Water Resources to supplement Corps guidance for analyses in this area. However, the NRC report concluded that implementation of these techniques by the Corps will require approval from the OMB, or revision of the P&G, or both. (NRC, *Analytical Methods*, 2004)

Continuity and timeliness of project work

Many, including some members of Congress and project sponsors, are concerned that the current budgeting and appropriations process results in inconsistent funding and slow progress on individual projects. Corps officials expressed concern over the lack of consistency in the budgeting of projects from year to year. They said that funding for projects and studies is

uncertain—projects may be in one year and out the next. Not only does this contribute to inefficient operations, it creates significant concern among the sponsors who are providing funding and have expectations about completion.

The migration of projects in and out of the budget or appropriation could occur for a number of reasons. For example, Congress and the Administration may differ on overall funding ceilings or on which projects should be funded. Often, the budget ceiling OMB sets for the Corps construction program is lower than the prior year’s appropriation level. Congress then appropriates funds for more projects than are included in the budget request. And the process is repeated in the subsequent years. The Administration budget request again includes fewer projects than had been funded the year before, and Congress again adds funding for additional projects.

At least in part, Corps officials attributed this “in and out” phenomenon to changing Administration policies governing budgeting decisions, such as setting the RBRC threshold for funding a project. Traditionally, Corps budget requests and appropriations have been distributed more broadly among Corps projects, partially funding many projects rather than fully funding a few. The use of the RBRC threshold, discussed above, is an effort to focus Corps funding on a relatively small number of high-priority projects.

Though the policy is intended to support the increasing emphasis—by both Congress and the Administration—on completing existing projects rather than on starting new ones, it may also create an obstacle to continuity and timeliness.

Fluctuation in a project’s RBRC ratio can contribute to lack of continuity in project budgeting, if not funding. The design and implementation of projects can lead to fluctuation in the RBRC ratio over time, possibly resulting in projects moving in or out of the budget. For example in building levees, most benefits are achieved in the early stages of a project, resulting in RBRC reductions over time. As an individual project’s RBRC changes, so does the probability that it will be included in the budget. Projects can be included in the budget one year, but not the next, even if they are not complete. In flood programs, for example, such a lack of consistency may compromise the optimal level of flood protection for the region. This issue is discussed more fully in Chapter 4 and in Appendix I.

Narrow focus of projects

The Corps has faced criticism that projects are in some cases too narrowly focused and give inadequate attention to the larger systems in which they are undertaken, leading to significant unintended but avoidable consequences. Stakeholders have called for a broader, more systematic, “watershed approach” to planning and project design.¹⁶

Changes in the cost-sharing rules for financing the planning and construction of projects have been a major factor limiting the scope of the planning and projects that the Corps is able to undertake. The lessons learned from Katrina, discussed later in this chapter, reinforce the need

¹⁶ A key recommendation that followed from the Corps’ “listening sessions” with stakeholders in 2000 was to move toward a watershed approach.

for a systems approach to the Corps' work. This concern is addressed in more detail in Chapter 5.

Social equity concerns

Katrina put a spotlight on public concerns about whether the Corps' projects and programs have equitably served various population groups across the country. But concerns are not limited to those related to Coastal Louisiana.

Some concerns are directed at existing Corps policies that focus on benefit-cost analysis as well as legislative requirements for non-federal cost sharing. For example, as discussed above, the Corps' benefit-cost analyses for flood damage reduction focuses on the benefit of property damages prevented. This has fueled criticism that the ranking and funding of flood reduction projects has favored the relatively wealthy, because the magnitude of the benefit of property damages prevented will be greater for relatively wealthier neighborhoods. According to this logic, relatively wealthy neighborhoods have higher property values and, all things being equal, projects protecting those neighborhoods would be more highly ranked for funding. Additionally, requirements for cost-sharing, especially since 1986, can also create circumstances in which limited resources force non-federal sponsors to support construction of projects that meet lower levels of protection or service than recognized in the feasibility study as optimum. In these cases, the Corps may not provide the same level of protection for adjacent geographic areas.¹⁷

Also as noted earlier in this chapter, specific Corps projects can have negative social, economic and environmental impacts, and those impacts may disproportionately affect minority and low-income populations; populations with fewer means to influence decisions and fewer means to overcome negative impacts.

In 1970, Congress articulated four objectives for water resources projects, including enhancing the well being of people. The other three objectives were enhancement of national economic development, regional economic development, and environmental quality. But over the years, the focus of both federal and Corps-specific guidance has been predominantly on the national economic development objective, and, to a lesser extent, environmental protection. Moreover, the Corps has issued little in the way of guidance related specifically to the executive order on environmental justice, which goes beyond the customary "county level" analysis to more focused efforts to identify target populations, ensure their participation in planning, and prevent disproportionate impacts.

¹⁷ Two studies the Academy reviewed on this subject have not found significant bias in Corps programs. The most recent, a 1989 study by the IWR, surveyed almost 500 studies and projects considered for budget inclusion in the mid- to late 1980s. Using income and housing values as metrics, IWR found no statistically significant bias against low-income populations between studies and projects with favorable versus unfavorable action. It found this was true for flood projects that were considered, although it did find that flood projects, in general, served wealthier, more urban areas than other kinds of Corps projects. (IWR, 1989) It should be noted, however, that this study addressed the issue for the entire project area, and did not assess possible within-project distributional issues which are the focus of the 1994 environmental justice executive order. Also, it did not recognize the possibility that cost-share requirements could result in studies or projects not being proposed at all. Finally, it is possible that many of the decisions studied did not reflect the changes made in the 1986 WRDA.

In contrast, however, as part of its planning efforts in the Everglades restoration effort, the Corps has devoted considerable attention to environmental justice issues. The Corps' Everglades efforts with regard to environmental justice are discussed more fully in Appendix G, which discusses the Corps' and other agencies' implementation of the environmental justice executive order.

Lack of Transparency in Budget Process

The Corps' current budget process—described in more detail in chapters 3 and 4—is not well understood outside, and in some cases within, the Corps. That lack of transparency might, in fact, be at the heart of the Congressional concerns that spawned this study. The Corps was unable to clearly articulate the reasons for the priorities it set—that is for the project selections it made. One non-federal person the Academy staff spoke to called it a “black box” process. Even one official directly involved described the headquarters process as cloaked in “the fog of war.” Inability to clearly articulate priorities and how tradeoffs are made can contribute to lack of trust from many members of Congress, various interest groups, and the public at large.

Another concern related to transparency goes beyond the headquarters budget process to the broader planning and project selection process. In spite of public participation efforts, questions have been raised about the Corps' efforts and ability to communicate risks to the stakeholders and the public in general. In part, these concerns relate to the issue about risk discussed earlier, that is, it is difficult for the Corps to communicate risk if risk is not explicitly assessed. But a 1996 IWR report pointed to other concerns about communication of risk, both within the Corps and with its stakeholders. The public has a difficult time dealing with risk and understanding technical explanations, such as probability distributions, and the notion that every daily act has risk and that no project can be built to a “no risk” standard. In summary, the report notes:

...risk communication in the context of collective risk management decisions is not just a technical problem and cannot have a neat technical solution. Rather, the decision on what to communicate, to whom to transmit and to whom to listen, is part and parcel of designing not the project but the decision process itself. That is the ultimate reason it is so hard to communicate risk. (IWR, March 1996)

Also, lack of transparency can help hide intentional or unintentional misuse of data and analyses, which can, in turn, result in unwise project choices, and, once discovered, contribute even more to mistrust from Congress and other stakeholders. A key example was the focus of a Pentagon investigation report released in 2000. It concluded that officials of the Corps had manipulated data in a study to support construction of a large project on the Mississippi River, after initial studies concluded it was not justified. The report's conclusion went beyond that specific issue to conclude that the Corps has a “systemic bias toward huge projects” and to question the Corps' ability to conduct honest analyses. (*Washington Post*, December 7, 2000)

The Pentagon report concluded that motivations for such manipulation included efforts by the Corps to expand its budget and mission and to please customers and “Congressional patrons,” as well as the bias inherent in districts to get projects approved, since their budgets depend on funded projects. More recently, a 2004 NRC study commented on institutional incentives to

promote projects on a geographical basis in the interest of keeping field personnel employed (NRC, *Analytical Methods*, 2004).¹⁸ Some are concerned that this fosters a tendency for the Corps to spread funding (recommend projects for appropriation) to support existing staffing levels, rather than basing decisions on national needs. Staffing stability is important, and the reality of this overhead mechanism is beyond the scope of the Panel's effort. However, it could constitute a significant dilemma in implementing any system that could change how priorities are set and, therefore, how funding is distributed.

Operation and Maintenance (O&M)

As discussed above, the Corps' operating context is changing. The age and condition of much of the Corps-built water resources infrastructure is a growing concern. Despite a long project life, many of the Corps' water resource structures have exceeded their expected life. The Corps' budget is increasingly going to O&M projects. In fact, the largest share of the proposed FY 2007 budget request was allocated to O&M, with construction a close second. It is likely that O&M requirements will continue to grow in the future, putting even more pressure on budget resources.

This problem is complicated by the need to distinguish between "rehabilitation," "major rehabilitation," and "construction." The lines of demarcation are not entirely clear. In fact, the Corps has recently recommended that certain "major rehabs" be moved from the construction account to the O&M account. The Congress has not signaled whether it will agree to this approach.

The FY 2007 budget request suggested an alternative approach to the traditional project-by-project allocation of O&M funds. Under this proposal, O&M funding would be provided in one appropriation for each "water resource region," rather than for each project in the region. Again, Congressional approval has not been forthcoming. While this proposal could allow the Corps to take a more regional approach to O&M, it would not significantly affect the O&M versus new construction tradeoff.

NRC has emphasized the need for the Corps' policies and efforts to consider its entire suite of missions by undertaking "portfolio planning." Portfolio planning also "recognizes the magnitude of past investments and the need for continued resources to ensure their vitality and operational utility." Planning for existing structures and future construction would take place together. (NRC, *New Opportunity*, 2004) This concept is closely related to that of watershed planning, discussed above.

While the Panel was not asked to study O&M, it is difficult to avoid this issue. Corps officials and stakeholders alike are increasingly aware of the important—and difficult—tradeoffs that must be made between the construction and O&M budget accounts.

¹⁸ Since the NRC study was undertaken, the Corps has moved away from the practice of budgeting by division to a business line approach, wherein individual projects are prioritized by business line and combined to produce a construction budget. This approach might be expected to counter the institutional tendency discussed in previous reports.

Implementation of Priorities Set by Congress and the Administration

In addition to concerns about how the Corps' budget priorities are set, there is concern about the implementation of priorities established by Congress in its appropriations. These concerns center on the use of the Corps' continuing contracts authority and its authority to reprogram funds.

Often, it may not be possible, or even wise, to spend funds in exactly the way appropriated. As time progresses, there may be opportunities to spend effectively more funds than anticipated at the time of the budget request. In other cases, unforeseen circumstances preclude the ability to spend all of the funds appropriated. In the past, the Corps has had some ability to prevent funding stops and starts by using continuing contracts and reprogramming funds. These authorities have provided the Corps with significant flexibility, which many say is required to carry out priorities efficiently under changing circumstances. However, Congress and the Administration have expressed concern that this discretion has not always been exercised in such a way as to properly carry out established priorities.

Including a continuing contract clause in construction contracts effectively commits the government to payment of construction costs on a project beyond the amount of funding that has been appropriated. Reprogramming authority allows the Corps to move funds from one project to another without Congressional approval. In some cases, funds are moved into and out of a project account in different years. Together, these funding instruments enable the Corps to maintain momentum in on-going construction projects and avoid the added contract expense (which can be significant) of continually mobilizing and demobilizing the construction workforce. Additionally, by maintaining a schedule, it is likely that the public benefits of the water resources projects will be realized sooner.

Nevertheless, Congress and the Administration have begun to restrict the use of these authorities. In 2005, the Government Accountability Office (GAO) raised serious concerns about the Corps' use of its reprogramming authority.

[I]n fiscal years 2003 and 2004, the Corps reprogrammed funds over 7,000 times and moved \$2.1 billion among investigations and construction projects; the Corps could not provide agency-wide data for reprogramming actions for operation and maintenance projects. During fiscal years 2003 and 2004, more than 60 percent of the over 1,500 investigations and construction projects had funds reprogrammed.

Although the Corps generally followed its reprogramming guidance, the guidance has been developed in such a way that it permits extensive movement of funds without Congressional notification. (GAO, 2005)

As a result of findings such as this, Congress has imposed strict limitations on the Corps' flexibility for reprogramming funds without Congressional approval.¹⁹ Congress also placed limits on the use of continuing contracts.

The Administration is requiring that all contracts executed after 2005 include provisions to limit the costs to the government of terminating the contract, and "...ensure that the Corps is able to limit the amount of work performed under each contract each year to stay within the overall funding provided for the project during the fiscal year." (President's FY 2006 Budget Request)

These flexibility-related issues go beyond the Panel's primary focus, but inform whatever project selection process is used.

Katrina's Lessons

Studies following the Katrina disaster have focused heavily on technical design and construction issues. However, several findings are clearly relevant to how the Corps identifies, prioritizes, and selects projects and the context in which these activities are conducted. Among these broader issues are a lack of a systems approach, focus on short-term needs rather than long-term goals, and lack of a comprehensive strategy.

The Corps organized the Interagency Performance Evaluation Task Force (IPET) to evaluate the structural performance of the New Orleans regional hurricane protection system during and after Katrina. The IPET study, while focused on technical issues, reached a fundamental conclusion that goes to the heart of the Corps' current process. It concluded that the levees and flood walls were a "system" in name only. Performance was compromised by incompleteness of the system, inconsistency in the levels of protection, and a lack of redundancy.

The Corps commissioned the American Society of Civil Engineers (ASCE) to assess the IPET study's methodology and conclusions. While this study was also focused on technical issues, it raised concerns about organizational and policy issues seen as contributing to the disaster; concerns that are not necessarily limited to the Corps' policies and practices in coastal Louisiana. The ASCE, for example, pointed out that, as the hurricane protection "system" was being constructed, the design was often subject to compromises, resulting from stakeholder concerns about issues such as land use, project cost, and environmental effects. It concluded that "protection of the public's safety was not always the outcome of these compromises." ASCE further concluded that, given the human tendency to lose focus on long-term needs in light of short-term demands, "[a]ll responsible agencies in New Orleans and elsewhere should reevaluate their policies and practices to ensure that protection of public safety, health, and welfare is the top priority for infrequent but potentially devastating impacts from hurricanes and flooding." The report also points to the critical need to develop ways to effectively communicate risk to all stakeholders. (ASCE, August 2006)

The ASCE also emphasized the need for consistent leadership and coordination for protection systems such as that in New Orleans. Recommending appointment of a "commissioner" for such

¹⁹ See Sections 101 and 108 of P.L. 109-103, "Making Appropriations for Energy and Water Development for the Fiscal Year Ending September 30, 2006, and for Other Purposes."

systems, it emphasized the need for “leadership, strategic vision, definition of roles and responsibilities, formalized avenues of communication, prioritization of funding, and coordination of critical construction, maintenance, and operations. (ASCE, August 2006)

Another study, funded by the National Science Foundation, was undertaken by researchers at the University of California, Berkeley. Their report also points to some organizational and institutional problems associated with the governmental and local organizations responsible for the design, construction, operation, maintenance and funding of the overall flood protection system. That study reiterated concerns about inadequate attention to risk, especially changing risk over time—noting, for example that parts of the flood protection system were originally designed to protect agrarian, not urban, regions. It also concluded that the Corps should take a more systematic approach to design, construction, and maintenance of flood projects, and pointed to a complex, even dysfunctional, set of relationships, including those with Congress and various state and local authorities. (ILIT, 2006)

Assessments of the Corps’ post-Katrina efforts to rebuild, repair, and improve the levees and other flood protection structures around New Orleans have also raised concerns. A September 2006 report by the GAO pointed to the Corps’ success in restoring pre-hurricane levels of protection by June 2006. But in part the Corps had been forced to use temporary measures. Much work remains to be done, and the Corps estimated it would take years, and billions of dollars, to permanently enhance and strengthen the hurricane protection for Southeast Louisiana. Box 2-4, below, describes the key players in the Louisiana recovery effort.

GAO reported that, as the Corps proceeds, it is also working to address FEMA’s new flood control standards, devise solutions to problems identified by IPET, and evaluate approaches that will meet the long term needs of local interests and respond to Congressional requirements included in emergency supplemental appropriations bills. GAO raised concerns that “the Corps is proceeding with over \$7 billion of interim repairs and construction without a comprehensive strategy and implementation plan to ensure that these various efforts are appropriately coordinated and integrated with each other as well as with any future plans for a stronger hurricane protection system.” GAO recommended development of such a plan and the Corps concurred with the recommendation.

Among other points, the Corps’ response to GAO indicated that it was “actively developing a comprehensive watershed strategy for hurricane and storm risk reduction for coastal Louisiana and Mississippi,” and that it will ensure that the measures funded in recent appropriations will be integrated into that plan.

Box 2-4: Post Katrina Planning for Coastal Louisiana

Many federal, state, and local agencies are working to meet short and long-term goals in coastal Louisiana, from restoring storm protection to its pre-storm level and getting housing for the many displaced persons, to working to improve the storm protection, redeveloping the city and other areas, and restoring the ecosystem. The Corps is one of three key players in this massive effort, each with somewhat different but clearly related authorities.

The Corps' Louisiana Coastal Protection and Restoration project (LACPR) was authorized and (initially) funded through the 2006 Defense Appropriation Act and supplemental appropriations. Under the fully federally funded LACPR, the Corps is directed to "...present a full range of flood control, coastal restoration and hurricane (risk reduction) measures..." including protection against a "Category 5" hurricane. The final report is due December 2007.

The State's Coastal Protection and Restoration Authority (CPRA) is charged with developing a long-term comprehensive coastal protection plan, combining hurricane protection and the protection, conservation, restoration, and enhancement of coastal wetlands and barrier shorelines or reefs. The plan must address these issues from a short and long-term view and incorporate structural, management and institutional components. A final Master Plan is due before the Corps' report, in March 2007.

The Louisiana Recovery Authority (LRA), is guiding the State's social and economic recovery. Through the long-term community planning initiative "Louisiana Speaks" and other collaboration efforts, LRA will work with the Corps and others to keep the public and other stakeholders informed and to feed back their concerns and preferences to the Corps and others. The LRA Regional Vision Scenarios will be finalized, again before the Corps' plan, in April 2007.

The importance of coordination and collaboration cannot be exaggerated. And the stakeholders in Louisiana know it. Stakeholder input, including the public, varying authorities, multiple funding sources, and differing capabilities and expertise need to be optimized to bring back a sustainable ecosystem, society and economy.

(See case description in Appendix E for more information.)

CORPS' EFFORTS TO IMPROVE PLANNING AND BUDGETING

As the Panel worked to help the Corps better articulate project selection criteria, it could not ignore broader concerns, such as those discussed above. Selecting the most critical projects is important, but having the right projects to select from is equally important. Planning then becomes crucial, especially the need to focus on performance in the context of a clearly defined mission and objectives.

The Corps has recognized many of the concerns addressed above. It is actively involved in efforts to revise its strategic and long-range planning. It is also taking the lessons from Katrina

beyond its planning for coastal Louisiana. The Corps has developed a corporate framework that incorporates lessons learned for application in its nationwide operations. These efforts are briefly described below and addressed, as appropriate, elsewhere in this report. It should be noted that, though clearly on the right track, these efforts are not fully developed or implemented at this time.

Strategic and Long Range Planning

Officials are aware that the Corps may not be sufficiently responsive to local and regional needs, that the budgeting process is complex and hard to understand, and that projects are funded inefficiently. They have also recognized that the planning and budgeting process is not effectively linked to a vision; that it lacks performance goals and objectives and ways to measure them; and that appropriations may not always be administered as Congress intends.

To address these concerns, the Corps is working to revise its strategic plan and develop a meaningful long-range plan. Officials have also been working with OMB to develop meaningful performance measures. The new performance-based budget process should also allow a greater focus on “programmatic” decisions and require less focus on “project” decisions. Officials state that they intend to integrate vision, goals, and long-range planning into budget development, especially for new projects and recapitalization of existing programs. The goals of these changes include:

- making project decisions consistent with strategic decisions
- making funding decisions more consistent from year to year
- enabling field offices and stakeholders to plan into the future

The five-year budget is also being designed to recognize fluctuations in funding and the tendency for Congress to appropriate funding in excess of that requested in the annual Administration budget request. It will include five-year funding plans under several alternative funding-level scenarios.

Corps officials have been coordinating with both OMB and the Congressional committee leadership as they develop these new approaches, and both have responded positively to the Corps’ efforts.

The efforts to focus planning and budgeting more clearly around broader goals will be further enhanced by another major initiative, the “12 Actions for Change,” announced in response to concerns coming out of the Katrina studies.

“12 Actions for Change”

On August 25, 2006, the Chief of Engineers announced “12 Actions for Change.” The announcement indicated that investigations into the Katrina disaster by the Corps’ IPET and others outlined ways the Corps needs to change in order to stay dynamic and relevant to the nation. These 12 Actions are intended as a blueprint as the Corps changes the way it does business in the years ahead. A list of the 12 Actions is provided in Box 2-5.

The Chief of Engineers also emphasized that many of the concepts included are not new to the Corps. He said that, indeed, as a world-class engineering and science organization, the Corps has worked to constantly improve the ways it conducts its business on behalf of the nation and its Armed Forces. Yet, the disastrous impact of Hurricane Katrina along the Gulf Coast—and in New Orleans in particular—was a wakeup call for the Corps and the engineering profession at large.

The Corps acknowledges that making these changes operational will require a significant cultural change in the organization. As introduced, the 12 Actions were categorized in three general areas:

- **Effectively Implement a Comprehensive Systems Approach:** Comprehensively design, construct, maintain and update engineered systems to be more robust, with full stakeholder participation.
- **Communication:** Effectively and transparently communicate with the public, and within the Corps, about risk and reliability.
- **Reliable Public Service Professionalism:** Improve the state of the art and the Corps’ dedication to a competent, capable workforce on a continuing basis. Make the commitment to being a “learning organization” a reality.

Box 2-5: Corps 12-Actions for Change

1. Employ integrated, comprehensive and systems-based approach
2. Employ risk-based concepts in planning, design, construction, operations, and major maintenance
3. Continuously reassess and update policy for program development, planning guidance, design and construction standards
4. Employ dynamic independent review
5. Employ adaptive planning and engineering systems
6. Focus on sustainability
7. Review and inspect completed works
8. Assess and modify organizational behavior
9. Effectively communicate risk
10. Establish public involvement risk reduction strategies
11. Manage and enhance technical expertise and professionalism
12. Invest in research

A Corps team, headed by the IPET Technical Director, has begun to flesh out a plan to make these 12 points operational. They are seeking both cultural and operational changes and to make the changes self-sustaining. Plans are still tentative, but some immediate funding has been found—and more is being sought through the FY 2007 and 2008 appropriations cycles. The team is working to identify on-going efforts that can serve as pilots to demonstrate many of the components of the program, alone or in concert with other components. For example, the Louisiana Coastal Protection and Restoration Program will probably serve to demonstrate how many of the steps can be implemented.

Success will, in part, depend on funding. Although the team is looking for existing projects that can be used to demonstrate the concepts included in the plan, some program specific activities will be necessary. As of October 2006, the team was working on an out-year budget, but anticipated that the actions would be assimilated into the Corps' culture and require no additional funding after 3-5 years. In his original announcement of the 12 actions, the Chief of Engineers also cautioned that “in some cases, the Corps may need to work with Congress and other policy makers to make certain structural adjustments to the way we do business.”

THE FRAMEWORK OF THIS REPORT

The information in this chapter presents the Corps with a daunting task. The Corps must find a way to meet rising expectations—from evolving missions and mandates—in the face of aging infrastructure, complex analytical challenges, and reduced funding and staffing. The Corps, then, must overcome continuing criticisms of its priority setting criteria and process and of its limited attention to systems planning and management in this increasingly complex operational context. The on-going efforts to improve strategic planning, performance orientation, and implement the 12 Actions, are an important start.

But more needs to be done. Chapters 4 and 5 (after a description of the current budgeting process in Chapter 3) outline a three-stage strategy to help the Corps meet these challenges. Each stage in the strategy allows the Corps to more effectively consider the many important factors that need to be included in planning and budgeting, and to do so with increasingly effective collaboration with the many organizations and agencies that have vital stakes in our nation's water resources. But each stage is also increasingly challenging to implement.

The initial changes, described in Chapter 4, represent a relatively limited modification of the current process. They require expanding the criteria on which budgeting decisions are made as well as making the budgeting process itself more transparent. They should improve the Corps' approach to achieving its stated goals for project planning and allow the Corps to more effectively justify its budgeting choices, based on multiple criteria that are clearly stated. Exceptions to the use of criteria would be documented and explained. Only limited changes in policies and procedures would be needed.

The second stage, described in Chapter 5, begins to move the Corps to systems-based watershed planning by focusing first on function-specific (such as navigation or flood damage reduction) systems management. The Corps would begin to prioritize among projects on a watershed basis for at least key parts of its mission. Field priorities for these functional system plans would be

based on assessments of how individual projects support the performance of a limited-function system, and would be set out in multi-year plans. Implementation would require some shift in responsibility for decision-making to the field, though headquarters would retain final say. At least initially, projects would be budgeted and funded on a project-by-project basis, but ultimately Congress would appropriate “functional system” amounts for Corps divisions.

The third stage, also described in Chapter 5, would support the Corps’ participation in a fully integrated, multi-functional, watershed-based system plan developed and adopted by a multi-party, intergovernmental planning organization. These plans are truly “watershed” plans, not solely Corps plans. The Corps’ budget priorities would be those that provide the greatest benefits to integrated systems performance. Implementation would require significant change in policies and culture—it would invest significant authority in regional planning organizations—as well as changes in the legislative authorization and appropriation process.

CHAPTER 3 CURRENT BUDGET PRACTICES

The budget process that establishes spending levels for the Corps' Civil Works programs is complex and often not well understood. This chapter describes the phases of this process as they pertain to the allocation of funds for construction projects—first generally and then in greater detail, including decision-making factors used or proposed to be used to establish priorities. Figure 3.1 summarizes how money is appropriated.

THE BUDGET PROCESS: AN OVERVIEW

Within the Corps, the budget process is guided by an Engineering Circular (EC), known as the “Budget EC”.²⁰ Initially, each Corps district prepares a ranking of its spending recommendations for each major line of business or project purpose (e.g. flood control).²¹ Each incremental recommendation can be for any phase in the Corps' project cycle: investigations (studies), construction, or O&M.²² Each increment is project-specific. For many projects, there is a current year “initial increment” of funding and a small number of “additional increments.”

Results are forwarded to division offices where the districts' rankings are combined into a single list for each business line. Division recommendations then are forwarded to Corps headquarters, which must not only combine the rankings for each business line, but also begin to make choices and tradeoffs across business lines. Once headquarters has completed this work and received approval from the Office of the Assistant Secretary of the Army for Civil Works (ASA/CW), it delivers two budgets to OMB for consideration: one within the “ceiling” set by OMB and a higher “recommended budget” reflecting consensus of Corps management and the ASA CW about what the Corps should receive to effectively accomplish its missions.

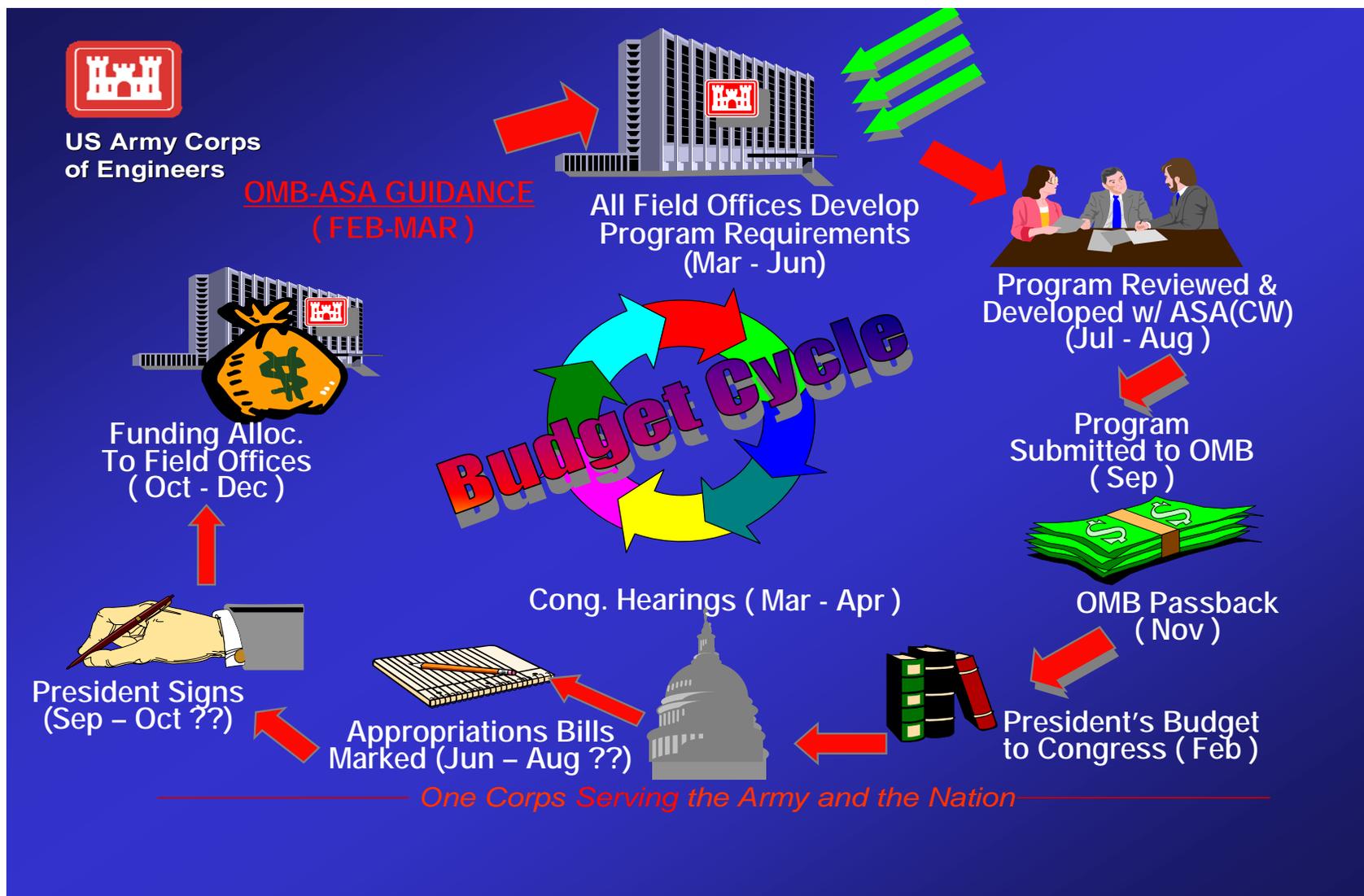
A process of negotiation between OMB and the Army follows, leading to an approved budget that is transmitted to Congress and released to the public. The House of Representatives and Senate then separately develop a set of recommended spending levels. The differences are resolved by a House and Senate conference committee and the conference report accompanying the appropriations bill shows how much money has been allocated to each project. In most years, the total appropriation exceeds what is originally requested in the President's budget.

²⁰ The policy guidance contained in the current “Budget EC” (EC 11-2-187: FY 2008 Program Development Guidance) is derived from 57 sources referenced in the EC. This document is revised annually to reflect policy changes. The current edition referenced in this report applies to decisions made for the FY 2008 budget.

²¹ For FY 2007, funding for construction is concentrated in the three major business lines—flood control and storm damage protection, navigation and aquatic ecosystem restoration—and to one additional business line: hydropower.

²² For most projects, each phase is funded from a separate appropriations account. As an exception, some projects are funded through the “Mississippi River and Tributaries Flood Control” (MR&T) account. This is a single account for all project phases, though the MR&T amounts requested for studies, construction and O&M are shown separately in the Corps' 2007 Budget Document.

Figure 3-1. Budgeting and Appropriations Cycle²³



²³ Source: USACE/CW, Program Integration Division.

SOURCES OF POLICY GUIDANCE

The Corps' current Budget EC is a 400-page document that describes in great detail required data collection and the procedures for developing the districts' and divisions' budget recommendations. It cannot be, nor is it intended to be, a "stand alone" document that allows the reader to understand fully why the budget contains some projects and not others. This section identifies other major sources of policy guidance that, together with other documents referenced in the EC, inform the current budget process.

Although the 1983 P&G was developed for planning, not budgeting, there is an obvious connection between these two decision-making processes. Projects are valued to the extent they enhance the nation's economy, protect the environment and produce other desirable social effects. However, economics is emphasized, except in the case of ecosystem restoration projects. Under the guidance, a project must have a benefit-cost ratio of at least 1.0 and, with some exceptions, a strong preference is given to projects that maximize national economic development.²⁴ The analysis required by the guidelines provides the basis for project authorization which, in turn, influences the views of project sponsors and other supporters on how budget decisions should be made.

OMB's annual budget guidelines are an important source of guidance. They include:

- a one-year program spending ceiling
- identification of "projects of national significance"
- five- and ten-year budget ceilings
- other administration guidelines for the prioritization of Civil Works construction projects

Under one of the "other" Administration guidelines, all ongoing projects that had RBRC ratios below 3.0 were to be considered for deferral, except those that had a significant risk to human safety.²⁵ There is a significant disparity between this ratio required for budget inclusion and the benefit-cost ratio of 1.0 required for authorization. This helps to explain why more projects are authorized than are likely to be funded within current resource constraints. This "backlog" puts pressure on budgeting efforts.

In addition to its guidance for annual budgeting of individual projects, OMB has increasingly emphasized the evaluation of program performance through application of the Program Assessment Rating Tool (PART) process. This process requires the Corps to develop measures and collect data that can demonstrate performance against agreed upon goals. In the case of the

²⁴ The P&G defines four "accounts": National Economic Development (NED), Regional Economic Development (RED), Environmental Quality and Other Social Effects. The NED account is the only required account. Other information required by law or that will have a material bearing on the decision-making process should be included in the other accounts.

²⁵ Chapter 4 provides more details on the other Administration guidelines.

Corps' construction programs or business lines, the implication is that projects should contribute to meeting program performance goals. Appendix H reviews the Corps' PART assessments.

The Government Performance and Results Act (GPRA), which initiated a broad effort to measure agency performance across the government during the 1990s, required agencies to develop five-year strategic plans and make budget projections beyond a single fiscal year. The Corps' FY 2004-2009 Strategic Plan identifies a range of performance measures. The Corps also has published a five-year development plan²⁶ that provides estimates of future spending for projects already in the budget and identifies other projects that should be considered as funding becomes available.

OMB's emphasis on program performance still is being integrated into its guidance for annual budgeting of individual projects. Meanwhile, the Corps is integrating performance measures into its forthcoming revised strategic plan, which is being developed in coordination with OMB.

PREPARING THE DISTRICT'S PROPOSED BUDGET

The Corps district and division budget priorities include all phases of projects, from study to O&M. The projects themselves do not necessarily appear as a single budget item. Instead, an "initial level" is determined for each one. During the construction phase, the amounts assigned to initial levels are those needed to continue work under existing contracts.²⁷ There can be additional "second levels." As stated in the Budget EC, all levels, added together, create a "capability level:"

Add additional funding increments for each project for logical, needed increments that contribute to program goals. Ranking will be based on performance measures...The basis for adding increments in terms of budget request for a project will be based on the demonstrable benefits. The last-added funding increment for each project, together with the Initial Level and previously added increments, will add to the project capability.

The primary product of this exercise is a spreadsheet for each line of business, ranking each increment and containing detailed information about factors that should or could be used in the ranking process. The information differs by business line, and some modifications are made each year to the previous year's list of factors.

Data elements required in the 2008 Budget EC are listed below.

Information for each storm and flood damage control project includes:

²⁶ *U.S. Army Corps of Engineers, Civil Works Program Five Year Development Plan, FY 2007- FY 2011*, March 2006.

²⁷ For a project with a continuing contract, the initial level is limited to the projected contractor earnings for the program year, unless the remaining balance is less than \$10 million. In this case, the initial level includes the fully funded amount.

- funding level increment (initial or secondary)
- budget item's rank in district/division/headquarters
- phase status (new phase, continuing, last year of phase)
- fiscal year that the phase is scheduled to complete
- purpose of increment funds/consequences/remarks
- benefit-cost ratio (at 7 percent discount rate)
- RBRC ratio (at 7 percent discount rate)
- total project cost and balance to complete
- annual benefits and costs
- number of people at risk in 100-year flood plain
- per capita income of the affected area
- risk: depth/velocity/warning/egress/remarks
- determination of whether project is part of watershed plan
- percent of design level, time available and inspections complete
- dam safety impacts, including relative risk
- date of Project Cooperation Agreement
- last year project was included in President's budget request
- last year funds were appropriated; last amount appropriated

Information for each navigation project includes:

- funding level increment (initial or secondary)
- budget item's rank in district/division/headquarters
- phase status (new phase, continuing, last year of phase)
- fiscal year that the phase is scheduled to complete

- requested amount from budget and from Inland Waterway Trust Fund
- navigation activity type (harbor or waterway)
- latest and five-year average commercial tonnage
- latest and five-year average system-ton-miles
- percent time available (to perform as designed)
- benefit-cost ratio (at 7 percent discount rate)
- RBRC ratio (at 7 percent discount rate)
- total project cost and balance to complete

Information for each ecosystem restoration project includes:

- funding level increment (initial, secondary, or other)
- budget item's rank in district/division/headquarters
- basin code
- phase status (new phase, continuing, last year of phase)
- fiscal year that the phase is scheduled to complete
- last year project was included in President's budget request
- last year funds were appropriated; last amount appropriated
- date of Project Cooperation Agreement
- years to completion of project
- collaboration: measure of stakeholder support for project
- total project cost
- acres restored
- cost per acre restored

- narrative justification
- scarcity of habitat (score from 0 to 20)
- connectivity (i.e., facilitates movement of native species)
- special status species (e.g., endangered)
- plan recognition by other agencies, tribes
- projected future O&M costs (self-sustaining?)

Not all project increments within each line of business are accompanied by all of the information listed here. For example, O&M increments for flood control and navigation do not include an estimated RBRC ratio.

The information collected provides the potential to consider a wide range of variables in determining budget priorities. However, current guidance constrains the ranking procedure by defining a limited set of “budget objectives” and by linking only a subset of the data collected to these objectives.

The 2008 Budget EC contains two separate objectives for the construction phase of flood and storm damage reduction projects. As shown in Table 3-1, there are separate ranking criteria used to establish budget priorities within each objective.

**Table 3-1: Flood and Storm Damage Reduction
Budget Ranking Criteria**

Budget Objective	Ranking Criteria
Complete ongoing construction to start getting benefits and reduce future flooding with new construction.	<ul style="list-style-type: none"> • RBRC ratio for project • net benefits • other purpose outputs (e.g. navigation, hydropower) • combined risk factors
Initiate and complete dam safety projects; conduct dam safety, seepage or static instability studies.	<ul style="list-style-type: none"> • relative risk of failure—risk compared to other Corps dams (Portfolio Risk Assessment) • number of people at risk in the 100-year floodplain

These factors strongly suggest that the FY 2008 budget decisions will mirror the 2007 decisions; for most projects, economics (i.e., RBRC ratio) will be a major determining factor; for dam safety, the risks and consequences of failure will play the major role.²⁸

Navigation construction project priorities will also be dictated primarily by economics as Table 3-2 shows.

Table 3-2: Navigation Budget Ranking Criteria

Budget Objective	Ranking Criteria
Complete ongoing construction to start getting benefits of high performing navigation projects.	<ul style="list-style-type: none"> • RBRC ratio for project • other purpose outputs (e.g. flood control, hydropower)

Ecosystem restoration project priorities are based on non-economic factors, as shown in Table 3-3.

Table 3-3: Ecosystem Restoration Budget Ranking Criteria

Budget Objective	Ranking Criteria
Complete ongoing construction to start getting benefits; keep ongoing construction proceeding at an efficient rate; initiate new construction	<ul style="list-style-type: none"> • significance (see note) • acres to be restored • years to complete • other purpose outputs (e.g. flood control, navigation)
<p><u>Note:</u> “Significance” is measured by a scoring factor based on five variables: “scarcity,” “connectivity,” “special status species,” “self sustaining” and “plan recognition.” Each term is described in detail in the budget EC. “Nationally Significant Habitat” will be judged on the first three of the five measures.</p>	

Although the scoring system for environmental projects was available for developing the FY 2007 budget, it had limited impact on the final outcome. Other considerations created a list of projects that required all funding allocated to ecosystem restoration. These considerations included designation as a national priority project, connectivity to other non-environmental projects with a high RBRC ratio, and conformance with the Endangered Species Act.

The data requirements described here generate an extraordinary level of detail. However, it is not clear how these data are to be used; decisions made by the districts and divisions are not publicly available. Presumably, they generally are consistent with the full range of policy directives and based on the data provided. At the same time, it is clear that professional

²⁸ ER 1110-2-1156 contains the basic guidance for the Corps’ dam safety program. This always has been a high priority program. The Corps is implementing a phased approach to incorporate more sophisticated risk analysis into its decision processes for allocating dam safety resources.

judgments will and should also be a factor. Even in the best circumstances, there is uncertainty regarding the full consequences that the spending will generate.

INTER-BUSINESS LINE BUDGET DECISIONS

Corps headquarters makes the budget decisions among business lines and accounts.²⁹ These decisions reflect the judgment of the senior program managers. Two factors in developing an initial baseline for developing the Corps budget are OMB's budget requirements and the budget request from the prior year. Tradeoffs are made at the margin based on a full range of policy considerations.

Certainly flood control and navigation projects with a high RBRC ratio have a better chance of making it into the budget. Projects with significant safety issues also "make the cut" even if their RBRC ratios are lower. Environmental projects are retained from the previous year or added based on non-economic factors. A common criticism of budget decisions is that they rely too much on a single variable, the RBRC ratio, and the cutoff value for this variable. The next chapter discusses the pros and cons of this metric. For now, it is worth noting that fully one third of the proposed FY 2007 construction budget is for projects that do not meet, or are not measured against, this economic criterion.

THE RESULTS: AN EMPIRICAL ANALYSIS OF RECENT BUDGETS

How were the factors discussed in this chapter used in developing the FY 2007 budget and the Corps' projected five-year budget plan? Only a limited amount of the information generated by this decision-making process is public. The competition among projects "at the margin" is not part of the public record. Even without the missing details of how projects fared in "one-on-one" competition, however, there is a wealth of information that can be used to identify and analyze the overall outcomes of the budget process. Data are available from each of the following:

- Corps of Engineers budget press releases FY 2006 (Feb 2005) and FY 2007 (Feb 2006)
- Corps of Engineers Five Year Development Plan, FY 2007-2011 (Mar 2006)
- Justification statements and enacted fact sheets for individual projects³⁰
- The House and Senate reports on the FY 2007 energy and water appropriations³¹

²⁹ "Business lines" are based on project purposes, such as flood damage reduction and navigation. Funds are appropriated not by business line, but by "accounts," including accounts which coincide with phases of each project: studies, construction and O&M.

³⁰ These documents can be found at <http://www.usace.army.mil/inet/functions/cw/cecwb/index.html>.

³¹ House Report 109-474 and Senate Report 109-724. The FY 2007 appropriation bill passed the House of Representatives in May 2006; it was reported by the Senate Appropriations Committee in June 2006, but did not receive Senate action.

- Conference Report (H.R.109-275), Making Appropriations for Energy and Water Development for the Fiscal Year Ending September 30, 2006 and for Other Purposes

These sources show construction projects in several broad categories. These categories are described below as “tiers” to show where they stand in the budget priorities, primarily those of the Administration, but also those of the Congress.³² A review gives some indication of what factors were most important in the budgeting process.

Tier I: Projects included in the Administration’s 2007 budget request (total of 106)

There are six “national priority” projects in the proposed budget: New York and New Jersey Harbor; Oakland Harbor; Olmsted Locks and Dam; Florida Everglades; Upper Mississippi River System (side channels); and Sims Bayou, Houston. In addition, two national priority projects—Columbia River Basin and Missouri River Basin—were moved to the O&M account. All are included in the numbers shown below.

- Projects moved from construction to O&M—Thirteen “projects” were moved from the “construction general” account to the O&M account. Seven of them are included as construction in the House report. The Senate has not indicated a willingness to agree to move any of the 13 projects to O&M; all are included in the Senate report as construction with recommended spending levels.
- Projects with a RBRC ratio of 3.0 or better—The Administration’s published budget guidelines established a RBRC ratio of 3.0 as the threshold for including projects in the budget, except in cases of significant risk to human safety. Roughly two-thirds (64 of the 93) of the projects included in the construction accounts (construction general and the construction portion of the MR&T account) meet the threshold RBRC value of 3.0.³³
- Projects with a calculated RBRC less than 3.0—Eleven projects were included in the budget despite having a RBRC ratio less than 3.0. The table below lists these projects and the reason for inclusion.

³² Given that this chapter is primarily about Administration budgeting procedures, the projects in the Administration’s budget are placed in a higher tier. This is not intended to represent an independent value judgment as to the relative merits of each project.

³³ The Corps’ February 2006 budget press release contains 91 projects recommended for construction. Subsequently, the Corps changed the status of two projects -- Brunswick Harbor GA and Yazoo Basin, Upper Yazoo Project MS (MR&T account) -- from “potential suspension projects” to “budgeted projects with RBRC ratio greater than 3.0.”

**Table 3-4: Projects with RBRC Ratios Less than 3.0,
Included in FY 2007 Budget Request**

Projects in Budget with RBRC Ratio Less Than 3.0	Reason for Inclusion in the Budget
American River Watershed CA	Reduction of Potentially High Risk Flooding Event
Barnegat Inlet to Little Egg Harbor (Long Beach Island) NJ	Reduction of Potentially High Risk Storm Damages
Chain of Rocks, Mississippi River (Deficiency Correction)	Reduction of Potentially High Risk Flooding Event
Chickamauga Lock TN	Essential Link in Inland Navigation System
Clearwater Lake (Seepage Control) MO	Reduction of Potentially High Risk Flooding Event
Columbia River Channel Improvements OR	Essential Navigation Link
Elk Creek Dam OR	Transport Fish while Resolving Court Order
Herbert Hoover Dike (Seepage Control) FL	Reduction of Potentially High Risk Flooding Event
Roanoke River Upper Basin, Headwaters Area VA	Continue Final Contract
St Johns Bayou and New Madrid Floodway MO	Essential Link in Levee System
Turkey Creek Basis KS	Reduction of Potentially High Risk Flooding Event

- Projects with no calculated RBRC ratio—Eighteen projects did not have a calculated RBRC ratio. The reasons are:
 - Seven are ecosystem restoration projects.
 - Seven are dam safety projects.
 - Four are reported as “monetary benefits unavailable,” including two close-outs, one affecting significant cultural resources and one meeting a U.S. treaty obligation.

Tier II: Projects not included in the Administration’s FY 2007 budget request, but listed as candidates for funding in the Administration’s five-year plan (total of 74)

- Projects with an unofficial³⁴ RBRC ratio of 3.0 or more—Ten projects. (Projects requiring new contracts needed a ratio greater than 4.0 to be included in the budget.) These projects did not pass the test.³⁵
- Projects with an unofficial RBRC less than 3.0 or with no reported RBRC—Fifty projects.
- Projects that have not been included in appropriations bills for FY 2004-2006 or in the Corps’ 2007 budget request (“new projects”)—Fourteen projects.

³⁴ The RBRC ratios for projects not in the FY 2007 budget request were obtained from the enacted fact sheets. The ratios reported in the enacted fact sheets do not represent a value certified by headquarters, and consequently are categorized here as “unofficial.”

³⁵ Although five of the ten featured RBRC ratios greater than 4.0, all were excluded from the budget based on a headquarters evaluation of the RBRC ratio.

Tier III: Projects not in Corps' FY 2007 budget request or five-year plan, but funded in FY 2006 Appropriations Bill, or recommended for funding in FY 2007 by House or Senate (total of 168)

- Projects funded in FY 2006 with an unofficial RBRC ratio of 3.0 or more—Twelve projects.
- Projects funded in FY 2006 with an unofficial RBRC less than 3.0 or with no reported RBRC—One hundred sixteen projects.
- Additional projects not funded in FY 2006, but added by House and/or Senate for FY 2007³⁶—Forty projects.

The information above is summarized in the following table:

Table 3-5: Current Construction Projects Considered for Funding by the Corps and/or Congress

Current Construction Projects	Number of Projects
Tier One: In Corps FY 2007 Budget Request	
Moved to O&M	13
RBRC \geq 3.0	64
RBRC < 3.0	11
No RBRC	18
Subtotal, Tier One	106
Tier Two: Not in FY 2007 Budget Request, but Listed in Corps 5-Year Plan as Potentially Eligible for Construction	
RBRC \geq 3.0	10
RBRC < 3.0 or N/A	50
New Projects	14
Subtotal, Tier Two	74
Tier Three: Neither in Corps' FY 2007 Budget Request Nor Listed in the 5-Year Plan.	
Funded in FY 2006 and recommended for funding in FY 2007 by House and/or Senate	
RBRC \geq 3.0	12
RBRC < 3.0 or N/A	116
Not funded in 06 but recommended for funding in 07 by House and/or Senate	
All projects	40
Subtotal, Tier Three	168
Grand Total	348

³⁶ Some of these projects had received construction funding in previous years.

This presentation does not show how the Corps and Administration would rank projects from “best to worst.” Nonetheless, from the Corps’ perspective, any project in Tier I is “preferred” over any project in Tier II, and so on.

Some critics may argue that results from this “screening process” do not provide sufficient information to show how difficult decisions are made at the margin. The following chapter includes recommendations for changing current budgeting procedures. One issue is the extent to which projects can be grouped and assigned equal budget priorities. The above analysis demonstrates the de facto grouping that now occurs and may be considered a baseline for comparison with other proposals.

CHAPTER 4

IMPROVING THE CURRENT BUDGET PROCESS

This chapter considers alternative means to improve the current Corps Civil Works budget process. Possible criteria and measures are reviewed and alternative prioritization methods examined. Although the changes considered in this chapter focus on decisions made within the executive branch prior to the budget's submission to Congress, they also are intended to aid Congress in its deliberations.

The proposed changes reflect two overarching concerns expressed by stakeholders about the budget process.

- an apparently limited range of factors considered in the selection and funding of projects in the President's budget. Particular concerns include:
 - an overemphasis on RBRC
 - insufficient attention to human life and safety
 - lack of emphasis on environmental costs and benefits
 - lack of continuity and timeliness of project work
 - narrow focus of project planning; need for greater attention to watersheds and other systems
 - insufficient attention to cross-cutting social equity issues
 - lack of clear connection to mission objectives
- lack of transparency. It is not clear to stakeholders what factors are considered and how they influence the decisions made.

The Panel found that the Corps already considers many relevant factors and collects much of the information needed to implement improvements. The proposals presented in this chapter are informed by Corps policy and planning documents, such as the Civil Works Strategic Plan, the Five-Year Development Plan and the program guidance contained in the Budget EC.

The Corps is taking important steps to improve its budgeting and planning processes, including significant changes to budget guidance documents planned for release in early 2007. The "12 Actions for Change" announced in 2006 is also an important initiative. These ongoing efforts, discussed in Chapter 2, should provide an even stronger basis for implementing the recommendations contained in this report.

This chapter focuses on budgeting for construction projects. However, prioritization of construction projects cannot be undertaken in isolation. The Corps is charged with operating and maintaining a vast array of water resources infrastructure assets, many of which have exceeded their planned lifespan or are approaching it. Consequently, the construction budget increasingly will come under pressure as resources must be applied to operation and maintenance demands. Tradeoffs inherent in these investment choices are not now being dealt with systematically or

explicitly. Doing so will require the Corps to regularly survey its assets, develop and apply methods and measures for their evaluation, and collect and maintain appropriate data.

Chapter Five describes a comprehensive, long-term strategy for moving the Corps to a fully integrated, systems-based watershed planning and budgeting process. These changes cannot be fully implemented within the next few budget cycles. However, the short-term changes recommended in this chapter can. Improved criteria and transparency would improve the process in the short term as longer-term changes are implemented. They also would provide a solid foundation for more comprehensive approaches envisioned in the long-term strategy.

Implementing near-term changes in the budget process will require consensus on specific criteria and methods. This chapter offers resources to assist decision-makers in building this consensus.

POTENTIAL CRITERIA

RBRC Ratio

Critics have complained that over-reliance on the RBRC ratio distorts the decision-making process and causes a significantly suboptimal allocation of resources in the Corps' proposed budget.³⁷ This section examines these issues. As a point of departure, it describes the role that the RBRC currently plays.

The Administration's FY 2007 Civil Works budget request provides several guidelines for use of the RBRC ratio in budgeting:

- Projects, except for aquatic ecosystem restoration projects, will be ranked by their remaining benefits divided by their remaining costs.
- Each project with an RBRC ratio of 3.0 or greater that can be completed in the budget year with a final increment of funding will receive the balance needed to complete construction.
- Projects with the highest RBRC ratios will receive not less than 80 percent of the maximum level of funding that the Corps can spend efficiently in each fiscal year.
- All ongoing flood and storm damage reduction, commercial navigation and hydropower construction projects with RBRC ratios below 3.0, except for flood and storm damage reduction projects that are funded in the budget to address significant risk to human safety, will be considered for deferral.

³⁷ See, for example, H.R. 109-474 (p. 19): "[T]he ratio of remaining benefits-to-remaining costs, has several inherent biases....In determining the projects identified in this report, the Committee used the Administration's ranking system as a guide but not as a final determination...." Also, S.R. 109-274 (p. 9): "Funding only the 'highest potential return' projects to the detriment of many other projects that provide a future vision or address far-reaching problems while not yet showing any BCR [benefit/cost ration] data, is 'penny wise and pound foolish.'"

The consequence of these guidelines is that most projects are subject to an “all or nothing decision” for inclusion in the budget. The most significant benchmark is an RBRC ratio of 3.0. Even if a project’s ratio exceeds this number, it is not guaranteed to be in the budget. According to a Corps official, new construction contracts required to continue work must have a ratio greater than 4.0. Although many worthwhile projects—benefits exceeding costs—are left “on the table,” overall limits to the Corps’ Civil Works budget require that the RBRC standard be set high. As the guidelines suggest, alternative thresholds could be offered. If projects are given less than 80 percent of their capability funding levels, for example, the minimum allowable RBRC ratio could be lower.

The guidelines indicate that there are important exceptions to the RBRC rule for projects that restore aquatic ecosystems or reduce risks to human safety. These exceptions are so important that roughly one-third of the construction budget request³⁸ is for projects that either do not have an RBRC ratio, or have one less than 3.0.³⁹

Most agree that some measure of the economic return from a project is a legitimate factor in making budget decisions. The question is how to balance the consideration of economic return (as measured by the RBRC ratio) with other factors in making budget decisions. However, concerns about the application of RBRC itself must be addressed as well. These issues include:

- How does the Corps apply the RBRC concept to incremental units of construction for a single project?
- Could the current methods of calculating RBRC be improved?
- Is there another measure—such as net benefits—that would create a stronger consensus for the proposed budget?
- Does the use of RBRC create instability in the budget request from year to year (as RBRC ratios fluctuate)?
- Since projects are designed and selected based on net benefits—not a ratio—will continued use of RBRC ratios in the budget process distort the selection of project alternatives during the planning stage?

Appendix I provides a detailed discussion on all of these questions, as well as a numerical example showing how the RBRC criterion is applied. The major conclusions are summarized here.

³⁸ This includes construction projects funded through the MR&T account.

³⁹ As shown in the previous chapter, the budget request includes nineteen projects with no calculated RBRC ratio and eleven with a ratio less than 3.0. The requested funding for these projects is \$526 million, out of a total construction request (including MR&T) of \$1.546 billion.

How is RBRC applied to incremental units?

At the time budget decisions are made, there is one and only one RBRC ratio for each project. It applies to all future work. Although the budgets are prepared by prioritizing multiple increments of most projects, all such increments have the same RBRC ratio.

Can the methods of calculating RBRC be improved?

Data for determining the RBRC ratio must be drawn from project planning reports used in authorization. As these reports are not designed for budgeting purposes, determining the remaining costs and benefits is difficult and the methods used to do so can vary from one project to the next. Moreover, estimates of project benefits often come from dated reports, which make data about costs and benefits unreliable. To deal with these challenges, the Corps has established a program for headquarters certification of RBRC ratios. The ratios have been certified for most projects included in the budget request. Yet improvements are possible. For example, the results of the headquarters certification process could be made available as part of the move towards greater transparency.

Is there a better measure of economic merit?

Net economic benefit is one alternative measure of economic merit. This measure is used in the selection of project alternatives and their justification for authorization. In the parlance of federal water resources policy, project alternatives featuring the maximum net benefit are referred to as the “NED” plan. This measure is appropriate for comparing project alternatives, but it does not lend itself to prioritizing multiple projects for budgeting. Marginal budget tradeoffs are based on the benefits derived from spending a specific amount on one project in comparison to spending the same amount on a second one. This issue is most effectively addressed by comparing ratios; by excluding sunk benefits and costs from the calculation, the RBRC appropriately focuses on the impact of future budget decisions.

Does the use of RBRC create an unstable year-to-year budget request?

Project RBRC ratios change from year to year as work is completed and benefits are realized. The timing and magnitude of the benefits and costs realized and incurred can vary with respect to numerous factors. For instance, certain types of projects might realize benefits early in their construction, while others do not realize them until near completion. With regard to the former, the RBRC might drop below the cut-off threshold for budgeting before completion. Whether RBRC ratios increase or decrease during the construction process is an empirical question, which is explored below. Even if a project is more likely to have its ratio increase, however, a drop is a serious issue for sponsors whose projects fall out of the budget request.

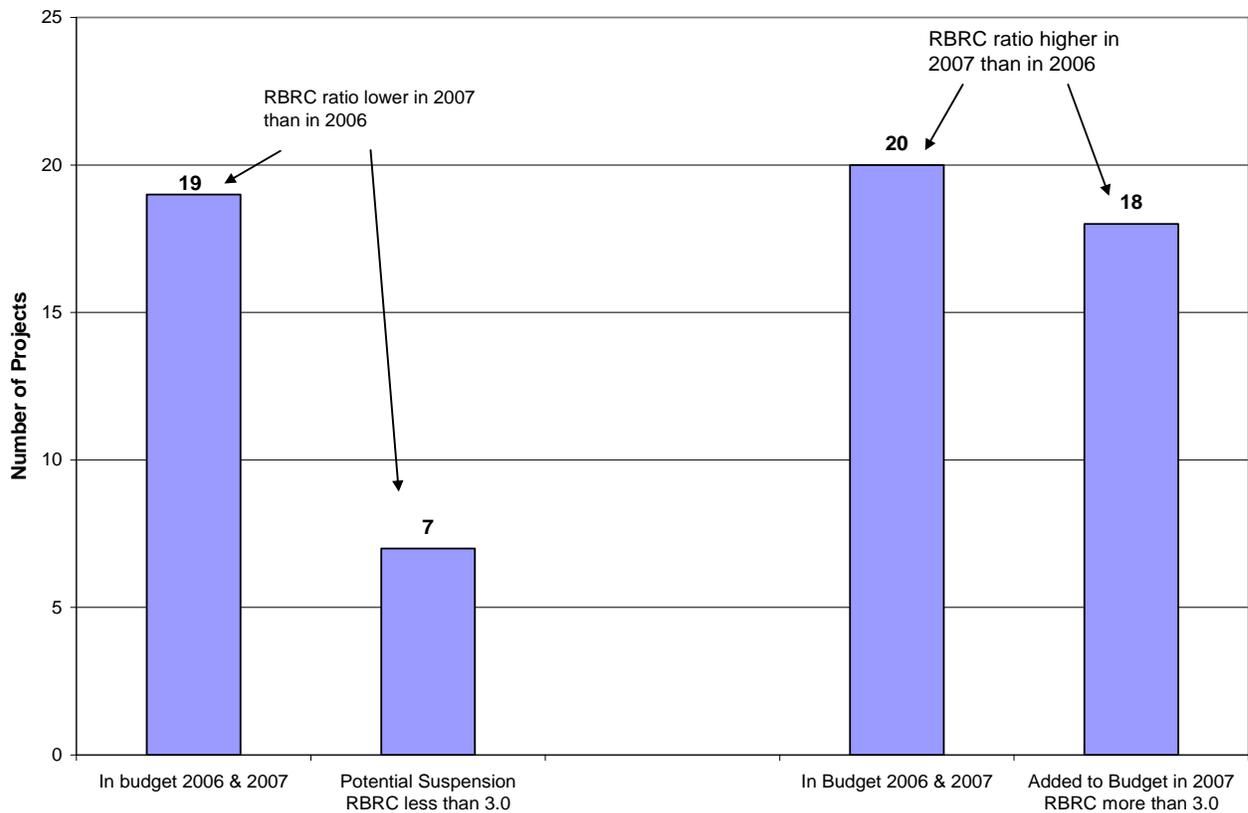
The Corps’ FY 2006 and 2007 budget requests are the best sources of empirical information.⁴⁰ As Figure 4-1 demonstrates, the data show that seven projects included in the Corps 2006 budget

⁴⁰ Although RBRC ratios were reported in the 2005 budget request, the numerator (benefits) included all benefits, whether or not they had been previously obtained. The Corps described these RBRC ratios as “preliminary.”

were removed in 2007 due to a drop in the RBRC ratio.⁴¹ At the same time, eighteen projects were added in 2007 because the RBRC ratio had increased above 3.0.⁴² An additional forty projects were included in both budgets with a reported RBRC ratio in each year, twenty with higher ratios in 2007, nineteen with lower ratios, and one for which the ratio did not change. On balance, based on the information from these three project groups, the “winners” (higher ratios) outnumbered the “losers” by a count of thirty-eight to twenty-six. This information is displayed graphically in the figure below.

Any time a project is added to a constrained budget, another project will drop out. While dropping projects prior to completion should generally be avoided, it would not make sense to make this an absolute rule. Moreover, as additional factors are considered in budget decisions, as recommended in this study, the role of the RBRC ratio will be reduced and, consequently, the likelihood of exclusion from the budget after inclusion in a previous budget will diminish. The concern over fluctuating ratios should not justify dropping RBRC from the list of factors used in budgeting.

Figure 4-1: Number of Projects, Increases and Decreases in RBRC Ratio 2006-2007



⁴¹ Ten projects were identified as “FY 2007 Potential Construction Suspension Projects.” There was no publicly available RBRC ratio for three of them.

⁴² An additional four projects were added to the budget even though their RBRC ratio was less than 3.0.

Does the use of RBRC ratio influence initial project design or the work schedule of existing projects?

The focus on the RBRC ratio at the budgeting stage provides an incentive in the planning stage to adopt a project design that maximizes the project's benefit-cost ratio instead of its net benefits thereby increasing its chances of being included in the budget. Once a project is in the budget, there is an incentive to create a work schedule that delays the realization of benefits to the end so as to maintain a high RBRC ratio until the end of the project thereby helping to insure that the project stays in the budget. These issues should be addressed, but their relevance will likely decline in the future, especially if additional factors are introduced into the budget decision process.

Conclusion

Economic benefit has been and should remain an important consideration when assembling the Civil Works budget. For the construction program, the continued use of the RBRC ratio is an acceptable way to include economic considerations in the allocation of scarce resources. Nonetheless, there are significant analytical challenges in developing and applying the RBRC ratio across a broad range of projects and geographical areas. As long as the RBRC ratio is used, the Corps should continue to seek ways to further enhance the methodology and monitor the results.

The RBRC ratio currently represents a “pass-fail” grade; “pass” equals 3.0 or better. This approach could be replaced by a continuous numerical variable, the ratio itself. As an alternative, there could be a grade continuum established by placing projects into groups with ratios falling within defined ranges (the group with the highest RBRC ratios receiving the highest grade).

This chapter will discuss a possible link between social equity and the application of the RBRC ratio. If projects for poorer communities have a lower RBRC ratio than equivalent projects for wealthy communities, this inequity needs to be addressed.

Risk to Human Life and Safety

Given the tragic consequences of Hurricane Katrina, greater emphasis on risk and uncertainty—especially as it applies to human life and safety—is central to changes in the Corps’ approach to project planning and budgeting. Perhaps most notably, the Corps has signaled a commitment to institutionalize new approaches for dealing with risk and uncertainty in its recently announced “12 Actions for Change.” Prior to this commitment, the planning and budgeting processes certainly were not indifferent to human life consequences. The 2007 budget request includes numerous projects designed to reduce or eliminate human risks, most of them dam safety projects. The Corps’ dam safety personnel are aggressively introducing improvements to their methods and working to apply them to the complete range of decisions regarding the Corps budget.

Several efforts are underway to define and quantify all relevant risk factors. This work provides a clear indication of the complexities and difficulties of such an undertaking. This section concentrates on a narrow set of these issues: how the budget process can be improved to include risk and uncertainty on a more formal and comprehensive basis. The approach here is to provide an illustrative example to demonstrate how a “human life and safety” budget factor might be measured.

There are multiple ways to measure risks to human life and safety, but three considerations are especially relevant:

- If more people live and/or work in the flood plain (or area at risk), there is a greater urgency to provide protection.
- If, under non-catastrophic circumstances,⁴³ there is a probability that a few lives could be lost with the occurrence of certain weather or seismic events, projects with a greater expected value of lives lost should be given a higher priority.
- If, under catastrophic circumstances, there is a significant probability of a high number of lives lost, a project should have a high priority.

Taken separately, these factors may create conflicting priorities. One way to resolve the conflict would be to assign weights for each factor. However, it is not possible to assign precise probabilities to multi-dimensional events with uncertain outcomes. To compensate for this lack of precision, specific factor weights are not used in this example. Instead, groups of projects with “equivalent human life and safety risks” are developed using expert judgment.

Assume that two flood control projects can be built to protect the same number of people.⁴⁴ For Project A, it is likely that, on average, 0-1 deaths annually might be attributed to non-catastrophic circumstances. For Project B, as many as 5-10 deaths annually might be attributed to similar circumstances. Assume that the likelihood of a catastrophic event occurring is a “low probability” for Project A, but a “very low probability” for Project B.⁴⁵ If the sole purpose of flood control projects is to “prevent deaths from catastrophes,” Project A should receive funding before Project B. If the sole purpose is to reduce the average number of deaths during more usual circumstances, Project B should be funded first. The conflict between these factors can be shown in the following “decision matrix.”

⁴³ “Non-catastrophic” circumstances are hazardous events that happen with some regularity in the project area. There is no official line of demarcation between non-catastrophic and catastrophic. The example used here is illustrative and does not constitute a formal recommendation.

⁴⁴ This assumption makes it possible to limit the “three dimensional decision function” described to two dimensions. The decision variables can then be displayed on a two dimensional graph or matrix.

⁴⁵ The terms “low probability” and “very low probability” are left undefined in this example, but must be addressed in any real world application of methods using similar concepts to those described here.

Figure 4-2: Decision Matrix: Probability and Consequences of Flood Control Project Failures

What is the average yearly loss of life under non-catastrophic circumstances? →				
	0-1 lives lost	1-5 lives lost	5-10 lives lost	10-25 lives lost
What is the likelihood of a catastrophic event? ↓				
low to moderate probability				
low probability	Project A			
very low probability			Project B	
virtually no chance of occurrence				

The successful application of this approach requires that two significant questions be addressed. First, what are the appropriate probability and statistical models for placing projects within this matrix? Second, how are judgments to be made where there are conflicts over priorities? This example has been deliberately structured so that there is no clearly objective method for preferring either Project A or Project B. Each box in the decision matrix would be assigned a score or letter grade to be applied to all projects in that box based on expert judgment.

The Corps already collects much of the data needed to make an assessment similar to that presented in the example above. The current Budget EC directs Corps personnel to consider the following data for each candidate flood control project:⁴⁶ the population in the 100-year flood plan; four important risk parameters (depth, velocity, warning and egress); and any additional risk considerations that may be useful to the decision-makers. With regard to the four specified risk parameters, it states:

The depth, velocity and warning time factors should be assessed for the without project condition and should be representative of the average hydrologic conditions in the project area. They should represent conditions in the flooded area that are, in general, the most likely to cause severe injury or loss of life. Similarly, egress conditions should assess the capability of the population to avoid potential dangerous situations in light of the warning times available. Special considerations should be highlighted in the Risk Remarks field.

Environmental Factors

In addition to its traditional missions, the Corps’ program includes ecosystem restoration as a primary purpose. The tradeoffs between economic projects and ecosystem restoration projects may be the most significant challenge that budget decision-makers face. The restoration projects vary greatly in size and intended outcome. This is illustrated in the table below, which lists the nine ecosystem restoration projects included in the Administration’s FY 2007 budget request.

⁴⁶ Although human life and safety issues primarily pertain to flood control (including dam safety), there is no reason why risks associated with projects built for other purposes cannot be similarly addressed.

Table 4-1: Ecosystem Restoration Projects in the FY 2007 Budget Request

Name of Project	FY2007 Budget Request (thousands)	Description
South Florida Everglades, FL	\$164,000	Restore, protect and preserve South Florida's ecosystem while providing for other water related needs. Reestablish a more natural timing of water flows through enlargement of some canals and structures, backfilling and acquiring land within five-year flood plain. Restore conveyance between geographic areas.
Houston Galveston Ship Channel, ⁴⁷ TX	\$43,067	Dredged material from bay will be used for construction of environmental resource sites. Mitigation features provide substrate for oysters to grow
Upper Miss River Restoration	\$26,800	Dike construction, island creation and other activities are designed to alter water flows and increase diversity of trees and prairies for wildlife.
Hamilton Airfield Wetlands Restoration, CA	\$11,700	Increase elevation of land within airbase using dredged material from Oakland Harbor, thereby restoring wetlands.
Atchafalaya Floodway, ⁴⁸ LA	\$4,840	Real estate acquisition of lands, easements, etc. to ensure unhampered use of the floodway during major floods; and to protect the basin's environmental resources. The water management units feature will improve historical overflow conditions and thereby enhance aquatic ecosystem productivity.
Mississippi Delta Region, LA	\$3,212	Construct salinity control structures and divert fresh water from the Mississippi River into coastal bays and marshes.
Lower Columbia River.	\$2,200	Construct features to improve fish and wildlife habitat units and other biological benefits within estuary and tributaries that are tidally influenced.
Lower Snake River Fish & Wildlife Compensation	\$850	Construct fish hatcheries that will provide 27 million juvenile salmon and steelhead annually.
Johnson Creek, Upper Trinity Basin, Arlington TX	\$500	Buy out 140 structures, restore 155 acres and create 2.25 miles of linear recreation facilities.

⁴⁷ The Houston Galveston Ship Channel, while primarily for navigation, has ecosystem restoration elements. The amount budgeted as shown is for the combined work.

⁴⁸ The Atchafalaya Floodway project, while primarily for flood control, has ecosystem restoration elements. The amount budgeted as shown is for the combined work.

There are at least three possible ways to evaluate and rank ecosystem restoration projects:

- Assign monetary values to environmental benefits; apply the same economic consideration to ecosystem restoration projects as to projects with other purposes.
- Base budget rankings on the results of cost effectiveness and incremental cost analyses as described by the Corps in its *Planning Guidance Notebook*.
- Provide and quantify “project descriptors” using data currently collected by the Corps in developing its budget.

Each method has merit, but also significant weaknesses. Each method is discussed below.

Assigning monetary values

If all environmental outcomes could be monetized, the Corps’ planning and budgeting processes could be greatly simplified. In some cases, some monetary values can be established. For example, if creating a wilderness area provides new recreational opportunities, generally accepted methods can be applied to derive economic estimates of these benefits. However, evaluation techniques that might be applied in other cases have not yet reached a consensus level of acceptability.

The *Planning Guidance Notebook* instructs Corps planners not to calculate net economic benefits for such projects. Instead, they are directed to identify a “NER” (Net Ecosystem Restoration) plan, not a NED plan.

Although the Corps limits its use of economic analysis of environmental projects, these methods may merit serious consideration for future use. Some have argued that many of the methodological issues can be resolved and that the methods should be integrated into the Corps’ Civil Works Program:

In comparison to other federal environmental and natural resources management agencies ... the Corps has made less use of environmental valuation techniques in its benefit-cost analysis...Today ... ecosystem planning and restoration are major and growing foci of the Corps work program...In this context, current Corps guidance concerning the use of environmental valuation techniques is out of date. Carefully used, these techniques can improve the Corps’ planning and evaluation capabilities. (NRC, *Analytical Methods*, 2004)

The EPA has aggressively pursued this approach. The results are reported in *Guidelines for Preparing Economic Analysis* ⁴⁹ and an *Environmental Economics Research Strategy*.⁵⁰ However, the EPA concludes in the *Research Strategy* that this is still a “work in progress.”

⁴⁹ U.S. EPA, Publication EPA 240-R-00-003, 2000.

⁵⁰ U.S. EPA, Publication EPA 600-R-04-195, December 2005.

With sufficient time and resources, economics research can provide the theoretical and technical basis for conducting the environmental economic analysis that EPA and others need. Although current economic analyses contribute valuable information to environmental policymakers, scientific limitations often prevent them from fully characterizing the benefits and costs of environmental policy changes.

On balance, it appears that an environmental benefit-cost ratio would not currently be an appropriate measure on which to base budget decisions. Even if accepted methods of monetizing environmental benefits and costs were available, the application of such analyses to already authorized projects would require significant new data collection and analytical effort because the pre-authorization studies were undertaken prior to this approach and did not collect the appropriate data. Still, the Corps should remain committed to supporting and contributing to this research on monetizing environmental benefits and costs.⁵¹

Cost effectiveness and incremental cost analyses

In its current strategic plan, the Corps identifies three performance measures for evaluating ecosystem restoration projects: acres of habitat restoration completed, river miles of habitat restoration completed and acres/river miles of nationally significant habitat restoration completed per dollar invested. These measures suggest that larger projects are preferred over smaller projects as they restore greater land areas; thus, they are more likely to be “nationally significant.” Given these measures, it is not surprising that the South Florida Everglades Project absorbs 78 percent of the recommended ecosystem restoration construction budget.⁵²

Smaller restoration projects are not automatically excluded, however. The current performance measures also include environmental outputs (habitat restored) per dollar invested:

[Projects] that are the most cost-effective in contributing to the restoration of a nationally or regionally significant aquatic ecosystem that has become degraded as a result of a Corps project, for aquatic ecosystem restoration will receive not less than 80 percent of the maximum level of funding that the Corps can spend efficiently in each fiscal year.... All ongoing aquatic ecosystem restoration projects that do not cost-effectively contribute to the restoration of a nationally or regionally significant... [project] and are less than 50 percent complete will be considered for deferral [emphasis added].⁵³

As explained above, ecosystem restoration projects are evaluated using an NER plan that is based on cost effectiveness and incremental cost analysis. A project alternative is considered cost effective if “for a given level of non-monetary output, no other plan costs less and no other plan yields more output for less money.” (*Planning Guidance Notebook*) A hypothetical Alternative

⁵¹ The Corps’ IWR has been the agency’s major source of guidance in this analytical realm.

⁵² The Houston Galveston Ship Channel and the Atchafalaya Floodway are excluded from the definition of “the ecosystem restoration budget.”

⁵³ Budget of the United States Government, Fiscal Year 2007- Appendix, p. 993. See also the Corps’ News Release, February 6, 2006.

A may be the most cost-effective (“best”) way of restoring 50 acres of wetland. Alternative B may be the best way to restore 100 acres. This does not, by itself, determine whether A or B is the preferred project alternative.

To determine the NER plan from the cost effective alternatives, such as A and B above, the Corps requires incremental cost analysis. First, the most cost effective alternative—highest ratio of costs per non-monetary output—is identified; second, alternatives that yield a greater level of output are evaluated in terms of their cost efficiency in providing incremental benefits. This leads to a series of “Best Buy” plans and a presentation of these alternatives should guide the selection of the best NER plan.⁵⁴ However, the two steps together do not eliminate the need for subjective expert judgment:

Neither cost effectiveness analysis nor incremental cost analysis include a “one plan” selection rule similar to the ‘NED plan’ selection rule for NED evaluations. In the absence of such a decision-making rule, neither analysis dictates what choice to make. (*Planning Guidance Notebook*)

Nonetheless, the analysis does generate cost-per-unit of environmental output data that can be used to set budget priorities once the project is authorized.

Because the benefits are not monetized, it is not possible to directly compare ecosystem projects to projects with economic outputs. Moreover, given the diversity of the “environmental output” of the included projects (as shown in the table above), direct comparisons even among ecosystem restoration projects remains a significant analytical challenge.

Quantified project descriptors

Although cost effectiveness always should be a basic objective of the Corps’ Civil Works program,⁵⁵ it is a measure of outputs, not outcomes. The logical extension of this measure would be some way to quantify the quality of the restoration effort. The Corps’ Budget EC already includes a set of variables that might be used for this purpose. These budget variables, listed in the table below, are fully consistent with the Corps’ *Planning Guidance Notebook* which, in turn, is consistent with the P&G.

⁵⁴ To continue the example, assume that Alternative A costs \$250,000, or \$5,000 per acre. Alternative B costs \$750,000 or \$7,500 per acre. Assume also that there is an Alternative C that yields 150 acres of restored wetlands at a cost of \$800,000, or \$5,333 per acre. From A to B, the incremental cost is \$500,000 or \$10,000 per incremental acre restored. From A to C, the incremental cost per acre restored is \$550,000 / 100 = \$5,500. Since the incremental cost per acre is less for C than for B, B is not a “Best Buy” plan.

⁵⁵ Section 206 of the 1996 Water Resources Development Act authorizes ecosystem restoration projects provided that they improve the quality of the environment, are in the public interest and are cost effective.

Table 4-2: Quality Indicators of Ecosystem Restoration Projects

Performance Component	Description	Highest Score
1. Habitat Scarcity	Relative scarcity and trends; declining trends score higher	20
2. Connectivity	Connected to other habitat areas to facilitate movement of native species	20
3. Special Status Species	Provides habitat for endangered species; internationally protected species, etc.	10
4. Plan Recognition	Evidence of collaboration with other agencies, local governments	10
5. Self Sustaining	O&M costs required to maintain the restoration outcome, higher cost projects receive a lower score	20

Since the variables are quality indicators, they are not traditional metrics such as dollars or acres, but discontinuous variables with discrete values assigned on the basis of expert judgment. For example, “habitat scarcity” is assigned one of four values:

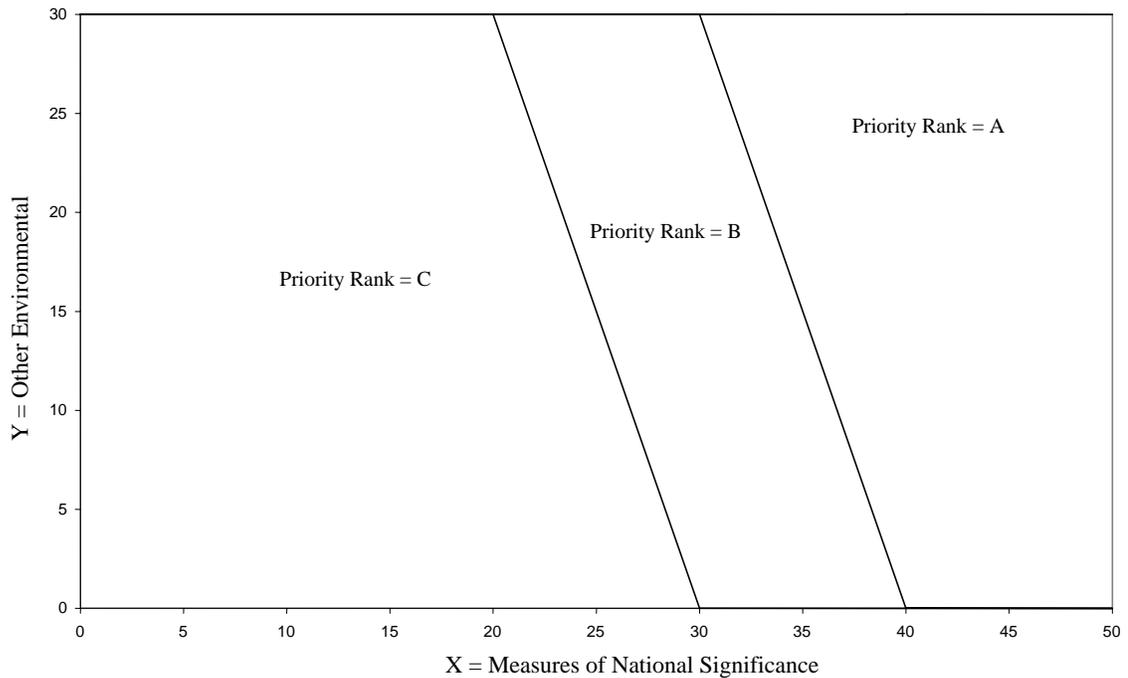
- 20 = nationally scarce habitat and becoming scarcer
- 10 = regionally scarce habitat and becoming scarcer
- 5 = other declining habitat
- 0 = habitat stable at natural levels or improving

According to the current Budget EC, the maximum score for each category is set to provide a sufficiently broad scale to allow analysts to make reasonable distinctions among projects. The maximum scores do not reflect the relative importance of the categories. For example, if Project A scores a 10 for “special status species” and Project B scores a 10 for “plan recognition,” Project A, which protects endangered species would be given a higher budget priority. In fact, the Budget EC states that projects receiving a perfect score (50) in the first three categories will be designated as “nationally significant” regardless of the scores for the remaining factors.

Since the categories are not of equal importance, a simple summation of the assigned values is not likely to yield a ranking structure that fully reflects society’s environmental priorities. If variables 1-3 are the most important, they should be a high percentage of the total score, even more than the 63 percent (50 out of a maximum of 80) they would receive by a simple summation.

It is not necessary to calculate a single value to meet the objectives of this chapter. As an illustrative alternative, define X as the sum of the performance components 1-3 (above) and Y as the sum of components 4 and 5. The X-Y values for each project could be plotted and assigned grades using the graphical regions displayed in Figure 4-3. In this example, all of the Corps’ “nationally significant” projects (a perfect score of 50 for the first three categories) would receive an “A” grade.

Figure 4-3: Illustrative Ranking, Ecosystem Restoration Projects



This example does not include cost effectiveness as a criterion. As an alternative, the graph’s vertical axis could represent a measure of cost effectiveness, while the horizontal axis could incorporate all of the outcome variables. Since the example is intended to be only an illustration of a multi-dimensional graphical approach, a revised graph—with possible changes in the priority rank areas—is not shown.

The Corps intends for the variables identified in this section to identify and measure the relative importance of ecosystem restoration projects. However, since all Corps projects, regardless of their primary purpose, change the natural environment of the project area,⁵⁶ all projects could be evaluated and ranked partly on their environmental impacts. Projects built for flood control, navigation and other economic purposes include mitigation measures to offset negative environmental effects that might otherwise occur. Although the initial intent of mitigation is to “offset” on a “one-to-one basis,” it is likely that some projects will result in more successful measures than others. As discussed in Chapter 2, the Corps is recognizing that projects serve multiple purposes; some of these economic projects will have ecosystem goals, as well.

Timely Project Completion

Stakeholders have expressed concerns on two related issues: continuity of project funding and timeliness of project completion. They have reported projects falling in and out of the President’s budget from year to year, and have expressed frustration with the length of time required to complete projects. These observations may partly reflect different approaches to allocating resources. In recent years, the Administration has sought to focus resources on a

⁵⁶ In some cases, the affected area will extend beyond the project area.

relatively small number of high-return projects with the express intent of maximizing potential returns and realizing them more fully by bringing those projects to completion sooner. Traditionally, budgets and appropriations for the Corps have distributed resources across a larger number of projects.

Both approaches involve tradeoffs. Although the current Administration's approach will speed up completion of high-priority projects, others may be delayed or not be completed at all. The traditional approach tends to lengthen the time needed to complete projects as resources are spread across a larger number of projects. Moreover, these tradeoffs are exacerbated by a large and growing backlog of authorized projects, each with sponsors that hold some expectation of completion.

Delays in project construction have important cost implications. Each project has an optimal construction schedule that is integral to its project management plan. When projects do not receive funding from year to year at levels that allow adherence to this optimum schedule, inefficiencies occur and costs can rise substantially. This would be an undesirable outcome even if the federal government completely funded the Civil Works program. Since most projects require a non-federal cost sharing partner, delayed completion should be considered even more seriously.

The criteria and methods proposed in this section will not eliminate the need for the tradeoff between completing relatively few projects versus making some progress on relatively more projects. However, they can help make the tradeoffs transparent by making them an explicit consideration in the ranking of projects for funding. Tradeoffs accompanying alternative funding approaches are discussed in more detail in the following section.

Looking beyond incremental improvements to the current annual budget process, it should be noted that the Corps is taking steps to address these issues by developing a longer-term planning approach. Its five-year plan aims to reduce the uncertainty that project sponsors face with regard to the continuity of funding and project completion. The plan includes five-year funding levels for projects in the budget request. In principle, as these projects are finished, funding will become available for additional projects. However, only small amounts of new funding are likely to become available, especially in the early years, evidence that the backlog is more than a transitional issue.

Given the impacts of schedule delays, timely project completion is an important criterion that could be considered in the budget process. Possible variables to consider for this purpose are:

- **Spending in previous years.** As a general rule, unfinished projects should not be in the budget one year and out the next. Even when projects are regularly included in the budget, spending fluctuations may create uncertainty regarding the federal commitment to a project and may lead to higher costs due to schedule delays.
- **Project size.** Small changes in the amounts allocated to large projects will have a small impact on the schedule; however, the same dollar amount of change will have a significant impact on smaller projects.

- **Forecast completion date.** As this date extends further into the future, there are many more uncertainties that will affect project schedules. It is less clear how reduced funding for multi-year projects will change the completion date.
- **Percent complete.** This is related to the forecast completion date, but may be a preferable measure of how close the Corps is to finishing construction.
- **Non-federal cost share.** Since local stakeholders are more affected by delays when their share of the total cost is high, the local contribution can be legitimately considered as a decision factor.

The remainder of this section presents one method for giving weight to the value of timely project completion. It combines scores on two measures: the percent of the project completed⁵⁷ and the percent of the local cost share of total project cost.⁵⁸ This method would be used to grade projects. Those closest to being completed and with the largest non-federal cost shares involved would receive the highest grades. To illustrate, this method is applied to a randomly selected sample of 26 actual projects shown in Table 4-3.

⁵⁷ This is measured as a percentage of the total *federal* cost of the project, not the total project cost, part of which is shared by the local sponsor(s).

⁵⁸ For inland waterway projects, the “non-federal” share is the amount contributed by the Inland Waterway Trust Fund.

Table 4-3: Grades for Corps Projects* Based on Progress Toward Completion and Level of Commitment by Non-Federal Sponsors

Project	Federal Balance to Complete	Non-Federal Cost Share	Construction Schedule. Grade	In FY2007 Budget Request
A	64.1%	0.0%	C	
B	54.5%	30.9%	B	yes
C	69.7%	34.8%	B	
D	10.5%	8.8%	C	
E	37.9%	0.0%	C	
F	55.7%	44.8%	A	
G	11.8%	34.9%	C	yes
H	62.9%	25.0%	B	
I	19.9%	35.8%	C	
J	71.1%	50.0%	A	
K	9.8%	0.4%	C	
L	4.4%	72.7%	B	
M	57.3%	53.9%	A	yes
N	91.6%	35.1%	A	
O	13.3%	25.0%	C	yes
P	62.2%	25.0%	B	
Q	96.6%	50.0%	A	
R	33.7%	23.6%	C	
S	9.4%	0.0%	C	yes
T	28.3%	55.0%	B	yes
U	38.6%	0.1%	C	
V	77.9%	24.9%	A	
W	9.3%	0.0%	C	
X	5.4%	25.1%	C	yes
Y	68.5%	32.2%	B	yes
Z	65.0%	11.8%	C	

* The sample includes projects from all of the Corps' major missions and the population was "stratified" so that there are some projects in the FY 2007 budget request, others in the five-year development plan and some in neither category. The names and sizes of the projects have been deliberately withheld so as to avoid pre-judgments regarding their "worthiness" for budget inclusion.

Project grades are based on a scatter diagram presented in Figure 4-4. This diagram shows the relationship between the two variables. Projects that fall into the middle diagonal set of boxes are assigned a grade of "B." Projects in the boxes to the north and east of the B grade boxes are assigned a grade of "A." The others get a grade of "C."

**Figure 4-4: Scatter-Plot Method for Ranking Projects with Respect to Two Measures—
Project Progress Toward Completion and Level of Non-Federal Sponsor Commitment**

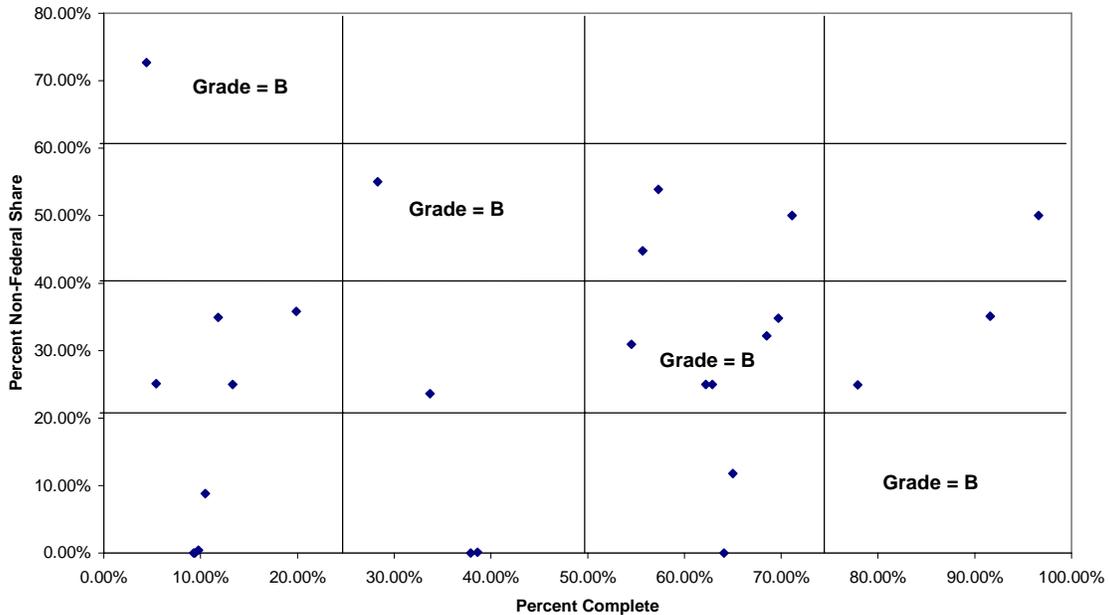


Table 4-3 indicates whether projects are included in the FY 07 budget request. So, the grades assigned to those projects can be used to consider actual budget choices with respect to a ranking based on the single consideration of timely completion. Of course, many projects that are ranked highly on timely completion are not included in the budget request. After all, it would be only one among multiple considerations reflected in these budget choices and in any future budget. As noted earlier, the method proposed in this section is intended only as a way to explicitly address the value placed on timely completion in making budget choices. Policy makers must decide on the weight to be given to this factor with respect to the others reviewed in this chapter and how to combine these factors into an overall ranking scheme. Options for doing this are discussed later in this chapter.

Role of the budget and appropriation process

Modifications to the Corps’ budgeting process can encourage continuity of project funding and timely completion. However, the incremental approach to making appropriations for Corps construction projects will continue to be an obstacle. A detailed review of alternative funding mechanisms is outside the Panel’s scope of work. However, the pros, and cons of alternative approaches bear some discussion.⁵⁹

⁵⁹ For an informative discussion of full funding, incremental funding and other approaches related to defense procurements, see O’Rourke, Ronald and Stephen Daggett; *Defense Procurement: Full Funding Policy—Background, Issues, and Options for Congress*; Congressional Research Service, Updated December 11, 2006.

Each Corps Civil Works project is funded by annual appropriations. As discussed earlier, a project may, in fact, be a stand-alone increment of a larger project. In addition, the budget request may not even cover the full amount that the Corps is capable of spending efficiently on the project in a given year. This approach, coupled with differences in the number and size of projects included in the appropriation compared to the budget, makes funding uncertain from year to year. It can also result in inefficient stops and starts to construction efforts which increase construction costs.⁶⁰

In contrast to this incremental approach, Congress and OMB require that procurement of many major capital assets, such as DOD weapons systems, be fully funded before they can begin. That is, Congress provides budget authority for the entire project in the first year in which it is funded. Full-funding offers several significant advantages compared to incremental funding. Most germane is that full funding can reduce the potential for inefficiencies related to funding starts and stops, by providing budget authority up front. Proponents also see this approach as requiring full disclosure of a project's total cost, thus making Congressional oversight more effective because it is easier to track the full costs of procurements and requires agencies to request additional appropriations to fund underestimated costs or unexpected increases.

Nonetheless, full funding has major downsides when the whole appropriation for a large multi-year project is included in a single year, and scored in that year against the annual budget authority ceiling established by Congress. When both Congress and the Administration seek to keep annual budgets as low as possible, there is a bias against big projects (or large increments of projects), the kinds with which the Corps is often associated. Additionally, given the historical size of the Corps' budget, fully funding some projects—large ecosystem restoration projects, for example—could effectively leave no funds available for other ongoing or critical projects.

One alternative to the traditional full funding approach would have budget authority for the full project cost provided up front but spread across several years. Only the first year's authority would be scored against the budget in year one because only that amount would be available. Additional budget authority from the initial appropriation would be scored in the out years as it became available and the project progressed. This approach addresses the concern about bias against big projects and the impact on other agency efforts.

Funding for the Department of Transportation's (DOT) New Starts transit program offers another alternative. After a project has received approval in the system-wide transportation planning effort, and is included in a fiscally constrained program plan,⁶¹ DOT signs a Full Funding Grant Agreement with the project sponsor. This agreement provides multi-year funding for the project. Although the agreement is non-binding, it is reviewed by Congress. Appropriations are annual, but they almost always match the schedule in the Full Funding Grant Agreement. This method has served transportation planning well, helping to ensure that once projects are started, they are finished.

⁶⁰ CRS noted possible benefits of the incremental approach, including that it recognizes limits on the ability to accurately predict total costs of large, long-term procurements.

⁶¹ Fiscally constrained means that funding is reasonably expected to be available from federal and non-federal sources for the projects in the program plan. See Chapter 5 for a more extensive discussion of the current approach to systems planning in transportation.

The choice to use one of these approaches or some combination involves important tradeoffs concerning the number of projects that can be funded and the nature of Congressional oversight. These should be explicit in whatever funding strategies are adopted by the Corps and its stakeholders.

It is also important to note that beginning any major, multi-year project can be seen as limiting the flexibility of future Congresses, regardless of the funding mechanism used. Whether incrementally funded or fully funded (or some combination), once projects are begun it can be difficult to stop them. There may be strong political support among Congressional delegations and other stakeholders that may be difficult to overcome. Under full funding Congress would have to take a proactive action to rescind prior budget authority to stop a project; under incremental funding it must proactively approve continuation every year. There is considerable debate about the pros and cons of these different approaches in this regard and these issues also should be considered in developing an alternative funding approach for Corps projects.

Consistency with Watershed Principles

As discussed in Chapter 5, there is virtually unanimous agreement that the nation is best served by planning, constructing and maintaining water resource projects using a watershed approach. The Corps devotes an entire section of its strategic plan to promoting this concept and provides examples of how it is already being applied within the program. The recently announced “12 Actions for Change” reinforces the Corps’ commitment to watershed planning. These watershed management principles also provide the underlying justification for stages two and three of the long-run strategy recommended in Chapter 5. This section discusses “consistency with watershed principles” as a decision criterion in an expanded set of criteria to be used in stage one of the Panel’s proposed strategy of transformation.

Although many existing projects were authorized without being part of a watershed plan, there is merit to including consistency with watershed principles as a factor in a revised budget decision process, even in the short run. Some existing projects were developed in broad-based planning process that incorporated elements of a watershed approach. This fact would be given consideration in prioritizing those projects, but a project based on a limited study would not be precluded from consideration if it scored high enough in the other factors. If two projects scored equally among all other factors, the project that is part of a broader regional plan should be selected first.

There are several ways to measure consistency with watershed principles. The most basic is to make it a “yes/no” variable. In fact, the Corps’ Budget EC already requires that the yes/no information be provided for all flood control and navigation projects. However, to answer even this basic question it is necessary to provide guidance by identifying the attributes of a watershed plan. These attributes might then be used either in a yes/no context or as a basis for a broader and more continuous measurement.

Chapter 5 sets forth the key characteristics of a watershed management approach. The Corps has provided two descriptions that include these characteristics. As described in the ecosystem restoration and flood control appendices of the Budget EC, a watershed approach:

- Requires consideration of multiple purposes.
- Improves opportunities for inputs by public and private groups.
- Identifies a combination of recommended actions by more than one party.
- Leverages Corps resources with other federal, tribal, state and non-governmental organizations.

As described in the strategic plan, a watershed approach:

- Accounts for all major aspects of natural and human systems.
- Identifies impacts in a large spatial zone of consideration.
- Balances across multiple uses or functions.
- Collaborates among federal agencies, state and local agencies, and the private sector.

In principle, it is possible to create a scoring system for consistency with watershed principles based on either set of characteristics. Of course, the establishment of a consensus on the appropriate scoring system for each attribute would be a significant challenge. The Corps provides one example of measuring the extent of collaboration in ecosystem restoration projects. This measure assigns scores, from “best” to “worst,” as follows:”

- 10 points = contribution to a multi-agency comprehensive plan in support of federal priorities
- 5 points = contribution to a multi-agency regional plan
- 2 points = contribution to a state, tribal, or local basin plan
- 0 points = Does not contribute to any collaborative plan

Watershed approaches are considered essential to good planning and execution by almost all stakeholders. Including it as a selection factor has significant merit. Using one of the methods described in this section could provide a quantitative basis to rank projects against a watershed standard.

Social Equity

As discussed in Chapter 2, the concept of equity is built into many laws, including the civil rights laws, NEPA and the Clean Air and Clean Water Acts. In 1994, Executive Order 12898 made environmental justice a part of the mission of all federal agencies, emphasizing the need to identify and avoid or mitigate disproportionate negative impacts of their programs on minority and low income populations.

In evaluating the social equity component of project selection, it is important to distinguish between authorization and appropriation issues. Two important authorizing issues are:

- Can flood control projects that provide protection to relatively poor populations generate enough benefits—calculation of benefits is based primarily on property values—to meet the standard required for authorization?
- Do cost-sharing requirements lead to decisions resulting in lower levels of protection for poor and minority communities?

Appropriators take the pool of authorized projects as a given. Therefore, the question becomes: Are projects designed to protect poorer populations given sufficient consideration in budget decisions? It is clearly unacceptable, for example, to consistently delay construction of protective structures in poorer areas while proceeding with construction of similar structures in more affluent areas. Reliance on the RBRC ratio to evaluate projects may work against projects in poorer areas. Since traditional calculation of flood control benefits is heavily dependent on the value of property being protected, it is possible that protection of poor communities may not be able to “make the cut” dictated by the current budget standard.

The use of the RBRC ratio can be complemented by attention to social equity in two ways. First, a separate assessment of risk to human safety may be undertaken. As discussed earlier, the Corps undertakes such assessments, which explicitly are factored into budgeting decisions. This assumes that some projects that do not meet the RBRC threshold will be included in the budget if a significant risk to human safety is determined to exist. This decision rule trumps any advantage based on relative property values that might bias a judgment based solely on RBRC. The less affluent receive equal protection from similar risks to human safety.

Social equity also could be addressed by modifying the RBRC ratio test. In the case of flood damage reduction projects, this would involve:

- Obtaining per capita income data for all census tracts in the area of primary flooding.
- Calculating the mean and standard deviation for per capita income for the full sample of flood control projects.

- Calculating an adjustment factor (“poverty index”) for projects where per capita income is below the sample mean.⁶²
- Creating a revised ranking of projects using the adjusted RBR ratios, using it to set budget priorities.⁶³

This proposal assumes that for the existing pool of projects, lower poverty indices are statistically correlated with lower RBRC ratios. This is an empirical issue that could easily be addressed, but is beyond the scope of this study.

Broader environmental justice criteria

The criteria discussed above directly support the agency’s environmental justice goal: to avoid disproportionately negative impacts of Corps projects on minority and low-income populations. However, as discussed in Chapter 2, environmental justice concerns go far beyond whether these target populations receive equal protection from floods. The types of negative impacts that could fall disproportionately on various populations can include, for example, disruption of communities and businesses, negative health effects, and reduction of aesthetic values. The definition of negative impact should also include unequal distribution of services, such as recreational benefits, water supply, relocation assistance, and small business participation.⁶⁴

In developing alternative project plans, each one is likely to mitigate disproportionate impacts in different ways and degrees. This also is true of projects considered during the annual budgeting process. Thus, alternative metrics would be needed to allow headquarters to consider the extent of success in addressing environmental justice issues when making budgeting decisions. Although significantly more work would be needed to design and implement such criteria, some possible approaches include:

- Project planners could be required to obtain opinions systematically from the affected low-income and minority groups on how well each project addresses community concerns. This could be done through surveys, focus groups or some other means more compatible with extant language, educational and cultural norms in the affected area. A standard set of questions and scale of satisfaction could be used.
- A “scorecard” for environmental equity could be developed, focused on the specified categories of impacts most likely to apply to Corps projects. For example, each project could be rated on the extent to which the project successfully avoided or had remaining unmitigated disproportionate impacts related to income, aesthetics, community cohesion,

⁶² There are numerous mathematical formulas that could be used; as a general rule, the further from the mean (measured in standard deviation units) the higher the adjustment factor.

⁶³ This has the effect of reducing the threshold for projects in low-income areas.

⁶⁴ Also, as discussed in Chapter 2, identification of negative impacts that are disproportionately distributed does not necessarily, or even often, result in cancellation of the project. Instead, reasonable efforts must be made to consider alternatives, and mitigate negative impacts. For example, if a disproportionate number of members of targeted populations are left with homes outside levee protection, efforts to mitigate could include actions such as buying their houses or modifying them to better withstand flooding.

risk to public health and safety and water supply. A summary rating could be developed to feed into an overall scorecard or the dashboard described later in this chapter.

- Projects could be ranked on the extent to which negative impacts are totally avoided or mitigated, or conversely the extent to which unmitigated disproportionate negative impacts remain. Given that impacts vary in severity, it may be appropriate to include an adjustment so that avoiding essentially small impacts does not provide as much priority as avoiding severe ones. A scale could be developed that recognizes the severity of the adverse disproportionate impact and the extent to which it is avoided or mitigated. In the example below, the decision criterion would focus on the extent of unmitigated impacts. The goal would be to give lower priority to projects that had fewer successfully mitigated disproportionate negative impacts. In this example, the higher the rating (the level of impact multiplied by the extent of mitigation) the lower the priority.

Table 4-4: Example Project Rating: Extent of Unmitigated Disproportionate Negative Impacts

Level of Impact			
• Severe impact (3)	9	6	3
• Moderate impact (2)	6	4	2
• Mild impact (1)	3	2	1
• No impact	0	0	0
Extent of Mitigation	Not mitigated (3)	Partially mitigated (2)	Fully Mitigated (1)

- Projects could be ranked solely on the overall extent of unmitigated, disproportionate impact. In contrast to the above option, the extent of mitigation efforts would not be considered. Projects would be ranked, with highest priority being where no disproportionate impact exists:
 - Priority 1: No impact or fully mitigated impact
 - Priority 2: Mild unmitigated impact
 - Priority 3: Moderate unmitigated impact
 - Priority 4: Severe unmitigated impact

Any of these criteria could be built into program performance measures and used to link success in meeting the environmental justice mission to budget prioritization. More study is necessary to develop meaningful, practical metrics to do so.

One possible problem with the last three alternatives is that these numbers would be fairly subjective and may be easily, if unintentionally, manipulated by project planners anxious to “score high” to ensure inclusion of the project in the budget. A more transparent process would help to ensure supportable ratings for these criteria. Another potential implementation issue is that, in each of the possible approaches suggested above, a consistent metric would be needed to allow Corps-wide priorities to be set. However, the definitions and guidance for using those

metrics may be different for different kinds of projects. The extent of mitigation possible for a levees project may be significantly different than for a project to deepen a channel.

Limited planning guidance

The Panel did not review actual Corps practices in incorporating environmental justice into project planning. However, based on a review of agency guidance and discussion with knowledgeable Corps officials, it seems clear that Corps guidance on incorporating environmental justice concerns into project planning is minimal, compared to the guidance some other agencies make available.

The Corps' project planning guidance on "other social effects" is the most relevant. The Corps is revising that guidance, but it is limited in scope and application. Furthermore, it is not tied to the distributional analysis of negative impacts and service levels, or the type of focused stakeholder participation, emphasized under Executive Order 12898.⁶⁵

Other agencies, most notably EPA and the Department of Transportation, have provided much more detailed guidance to their staff on how to incorporate environmental justice into their program activities. In fact, knowledgeable Corps staff said that in some cases, absent extensive Corps-specific guidance, Corps field staff use this guidance when incorporating environmental justice issues into their planning studies. However, in at least one undertaking, the Everglades restoration, the Corps—following specific legislative requirements to do so—has paid significant attention to these issues. Those efforts may serve as a precedent for successfully implementing this expanded emphasis. Those efforts are described more fully in Appendix G, which discusses the Corps' implementation of the environmental justice executive order. A case description in Appendix E also provides a more extensive description of the Corps efforts in the Everglades.

Other Possible Construction Criteria

Many other factors could be considered in prioritizing construction projects. For example, one might add a measure of the extent to which a project is expected to contribute to meeting established agency-wide goals. Current Corps efforts to develop improved performance measures and to revise its strategic plan would provide the basis for developing such a metric and would ensure that supporting data are available. Such a factor would be a means to help evaluate projects during the transition from an improved budget process to progressively more developed planning approaches discussed in the next chapter.

Another possible criterion could focus on project management and the extent to which the project is on schedule and within budget. This criterion is related to the one discussed earlier, which is intended to promote the completion of construction projects and thereby reduce delays and cost overruns. In contrast, other things being equal, this project management criterion would seek to prioritize the best-managed projects, relative to actual (not optimal) schedules and budgets.

⁶⁵ As discussed in Chapter 2 and more fully in Appendix G, analysis of impacts over an entire project area generally would not meet the intent of EO 12898, to identify—and mitigate—disproportionate negative impacts on concentrations of targeted populations within the project area.

For example, the measure of “success” or “failure” could be based on the fundamental project management tool of earned value. As a project moves through the construction phase, it is possible to measure its “earned value” (often called budgeted cost of work performed) and compare it to “planned value” (budgeted cost of work scheduled) and actual cost (actual cost of work performed). These could be combined into a cost performance index (earned value:actual cost) and a schedule performance index (earned value:planned value). The lower the values of these indexes, the less likely it would be that a project would meet its original cost and schedule objectives. Some combination of the indexes would be used to obtain the project’s score or grade for the project management factor.

Many factors could cause a project to overrun planned costs and schedules, many of which are out of the control of project managers. For example, project scope could be affected by changed circumstances in the project area or a change in the intended purposes of the project. Or, as discussed earlier, expected funding may not be made available as a result of the budgeting or appropriation process. Using this criterion would necessitate modifying the “score” on this metric based on judgments about circumstances, preparing a revised project management plan that adjusted for these uncontrollable factors, or some other action. If nothing else, a metric that alerts officials to budget and scheduling issues—whether or not they are within the control of managers—could be a valuable addition to the prioritization process.

Criteria for Prioritizing O&M Investments

As discussed in Chapter 2, the age and declining condition of the nation’s water resources infrastructure is of increasing concern. The Panel did not focus on O&M projects, but the Corps’ ability to set priorities between new construction and O&M is very important.

In fact, the Corps is taking steps to better manage and prioritize among its O&M investments. Most visibly, it is aggressively developing and applying improved methods to the evaluation of dams and the prioritization of dam safety investments. More broadly, it is continuing to develop and improve its Asset Management Plan, which begins to build a framework for evaluating and monitoring the condition of its assets and developing and applying criteria for prioritizing investments.

The plan is a response to Executive Order #13327, issued in 2004. The order’s purpose is to promote efficient and economical use of federal real property resources. It requires all federal agencies to establish asset management plans and develop monitoring and performance measures.⁶⁶ The plan describes the prioritization process for operations and maintenance work, noting that some criteria include safety as well as environmental and legal obligations. It also states that priorities were based on watershed needs and an assessment of field office facility portfolios.⁶⁷

⁶⁶ The Corps submitted the required asset management plan and OMB approved it in the third quarter of 2006.

⁶⁷ Like construction funds, O&M funds traditionally have been appropriated on a project-by-project basis. The Corps is seeking more flexibility in its O&M funding. In the FY 2007 budget request, it defined “water resource regions” and requested one, combined O&M appropriation for all projects in each region. It is hard to predict maintenance needs in advance. The proposal was intended to offer more discretion to the field to make investment decisions so as to better respond to changing local circumstances.

The order also established the Federal Real Property Council to develop guidance and facilitate the success of asset management plans developed by major agencies. The Council established four performance measures: utilization, condition index, mission dependency and annual operating and maintenance costs. Perhaps the most relevant performance measure to address this issue is the condition index (CI).

The condition index is a general measure of a constructed asset's condition at a specific point in time. The CI is calculated as the ratio of "repair needs" to "plant replacement value." "Repair needs" is the amount necessary to ensure that a constructed asset is restored to a condition substantially equivalent to its originally intended and designed capacity, efficiency or capability. The CI is reported as a "percent condition"; the higher the CI, the better the condition of the constructed asset. Each agency or department must report the CIs for each major asset.

The Council envisions using target CI levels to establish project priority in future budgets. In the Corps' case, potential maintenance investments could be prioritized in the order of CI percentage, with priority given to assets with the lowest percentage. Alternately, a target could be set to improve the overall inventory by a certain percentage each year over a multi-year program. As with construction, however, allocation of O&M funding should depend on multiple factors, including consideration of human safety and operational capacity.

Initially, the CI will be used to identify and rank O&M investments in those assets with the greatest maintenance needs and that pose the highest risk. However, once immediate maintenance issues are addressed, it can be used for planning purposes. It can provide a guide for prioritizing the maintenance of assets with the aim of preventing deterioration that would make urgent, major, unplanned repairs necessary. Better prioritization of O&M project investments is an important first step in making tradeoffs between O&M and construction priorities. But, more needs to be done to better define criteria for those tradeoffs.

USING MULTIPLE CRITERIA IN DECISION-MAKING

This chapter has identified criteria and possible metrics for the Corps' use in budget decision-making. The primary candidate criteria are economic return, human life and safety, environmental quality, timely project completion and consistency with watershed principles. The role of social equity as a budget factor also was addressed, first as it is incorporated into two of the primary factors—economic return and human life and safety—and then, as a stand-alone criterion. Finally, other possible criteria were discussed.

An important goal behind reforming the current budget process is to increase transparency. To meet this goal, it is necessary to:

- Make sure that the included factors are clearly understood.
- Establish measures and methods that could be used to quantify the importance of each factor.

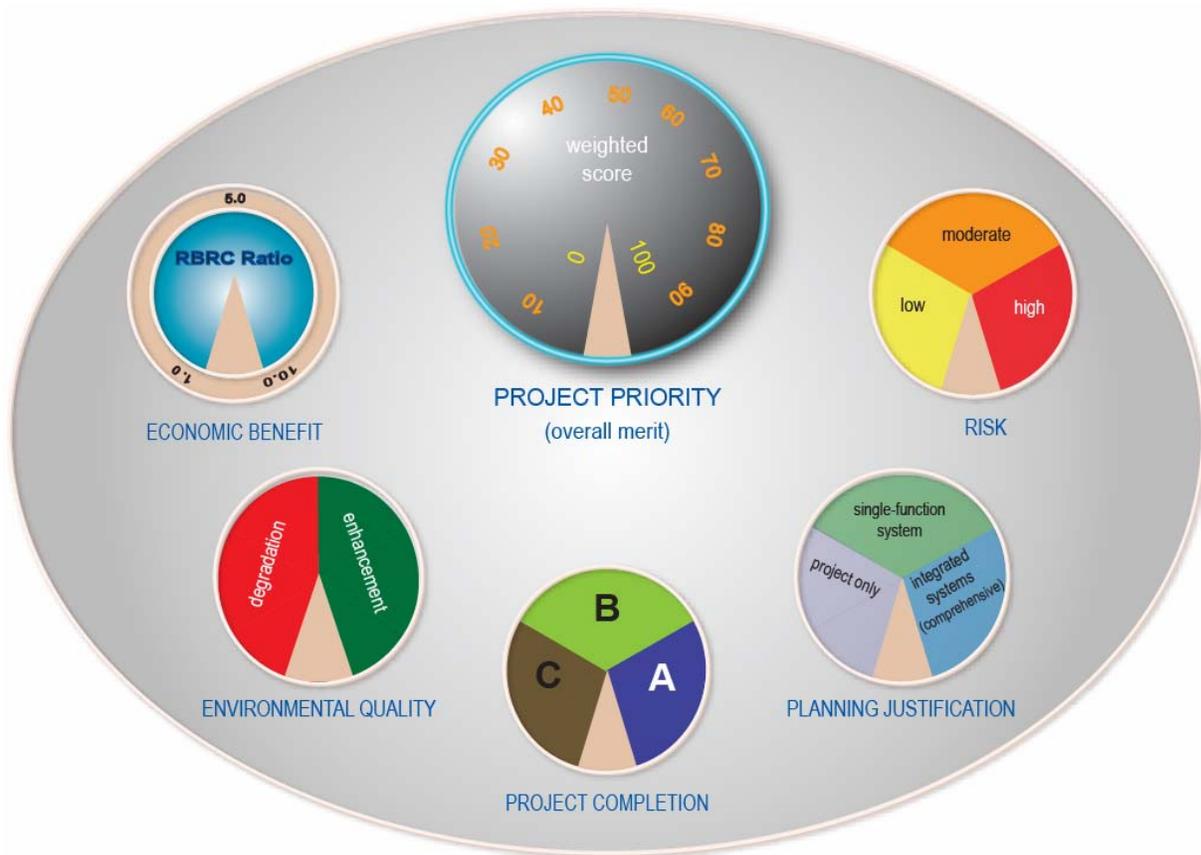
- Provide a method for translating the performance of projects on individual factor measures into a clearly understood overall indicator to guide budgeting decisions.

Thus far, the focus has been on the first two steps. The third step is discussed in the following section.

Communicating Project Priorities: Dashboards and Report Cards

The individual criteria ultimately chosen must be combined to allow an overall assessment of each project, and this must be done in a way that can be clearly communicated. Two possible approaches are considered here. The first is a visual approach in which project performance on individual factors, along with a composite measure, are represented by gauges on a project “dashboard.” Figure 4-5 demonstrates one possible dashboard. The second approach is to render the same information in a report card format.

Figure 4-5: Illustrative Project Dashboard: Corps of Engineers Civil Works Construction Projects



Note: Other considerations that may influence the priority of a construction project, but may not be as easily depicted by project-specific metrics, include contributions to system and/or agency performance, condition of existing facilities, project management, and social equity. Alternative means of representing these considerations during the budget process should be used.

Discrete and Continuous “Gauges” for Project Dashboard

Gauges on a dashboard could represent each factor as a continuous variable. A “project” gauge would provide a combined measure of the factors that represent the overall project “score.” Table 4-5 provides examples of continuous metrics for some criteria discussed in this chapter. If project factors are ranked on a continuous scale, they must be converted into comparable units of measurement so that combined scores can be derived. For example, an environmental score ranging from 0 to 80 will dominate a RBRC ratio, which for most projects varies between 1.0 and 10.0. The conversion to scales of equal minimum and maximum values is a straightforward mathematical process.

Table 4-5: Possible “Continuous” Metrics for Selection Factors

Factor	Continuous Variable Candidates
Economic Return	RBRC ratio as currently calculated for each project RBRC ratio adjusted to increase value for projects protecting poorer communities
Risk to Human Life and Safety	Weighted average of risks associated with “normal” years and risks associated with risks during catastrophic years Calculated risk index using factors described in Budget EC
Environmental Quality	Cost per acre of wetland restored Environmental value index using factors described in Budget EC
Consistency with Watershed Principles	Yes/No Watershed principles index using factors described in Budget EC or in Corps strategic plan
Timely Project Completion	Changes in project schedule caused by inadequate funding in previous years Weighted average of percent complete and non-federal share (percent of total project costs)

Alternatively, gauges could represent factors as discrete variables with such measures as high, medium and low, while the overall project gauge represented a continuous variable reflecting a weighted average of the factor gauges. If this method were used there would be no conceptual difference between the use of gauges and a report card format.⁶⁸ The remainder of this section uses the report card concept as its basis for discussion. Under another variation, even the overall project gauge on a dashboard could be discrete. Decision rules would be applied to the factor results and used to group projects into budget tiers—one for the best uses of limited funds, two for the second best uses and so on.

⁶⁸ In the report card format, the overall measure of merit could be the project’s grade point average.

Discrete variables can be derived from continuous measures in several ways. For example, decision-makers could:

- Group continuous variables into quartiles, where the top quartile receives an A, the second receives a B and so on.
- Construct histograms of a sample of continuous factor variables, identify groups (not necessarily evenly divided into quartiles) and assign grades of A, B, C and D.
- Display results of multi-variable analysis graphically and assign grades to separate areas of the resultant scatter diagram, as described in the sections above on risk, environment and project completion.

Discrete Versus Continuous Gauges

Continuous variables allow granularity of measure for fine comparison. However, the application of continuous measures is either inappropriate or not feasible in many cases. Many factors simply do not lend themselves to continuous measures. For other continuous measures that might be appropriate in principle, sometimes there is no agreement on metrics or data are not available or cannot be collected cost effectively.

Discrete measures often present a more robust approach. They can be applied to factors that cannot or should not be measured continuously and continuous measures can be converted to discrete ones.

Translating Grades and Gauges into Prioritization

As a final step, decision-makers must use the information from each project's grade or score to establish budget priorities. There are at least four ways to accomplish this. The first two create a continuous (best to worst) ranking by:

- Adding up the individual factor scores (or grades converted to numerical scores).
- Taking a weighted average of the individual factor scores, possibly changing the weights depending on the project business line.

The second two create project priority "tiers" by:

- Displaying results of multi-factor analysis graphically, assigning scores to separate areas of the resultant scatter diagram (similar to the multi-variable analysis described above for a single factor).
- Establishing discrete decision rules.

In the last approach—using decision rules—projects are first graded according to the principles outlined above. The next step would be to apply the decision rules, such as those presented below.

- **Rule I:** Any project with an A for Risk to Human Life and Safety gets full funding.
- **Rule II:** For all remaining projects, those with a B for Risk to Human Life and Safety get 80 percent, depending on funding availability.
- **Rule III:** For all remaining projects, Economic projects with an A in Economic Return and Ecosystem projects with an A in Environmental Quality get 80 percent, depending on funding availability.
- **Rule IV:** For all remaining projects, those with an A in Timely Project Completion and “Yes” for Consistency with Watershed Principles get 80 percent, depending on funding availability.
- **Rule V:** For all remaining projects, economics projects with a B in Economic Return and Ecosystem projects with a B in Environmental Quality get 80 percent, depending on funding availability.

The application of these decision rules is demonstrated in Table 4-6 for 11 hypothetical projects. The decision rules are applied under three different budget scenarios: budget ceilings of \$100, \$150 and \$200. The table demonstrates how these decision rules would indicate the initial choice of projects and funding levels and the choices of additional projects and funding indicated in the event of incremental increases in the budget ceiling.

Table 4-6: Example, Project Selection Guided by Decision Rules

	Economic Return	Environmental Quality	Risk to Human Life & Safety	Timely Project Completion	Consistency with Watershed Principles	Capability	Budget Request Level:*			Rule Number
							I	II	III	
Flood-1	A	C	B	C	Yes	15	12			II
Flood-2	C	A	B	A	Yes	20	16			II
Flood-3	INC	B	C	A	No	12				
Dam Safety	B	C	A	A	No	8	8			I
Nav-1	A	B	C	B	Yes	40	6	15	11	III
Nav-2	B	A	C	A	No	25			8	V
Nav-3	C	C	C	A	Yes	15			12	IV
Hydro	B	B	C	B	No	30				
Eco-1	N/A	A	C	C	Yes	80	10	35	19	III
Eco-2	N/A	B	B	C	Yes	60	48			II
Eco-3	N/A	C	C	B	Yes	10				
Total						315	100	50	50	

* Budget Request Level One: Budget Ceiling = 100

Budget Request Level Two: Budget Ceiling = 150; Budget increment = 50

Budget Request Level Three: Budget Ceiling = 200; Budget increment = 50

Choice among Scoring Methods: Options for Prioritizing

The four methods of scoring and prioritizing projects have different strengths and weaknesses. Methods one and two enable projects to be rank ordered, providing a prioritized list of projects. In principle, such a method could provide a “top 10 list.” However, in practice, the application of such a method would founder on the limitations of the data and measures available. Rank-ordered lists of projects imply a level of knowledge and agreement on measures that does not exist.

Methods three and four offer a potentially more feasible approach by sorting projects into prioritized groups. This approach eliminates most of the difficult project comparisons, but priorities would still need to be made within the group if a full group cannot be funded.

A choice between methods three and four might well reflect at least two considerations. First, the use of decision rules is familiar to stakeholders; decision rules already are used in budgeting under the Administration’s budget guidance. For instance, projects (except for ecosystem restoration) must meet a minimum threshold RBRC ratio of 3.0⁶⁹ to be included in the budget unless the project is judged to address a significant risk to human safety. Moreover, those cases are funded to no less than 80 percent of capability. Second, the use of decision rules is readily comprehensible and thus relatively transparent. For example, the priority given to projects addressing risk to human safety is clear.

Nevertheless, rules-based decision processes like this tend to be too mechanistic to adequately reflect synergies among individual projects. More integrated approaches to project prioritization within the framework of systems-based watershed planning are considered in Chapter 5.

SUMMARY

The most important attributes of an improved, transparent budget process are these:

- The criteria used to prioritize projects would be meaningful, well-defined, accurately documented and generally accepted.
- Information would be made available about each project’s evaluation with regard to the relevant factors.
- The identification procedures used to put projects into any of the proposed budget categories would be clearly articulated.
- Project advocates would be given the necessary information to allow them to make the case that their project has been “under-graded” if they do not like the results of this process.

⁶⁹ As discussed earlier, an RBRC ratio of 4.0 is required for projects requiring a new contract to continue.

Such an approach is consistent with the direction in which the Corps is moving and, for the most part, can be based on data currently collected.

Refinements discussed in this chapter constitute a substantial change from current budget procedures. However, several major obstacles must be overcome before a new process can be accepted by the stakeholders and fully implemented. These include:

- **Picking factors.** The five primary factors highlighted in this chapter have achieved a high level of acceptability. Yet there are other attributes of projects worth considering in project selection.
- **Agreeing on measures.** There are multiple ways to measure any of the factors discussed. The intent here is to identify alternatives rather than making specific recommendations.
- **Displaying the information.** The processes described in this chapter will yield a large amount of data about many projects. To be useful in the budget debate, this information must be publicly available and presented in an understandable format. Electronic data processing makes this task significantly easier.
- **Obtaining high quality data.** Many of the variables discussed in this chapter go beyond a simple measurement of physical characteristics of a project. They include forecasts of future events and estimates of risk and uncertainty and, in some cases, are scores based on expert judgment. It will be necessary to devote some resources to monitor the quality of the information and to promote consistency from one Corps district to the next.
- **Avoiding budget “gamesmanship.”** When parties have an interest in seeing a project included in the budget, they may be able to plan or measure its performance to achieve this result. This is inevitable no matter how simple or how complicated the decision-making process. Increased transparency can be expected to mitigate this tendency; however, independent monitoring will be required.
- **Comparing projects across business lines.** This always will be a contentious “apples to oranges” procedure no matter how formal the method of project selection becomes. The “grading” or “decision rule” methods described here are two compromises that could at least reduce the level of contentiousness.
- **Creating a stable project list.** The use of more factors in budgeting decisions is likely to reduce, but not eliminate, instability in the project portfolio from year to year. Some changes in the portfolio are to be expected in any budget process. Although the consideration of more factors in the budget process will require a greater investment of time and effort by Corps decision-makers, current information technologies can be applied to minimize this increased burden.
- **Establishing a long-range plan.** Comparing year-to-year changes in project attributes may not lead to the same conclusions as a long-range comprehensive plan. This

possibility strongly supports consideration of the planning approaches discussed in Chapter 5.

It is worth repeating that it would be impossible and undesirable to remove judgment from the budget process. Greater transparency can enhance the agency's ability to defend its budget choices, but it will never eliminate the give-and-take that is necessary to allocate limited resources to address the water resources needs of the nation most effectively.

CHAPTER 5

STRATEGIC APPROACHES TO PRIORITIZING CIVIL WORKS IMPROVEMENTS

Chapter 2 identified several key concerns about the current Corps budget process, including too narrow a focus in prioritization criteria and lack of transparency. The chapter also identified underlying concerns, especially the impact of the current project-specific planning orientation. The identification of these problems is by no means unique to this Panel. Many prior investigations of the Corps' water resources program have reached similar conclusions, and some of these are referenced in this report.

Chapter 4 presented a first step to address these concerns, primarily the problems specific to the budget process. This chapter broadens the scope of the improvements to suggest a systems-based approach to problem identification and project origination. The budget would then be prepared in the context of watershed needs, resources, and priorities. Ultimately, the Corps' role would evolve from that of engineer to the role of watershed manager, continuing the evolution in mission that has been occurring since the Corps was created. The Panel sees this change as a prerequisite for the nation to effectively compete in the globalized economy that will dominate the 21st century. Accomplishing this transition will require many changes in how the Congress, federal agencies, and all other governmental agencies carry out their responsibilities, including how they interact.

The approach presented in Chapter 4 seeks to improve the existing budgeting process by expanding the criteria used and making both the criteria and the decision process more transparent. In the short-term, these are critical steps, but they are only the first stage in a broader strategy and are presented in the knowledge that accomplishing the more important objective of truly integrated watershed planning and management is a long-term effort. The strategies presented in this chapter build on the criteria and prioritization process offered in Chapter 4; they have a goal of not only better prioritizing projects, but developing better projects. But the Corps faces many challenges in reaching the ultimate goal of integrated water resources management.

The Corps' efforts to develop a mission- and performance-based budgeting process, along with the recently announced "12-Actions for Change," both described in Chapter 2, offer an important opportunity for the Corps to position itself for an active and effective role in meeting the nation's water resources needs in the coming years. But, many questions still exist about how the Corps will put these actions into practice. It will take a significant change in the Corps' cultural fabric and it will also require support from the Congress, the Department of the Army, OMB, and others. It is inevitable that this change will take time. Ultimately, the Corps will need to move toward the integrated planning and management—performed in partnership with other agencies and governments at all levels—that is the focus of the third stage of the strategy outlined in this report.

BENEFITS OF WATERSHED MANAGEMENT

Many studies have pointed to the benefits of employing integrated systems-based water resources planning and management on a watershed scale. For example, the NRC, IWR, and, in deed the Corps itself, have concluded that managing in the context of large watersheds helps ensure the best use of resources and helps avoid unintended consequences. According to NRC, watershed management helps "...better address diverse and competing objectives, promote the federal interests in environmental stewardship, and balance competing interests."⁷⁰ (NRC *River Basins*, 2004) Guided by performance-based, outcome objectives, this management approach allows all decision-makers to assess how well objectives are being met, and to make better-informed resource decisions.

The panel fully subscribes to this view and believes that the foundation for moving the Corps budget process beyond the problems that have been identified lies in establishing and selecting priority investments based on the principles of integrated water resources management. The central assumption is that a clear vision for investment priorities must be derived from a systematic consideration of the full range of problems, needs and opportunities within a watershed or natural geographic area, with stakeholder involvement.

The Corps has recognized the benefits of this approach for many years. For example, the Corps' current strategic plan) states that integrated water resources management facilitates the search for comprehensive and integrated solutions to achieve objectives set by all concerned parties, rather than concentrating on a single water use at one project site. The need to manage watersheds "holistically" was one of the key themes emerging from the many "listening sessions" the Corps held during 2000 in preparing to develop its strategic plan.

Defining "Watershed"

In the context of this report, the term "watershed" is used generally to refer to the appropriate geographic/spatial area to be considered in planning and implementing water resource projects.

One definition of "watershed" refers to a geographic area of land, water, and biota within the confines of a drainage divide.⁷¹ But other terms are used to define a logical geographical scope on which to focus water resources planning and management activities. For example, NRC recognizes river basins as interconnected physical, biological, hydrological, and geochemical subsystems that interact so that changes in one can result in changes in another. Mirroring the above definition of "watershed," NRC notes that river basins are separated from surrounding basins by a drainage divide, indicating that the term "watershed" is often used to describe smaller drainages nested within a larger river basin. Neither term is defined by size; both can vary from fairly small areas to very large ones. (NRC, *River Basins*, 2004)

⁷⁰In 1999 NRC cautioned that, while watershed-scale management can be especially useful for managing biological and geophysical resources and for some local and regional applications, its value for integrating other objectives—ecological, economic, and social—had not yet been completely proven. Nonetheless, the report concluded that flexible application of watershed principles can improve efforts to achieve a sustainable economy and quality environment. (NRC, *New Strategies*, 1999)

⁷¹ See the *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management*, Federal Register, October 18, 2000.

Coastal systems define another logical geographic planning area for water resources. These are geographic units of the coastal zone that can be delineated based on their hydrology, geology, and/or biology. Their boundaries are harder to define than river basins or watersheds. But they are often influenced by upland watersheds and, as a consequence, coastal system planning should usually include both the watershed and the coastal environment. (NRC, *River Basins*, 2004) As used in this report, the term “watershed” can refer to any of these logical planning and management units.⁷² And, in fact, NRC has pointed out that in some cases the impacts and stakeholders affected by water projects can reach beyond the geographical watershed to a broader “problemshed.” (NRC, *New Strategies*, 1999)

In watersheds many things are connected: hydrology, geography, ecology, human and animal behavior. In fact, as used by NRC, the term “watershed” includes not only the hydrology of the area, but its associated water, soils, vegetation, animals, land use, and human activities. (NRC, *River Basins*, 2004) Watersheds also seldom coincide with governmental boundaries, and usually exist in the context of many governmental and private stakeholders with many, often conflicting, goals, including, for example, navigation, flood control, economic development, hydropower, environmental stewardship, and recreation.

CHARACTERISTICS AND STEPS IN “WATERSHED MANAGEMENT”

Not unexpectedly, integrated systems-based “watershed management” is a complex and often difficult process. Although water resource projects range in size and purpose, they often have impacts well beyond those intended, both in scope and nature. If nothing else, Katrina showed us the extent to which unintended consequences can result, even from efforts undertaken in accordance with “best practices” and with national goals in mind. Natural and human elements interact, often in unknown ways. Optimizing these goals relative to each other is the goal of watershed management, but it is a difficult one. Inability of competing jurisdictions to agree on approaches has often led to judicial involvement in water resources management decisions, an approach that is seen by many as lacking stability, increasing complexity in meeting the needs of a given area.

The following sections briefly describe what is involved, but this simplified discussion belies thorny issues inherent in any large-scale, multi-dimensional planning. It requires balancing the divergent needs, authorities, capabilities, and personalities of the stakeholders who sit at the core of the process. The experiences described in Appendix E, for example in the Apalachicola-Chattahoochee-Flint, the Mississippi River and Tributaries Project, and the Sacramento-San Joaquin River Basins, demonstrate the significant difficulties in coming to agreement on the wide range of issues inherent in watershed planning. See Box 5-1 for one example.

⁷² Appendix E provides examples of watersheds, including river basins and coastal systems.

Box 5-1: Difficulties in Coming to Agreement in the Sacramento-San Joaquin Valley

After disastrous flooding in 1997, Congress authorized the Corps to undertake a comprehensive study aimed at producing a comprehensive plan that would specify flood damage reduction (to both human life and property) and ecosystem restoration projects throughout California's Central Valley. While the stakeholders reported consensus on the basic problems, they were unable to come to agreement on specific measures to be taken. Money ran out in the fifth year of the study. A report (the "Interim Report") was issued in December 2002. It did not recommend particular projects.

Instead of specific projects, the plan established a set of general principles to guide the development, operation and maintenance of future projects; an approach to evaluating the system-wide effects of individual projects regardless of their scale; and an administrative structure to oversee project analyses and to ensure the consistent application of guiding principles. One analysis pointed to several lessons from this experience. The authors concluded, for example, that

- the scope of watershed planning can be overwhelming, and issues need to be broken down into manageable segments
- large scale planning can require costly and time-consuming effort

Another conclusion pointed to the negative side of ensuring everyone's interests are clearly articulated; namely that, once articulated, they need to be addressed. They concluded that on one hand, a systems approach that engages stakeholders can be useful in developing a common understanding and potential commitments. But, on the other hand, some stakeholders found this approach threatening, in so far as it also clarified conflicting interests and strategies of stakeholders. In short, the approach made the process "too transparent" for comfort.

(See case description in Appendix E for more information.)

Characteristics of a Watershed Management Approach

The necessary characteristics of successful watershed management reflect the multi-dimensional and inter-connected nature of watersheds. Though stated in various ways, the literature on watershed management identifies the following key characteristics.

- **Geographic scope that allows all significant impacts to be addressed:** The appropriate geographic scope (and time horizon) will differ. Watersheds differ significantly along a number of dimensions, such as size, climate, geology, soils, flora and fauna. There is also great variation in history, culture, institutional arrangements, laws, policies, and attitudes—and in the physical and environmental demands being placed on them. (NRC, *New Strategies*, 1999)
- **Focused on multiple objectives:** Multiple objectives are addressed to ensure competing objectives are recognized and considered. Efforts are made to optimize benefits and satisfy the needs of as many stakeholders as possible.

- **Systems-based:** Systems-based analysis, supported by multi-disciplined expertise, considers the inter-related nature of watersheds and the sub-systems in them to help ensure that all of the aspects of the watershed that can influence, and be influenced by, water projects are considered. This analytical approach helps ensure multiple objectives can be identified and attained and helps prevent unintended consequences. Though delineated in many ways in the literature, at a minimum the systems include economic, social, and environmental.
- **Participatory and inclusive of all appropriate stakeholders:** Participation by all stakeholders in a watershed, including all federal agencies with roles and authorities, is an essential element in identifying all of the possible objectives, costs, benefits, and impacts. Collaboration also helps to ensure the necessary support for the overall management effort, facilitates bringing all needed expertise to the table, and fosters coordination of the players and payers. NRC points out that, given the complexity of issues and the number of stakeholders involved at the river basin level, collaboration is needed in data gathering, analysis, development of alternatives, and decision-making. (NRC, *River Basins*, 2004)
- **Uses best science available:** Sound data and analysis lie at the heart of the watershed approach. They are critical to informing the judgments necessary in balancing competing objectives and to engendering trust among stakeholders and agreement on recommended actions. Advances in data collection, management, and analysis, including ecosystem modeling, are being made, though significant work remains to be done in developing the scientific approaches needed to most effectively manage at the watershed level.
- **Flexible and adaptive (performance-driven):** Continuous assessment and adaptive management allow impacts to be measured and needed changes made as their results become apparent. Assessing performance against stated objectives and goals allows the overall plan to be adjusted as necessary. It also fosters an on-going consideration and assessment of reliability and performance of existing projects/infrastructure, moving to the “portfolio analysis” NRC has recommended. “Portfolio planning does not mean that there is no longer a need for new investment, but it does mean evaluating new investments in the context of the condition and operations of existing physical infrastructure.” (NRC, *New Opportunity*, 2004)

The Delaware River Basin Commission (DRBC) provides a sound example of the benefits of this type of broad-based, multi-party planning and management. The Commission guides the watershed’s management, incorporating authorities, funding, and objectives of the several states, federal agencies, and local governments with interests in the watershed. The Corps Division Commander represents the President on the Commission. A critical element of the DRBC’s coordination role is that no project can be undertaken without DRBC’s agreement that it is in accord with its adopted comprehensive plan.⁷³ The kinds of issues successfully addressed reach well beyond those for which the Corps has direct authority. See Box 5-2 for more information.

⁷³ The concurrence of the federal commissioner is needed to bind the federal government to the Comprehensive Plan. (GAO, 1986)

Box 5-2: Delaware River Basin Commission's Experience in Managing the Watershed

In 1961 the four basin states (Delaware, Maryland, New York, and Pennsylvania), along with the federal government, signed the Delaware River Compact, creating the first regional body in which the federal government and a group of states joined together as equal partners to oversee a unified approach to managing a river system without regard to political boundaries.

Each commissioner has one vote and, for most issues, the majority rules. As required by the Compact, the DRBC successfully adopted, in 1962, its first comprehensive plan for managing the basin's water and related resources. In 2004, a new comprehensive plan was approved (this one taking about five years to develop). The Commission points to many accomplishments, such as:

- successful negotiation of water supplies during times of drought,
- adoption of comprehensive water quality standards
- initiation of a water conservation program
- issuance of regulations (1) restricting development in the 100-year flood plain and prohibiting it in the floodway and (2) concerning discharge of toxic pollutants
- construction of a new reservoir by in-basin electrical utilities

But in the early years, efforts at negotiating revised drought allocations failed, in part because of lack of convincing scientific data, and in part because a chief player, New York City, was not part of the Commission and, therefore, not part of the negotiations. In 1978 an ad hoc group composed of the states and New York City was established. Relying on the data from a long-term study, the ad hoc group approved the Interstate Water Management ("Good Faith") Report, which, among other things, laid the framework for a drought operating plan, which has been used successfully in water emergencies since then.

Among the lessons offered by the Commission's experience:

- The ability of the Commission to decide key issues on a majority vote and the corollary inability of one party to prevent action appear to be critical to its success.
- The importance of including all key players in decisions is clear. Negotiating water allocations without New York City at the table proved unsuccessful.
- Having sound data—that negotiating parties agree are both authoritative and objective—is central to the ability to develop negotiated decisions.
- Having all major stakeholders at the table facilitates consideration and successful implementation of a wide range of projects and problem solutions.

(See case description in Appendix E for more information)

Key Steps in Watershed Planning and Management

A variety of frameworks for sound planning have been developed in many fields. One such framework for use in water resources planning is presented below.⁷⁴ Each step should be considered in the context of the characteristics described above. For example, each step should be carried out collaboratively, based on the best science available, and inclusive of all significant objectives. Also, though presented as sequential, the steps, in practice, will be iterative and interactive.

Inventory watershed conditions: The first step is assessment of conditions—identifying existing or anticipated problems or opportunities—to provide the foundation for planning water resources activities. The assessment’s scope and detail will vary with the size of the watershed studied and the extent and potential significance of problems identified. But it will focus on factors that are most likely to influence changes (e.g., soils, human activity, or topography), will include a broad range of potential problems, and will seek to identify the causes of any problems found.

Develop program plan: The second step is development of a shared vision among stakeholders, a broad program of action for the watershed. A collaborative process will identify priority issues, considering all stakeholders’ concerns; identify and integrate the authorities of various stakeholders; specify watershed goals; and delineate corrective measures—typically diverse projects in multiple places in the watershed. Identification of needed research could also be a part of the overall program.

Plan and implement specific projects: The third major step is development and implementation of the specific corrective actions and responses to positive opportunities. In most cases, project development will include further study of alternative approaches to implementing agreed-upon actions. Different approaches can have different affects on various aspects of the watershed, and multiple types of impacts need to be considered. Decisions on final design are developed through stakeholder collaboration, and include decisions about allocation of funding and implementation responsibilities among the stakeholders. Experience has shown that this is often the most challenging step. This is the step at which all stakeholders have to come to grips with reality—not only finding funding, but accepting that not all stakeholder needs can be fully met, at least not with individual projects or in the short-term. But difficult as it may be, this is the most essential step. If it cannot be taken, all the other steps are for naught. Extra time and attention may need to be applied here to make sure that the process produces results.⁷⁵

⁷⁴ The five steps outlined here were developed by IWR as presented in *Improving Watershed Planning and Management through Integration: A Critical Review of Federal Opportunities (2002)*. IWR developed this illustrative programmatic planning cycle for watershed planning, in part, to illustrate how existing authorities and capabilities distributed among federal agencies and state and local governments could be meshed into an integrated approach. The descriptions of the steps are drawn from a variety of sources beyond the IWR report, especially the *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management*.

⁷⁵ In the federally-required transportation planning process, the essential nature of this step has been recognized in special detailed requirements for regularly updated and collaboratively adopted short-term, fiscally constrained “Transportation Improvement Programs” that are specifically designed to systematically implement the long-range plans.

Operate, maintain, and monitor structures and systems: Once projects have been completed, the responsibility for operation and maintenance is assigned to one or more of the stakeholders. Regular monitoring of facility condition is essential to lengthening their useful lives, safety, effectiveness, and efficiency. For federal facilities, a systematic asset management plan is required, as described in Appendix J. For federally constructed facilities that are turned over to others for operations and maintenance, similar expectations should apply.

Evaluate results: Evaluation of the project and program results is linked to an on-going evaluation of watershed conditions (see step 1). This critical last step allows stakeholders (and planners) to determine how well program and project goals are being met, and to identify changes in priorities and projects that may be needed.

MOVING THE CORPS TOWARD INTEGRATED WATERSHED MANAGEMENT IN TWO STAGES

The Panel sees the only real solution to better project prioritization and infrastructure investment strategies coming from the broadest possible planning and management approach. However, there are many obstacles to developing, adopting, and implementing a comprehensive, fully integrated, watershed-scale management approach. Consequently, the Panel recognizes that the transformation to this broad planning approach will take time and perseverance, and that change will need to be incremental. Moving ahead should not wait for a fully developed program.

This section describes two stages of improvements that, when built on changes in Chapter 4, constitute a strategy to ensure that Corps projects support fully integrated watershed management. Each stage addresses, in different ways, criticisms of the Corps' current project selection and budgeting approach. Each is supported by the principles being followed in the Corps' mission-based planning initiatives, as well as in the "12-Actions for Change." That initiative's focus on systems-based planning and management, communication, and science, for example, is necessary to achieve the systems planning described below. Later in the chapter, the Panel discusses the many obstacles that the Corps faces, and has faced, in moving to systems-based, watershed management. Chapter 6 will discuss in greater detail recommendations to "get to the goal," including thoughts on overcoming the obstacles discussed below.

Functional Systems Management

This stage, functional systems management, represents initial steps away from a project-by-project approach toward a more comprehensive performance-based, systems approach for setting priorities. Under the improved project management approach offered in Chapter 4, projects are evaluated on an individual basis with respect to a defined set of criteria. Under this functional systems approach, projects would be ranked and budgeted in the context of functional (business line) plans designed to accomplish agreed-upon system performance goals, expressed for significantly large-scale geographic areas, such as river basins or, statewide, or even nationwide (with respect to long-distance transportation needs, for example).

Main features

Function-Specific Performance Plans

Under functional systems management, the Corps would develop multi-year plans to achieve performance goals for each of its functional program responsibilities, such as flood damage reduction, navigation, ecosystem restoration, hydropower, or recreation.

Developing these plans would begin with an inventory of Corps projects in each of the Corps' geographic jurisdictions. This inventory would include the full life cycle of projects, including studies, construction, and operation and maintenance. Integration and coordination with related functional plans and projects planned by other federal agencies, by state and local governments, and by other organizations would also be important to validating these functional plans—and the projects they generate.

These plans require the identification and development of performance variables, measures, and targets to gauge success. Credible performance targets would require negotiation between the divisions and headquarters to balance varied local circumstances against national goal setting. For instance, the operational capacity of Corps hydropower facilities and the demand for electricity output will vary across divisions. Divisions must set performance targets that reflect these circumstances and headquarters must develop national targets that reflect these circumstances in the aggregate, while still pressing for improvement.⁷⁶

Each division would prepare a five-year performance plan, which would build on five-year plans developed by its constituent districts. These plans would include various levels of assumed spending. Alternative budgets would be linked to increments of performance in each functional program area. Projects would be identified under the different budget profiles in each program area. Current efforts by the Corps to change its planning and budgeting process, described in Chapter 2, closely mirror these concepts. According to Corps officials, as currently conceived, the move to more performance-based budgeting⁷⁷ will be accompanied by development of annual budgets and five-year plans at the district and division (essentially watershed) level. Agency-wide performance goals would ramp up from the district/division goals.

The Role of Exploratory and Coordination Studies

Developing performance plans initially would rely on the information provided by project-specific studies. But these studies vary significantly in scope and they may not adequately address the functional linkages among projects within and across functional program areas. These gaps in knowledge might significantly inhibit the usefulness of functional performance plans. Therefore, an essential element is the use of exploratory and coordination studies in the performance planning process. Although these studies may indicate the need for substantial modification of existing projects or even new projects, their focus would be to investigate and

⁷⁶ The relationship of performance goals to the OMB PART process is obvious. System performance goals should be developed in conjunction with the PART process, as well as on the basis of stakeholder input.

⁷⁷ As noted elsewhere, the Corps is working with OMB to develop improved performance measures for the Corps business lines and to link them to the budget process.

clarify possible, significant synergistic linkages among projects. The ultimate intent of these studies would be to inform the development of more effective functional performance plans.

The scope of these studies would vary depending on the gap in knowledge to be addressed. However, as a rule, the studies would not be long-term, comprehensive studies, but more limited attempts to explore functional linkages within a time frame that would provide results that could inform the planning process. Still, these studies would likely demand more than is possible within the usual reconnaissance study (limited to one year and \$100,000) and extend in scope beyond the immediate interests of individual project sponsors, making them difficult to conduct as cost-shared studies.

Roles of Headquarters and the Field

Performance plans would be developed in the field. However, where functional systems span division boundaries, such as inland waterways, headquarters would take the lead in developing performance plans with input from all the relevant divisions. Headquarters might also help with needed linkages to other federal agencies with related responsibilities. For example, it will be important that navigation and waterway projects be properly integrated with competing and/or complementary rail, air, and highway projects.

A key feature of this approach is that the Corps headquarters role would shift from a focus on ranking and budgeting individual projects to allocation of budget resources across divisions. This allocation is based on an assessment of the projected performance of each division's functional system plans, more specifically the increment of performance provided by marginal projects in each division.

Division-level performance plans would be developed based on guidance from headquarters. Headquarters would work with the divisions to develop acceptable performance targets and oversee the planning process to ensure accuracy and conformance with policy.

Role of Stakeholders

Performance plans at the division level would be developed in consultation with stakeholders in a formal, public process. Division staff would prepare alternative functional system plans in consultation with stakeholders. Stakeholders would participate in alternatives analysis, including options for ranking and budgeting projects between functional system plans. Division leadership would retain the right to make final decisions on functional system plans. Stakeholders would be engaged not just in the general planning process, but also in development of proposals for exploratory and coordination studies to inform the development of functional system plans.

The development of performance plans would include, from the beginning, consultation with national and state-level agencies responsible for plans bearing on water resources management in the Corps' program areas. For instance, FEMA flood risk reduction plans would be factored into division-level planning.

Precedents

In recent years, the Corps has been exploring elements found in the functional systems approach, such as watershed or systems approaches, multi-year budgets, and program performance metrics. The Corps has articulated elements of a watershed approach in its current Civil Works strategic plan and in policy guidance documents, including its Budget ECs. However, much of the Corps' existing guidance is focused on conducting planning for individual projects in a watershed context. That is, the guidance focuses on considering options and possible unintended consequences of specific projects over the entire affected area. This type of planning does not result in the types of studies necessary for functional systems planning.

Precedent for broader types of exploratory and coordination studies exist in the more flexible, broader, needs-based studies conducted prior to the policy changes made in 1986. Prior to WRDA 1986, the Corps was able to undertake larger, more thorough studies with 100 percent federal funding. In recent years, studies of a similar scale and depth are generally possible only if specifically authorized and funded by Congress.

The Corps is developing a more realistic five-year budget plan, in part, to facilitate more consistent project funding. Taking advantage of the Corps field structure, in which district and division boundaries essentially parallel key watersheds, it will allow districts and divisions to set priorities and develop budgets at the watershed level within headquarters-set policy and spending limits. Officials were pessimistic, however, about the extent to which a wide range of stakeholders could be brought into this longer-term, broader planning process. Existing funding levels, they said, essentially limit such participation to specific project issues.

The Mississippi River and Tributaries (MR&T) Project offers a precedent for a functional systems management approach. Though recognizing multiple objectives, the primary focus has been on flood damage reduction and navigation in the lower Mississippi watershed. This long-standing effort is unique in the Corps. It is funded through a separate appropriation account, rather than through Corps-wide accounts for investigations, general construction, and operations and maintenance, and was created by legislation that authorized a plan providing for a broad array of projects and allowing flexibility in implementation. The MR&T Project's special budget status—combined with an active and organized set of stakeholders in the area—has enabled the Corps to pursue objectives in a systematic way with relatively stable support.

Box 5-3 describes some key aspects of MR&T operation.

Box 5-3: Watershed-based funding: Mississippi River and Tributaries Project

In practice, a separate budget account for MR&T projects has meant that they do not compete directly with other Corps projects. Consequently, MR&T projects have enjoyed a somewhat privileged hold on resources. Additionally, the large geographic scope of the MR&T translates into a large constituency for projects. Institutions—such as the Mississippi River Commission which predated the MR&T and provides a solid base for constituent input—and an active regional flood management association have facilitated organization and dispute resolution among groups within this constituency. Consequently, this constituency has been able to exert significant impact on the Corps' proposed budget for the overall Project, facilitating regional agreement on basic priorities and managing conflict among individual interests. For instance, stakeholders with authorized flood control projects on the river system's tributaries were willing to wait until work was done on the main stem. The MR&T project area covers parts of seven states, which means that an array of Senators and Congressmen are available to push for funding and to fight any significant alterations in timing and sequence of individual project funding.

These two factors—the special budget status of the MR&T Project and the political coalition organized around it—can come together in positive and negative ways. On the positive side, it can enable Corps staff to pursue projects in a systematic way with stable support. Staff has the discretion and the resources to pursue projects based on their judgment of how best to build the system. On the negative side, a strong political coalition together with privileged budget status can make headquarters oversight of MR&T budgets more difficult. Also, the broad, cohesive coalition can make it difficult for the Corps or Congress to reduce funding for projects included in the plan that may no longer be justified in the face of changing circumstances.

(See case description in Appendix E for more information.)

Currently, the Corps is working to revamp its planning and budgeting approach. A key aspect of these efforts is to link agency goals and budget plans more closely to performance metrics, measures focused on functional—business line—systems.⁷⁸

Anticipated benefits

Earlier chapters of this report highlight numerous criticisms and concerns related to the Corps' current planning and budgeting approach. Functional systems management can help the Corps overcome, or begin to overcome, many of the criticisms, as well as meet its stated intent of moving to a systems-based management approach.

- Planning and budgeting would be linked to systems performance. The Corps' progress toward linking the ranking and budgeting of projects to the accomplishment of agency

⁷⁸ The Corps has been working closely with OMB and the ASA/CW to develop agreed-upon performance measures as part of on-going work on the new strategic plan and in preparation for a new round of PART assessments.

performance goals would be continued. Projects would be evaluated to the extent possible in terms of their contribution to the performance of functional systems. An understanding of systems and the functional linkages among projects within and across program areas would be aided by local knowledge and experience at the district and division level.

- Stakeholder involvement would be integral to the process. This involvement would offer two benefits. First, it would contribute to more robust plans. Locally knowledgeable stakeholders can offer critical information and perspectives to help understand watershed needs, devise credible performance targets, and identify operational linkages across projects within functional program areas. Second, the involvement of stakeholders in developing functional system plans would increase their commitment to those plans ultimately adopted by the divisions. In turn, this support could help engender congressional support and prevent the delays sometimes incurred when stakeholders do not cooperate or take political or judicial action to stop projects they object to.
- A wide range of factors would be considered. Focusing on a functional system, operating throughout a watershed, would encourage and facilitate consideration of multiple objectives, a range of alternative approaches, and a fuller set of possible (intended and unintended) consequences. Participation by a broad set of stakeholders, including relevant federal agencies, would substantially contribute to this goal.
- Transparency would be increased. The involvement of stakeholders in a public planning process would increase transparency of the planning process to participating stakeholders, and would place much of the information into the public record. The practical definition and application of factors would be subject to broader debate and discussion. Also, a public process would produce a public record available to higher-level decision makers and the public more generally.
- Project completion and continuity would be better ensured. Planning on a systems basis—identifying the inter-relationships of individual projects—and developing five-year (or longer) plans should reduce the likelihood of individual projects being added or subtracted to meet the interests of a particular stakeholder without regard to its effect on the overall system. Also, the ranking and budgeting of projects based on their contribution to a performance plan is aimed to “raise the bar” for making changes by calling for a justification in terms of performance against agreed upon public goals. A public planning process involving stakeholders and supported by scientific data would further legitimize the plan and oblige opponents to justify any changes. At the same time, while helping to resist narrowly motivated changes in project mix, this functional systems approach promises to improve the institutional capacity to adapt to changing circumstances that affect the plan’s performance. Public stakeholder involvement in planning and the availability of scientific data encourage trust among participants. This trust may allow the Corps to win continuing and consistent support for changes to the plan.

- A wider range of social equity issues could be addressed. In the improved project-by-project approach, project selection criteria focus on comparing the extent to which individual projects address environmental justice concerns. In this functional systems approach, broader issues could be addressed, recognizing that, although any given project may not have disproportionate impacts, a “program of projects” might. For example, overall flood protection may not be “equitable” along the river for different population centers, or navigation improvements may consistently benefit large businesses to the detriment of small, minority-owned businesses. Criteria similar to those suggested in Chapter 4 could be developed on a “systems” basis. Planners could, in fact, use them in developing systems plans, and headquarters could further consider them in making budgeting decisions. Where necessary, the functional plan(s) would be altered to better ensure equity in distribution of program benefits. The meaningful participation by affected communities, so critical to addressing environmental justice issues, reinforces the strong emphasis on stakeholder participation inherent in systems-based planning.

Box 5-4: Illustrative Example of Flood Damage Reduction Functional System Planning

The purpose of the Flood Damage Reduction (FDR) business line is to save lives and reduce the level of property damages incurred by floods and storms. Currently, the FDR program does not have results-oriented performance objectives; however, it is reasonable to assume that such measures will be adopted as part of the OMB PART process. For purposes of this example let us assume that a results-oriented PART measure for the FDR program has been adopted as follows:

“Eliminate flood exposure of people and property in urban areas from flood and storm events of probabilities of .01 or greater (100-year level of protection).”

This PART goal might apply uniformly throughout the Corps, or division-specific goals might be set, with the sum of division performance meeting the agency-wide goal. However it is applied, it would be used for evaluating FDR projects for funding. Each Corps division would have the responsibility for developing a multi-year investment strategy for FDR to find the best mix of project investments to realize the PART objective. The project investments reviewed would consist of projects authorized for construction, as well as the operation, maintenance and rehabilitation of existing projects in the division with FDR purposes.

In developing the investment strategy the division or districts would perform one or more exploratory and coordination studies. In setting investment priorities, it would examine factors such as the sequencing of construction projects to realize the most benefits in the quickest time frame, potential modifications to existing projects to better achieve FDR PART objectives; and changes in the operating rules of existing projects to better achieve FDR PART objectives. Additionally, coordination with other federal and state agencies with related responsibilities would take place to solicit views on finding the best investment strategy. And, finally, the division would have a formal consultation process with a broad array of regional stakeholders—perhaps organized into an advisory body based on the MR&T model—to arrive at the FDR investment strategy for the division.

Integrated Systems Performance Management

Integrated systems performance management is a fully integrated watershed-based, systems-based planning and budgeting process. Like the “interim” functional systems management approach, it focuses on performance outcomes, involves multi-year planning, and looks at systems impacts.

But it differs from the “interim” approach in several important ways. First, it is based on watershed-wide studies and assessments of all water-related resources and needs; these studies identify, from the ground up, what problems exist and what goals should be established. Second, the program and plan derived from those goals involve not only Corps projects, but all water-related projects in the watershed. Third, consequently, the stakeholders involved represent a wider range of interests and authorities, including a wide range of key federal, state, and local agencies, relevant private and non-profit groups, and the public. Finally, with some exceptions and, of course, with Corps and Army oversight, decisions about which projects to implement, and when, are decided by the stakeholders at the watershed level within a fiscally constrained framework. Congress, the Administration, and the Corps headquarters decisions would establish the watershed planning process and participants, set forth the criteria to be considered in the planning, require that the planning produce a regularly updated set of prioritized implementation projects, and establish annual ceilings for the federal financial participation in the projects in the watershed.

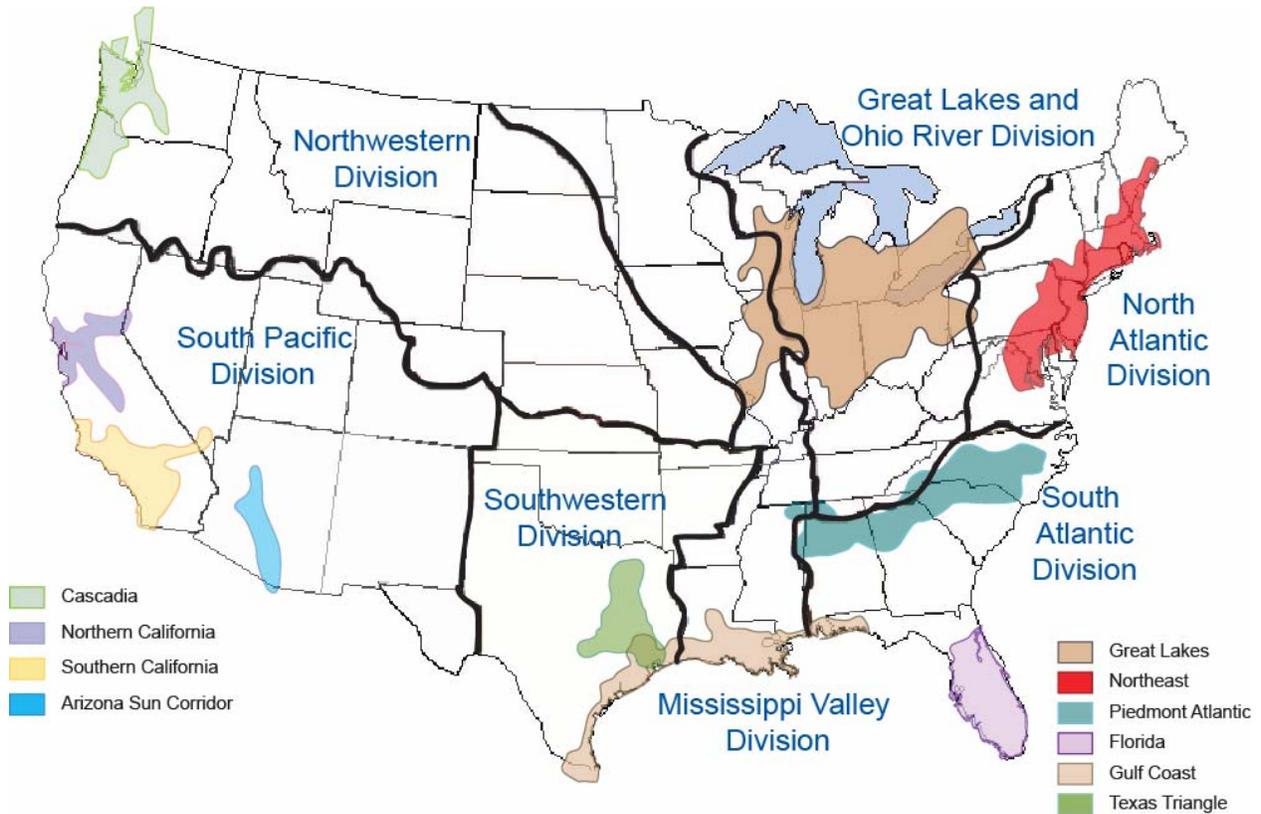
How it would work

Strategic Plan

A sound strategic plan must provide the underlying support for this integrated systems planning. It would provide the broad context in which watershed management is conducted. The Corps has an important effort underway to revise its strategic plan to make it more mission-directed and performance-driven. Ideally, the strategic plan would place the agency in the context of the nation's water resources needs, and reflect changes in economic and social parameters to help ensure that it, and the watershed plans it supports, are focused on the right issues in the right areas. It would, for example, ensure a careful assessment of how the Corps impacts, and is impacted by, broad economic and population changes across the country. Figure 5-1 demonstrates some kinds of information that would be considered. The map superimposes one estimate of the nation's major economic and population growth areas—through the year 2050—on a map of the Corps divisions.⁷⁹

⁷⁹ These ten growth areas were defined by a distinguished group of nationally renowned planning and economic development experts brought together by the Regional Plan Association of New York. For more information see *America 2050: A Prospectus* (New York: Regional Plan Association 2006). www.America2050.org

Figure 5-1: Comparison of Future National Economic and Population Growth Areas to Corps Divisions



The point is not whether the depiction of these 10 emerging "mega regions" accurately predicts America's future, but that different parts of the Nation will almost certainly be affected differently. Therefore, the Corps' various field offices can expect to be affected differently as the nation changes. The needs the Corps will be called upon to address—in navigation, flood protection, water supply, port expansion, ecosystem protection, and the like—will differ from place to place. These differences in pressures to accommodate growth and meet other needs should be accounted for in the Corps' strategic plan, along with appropriate performance goals, annual targets, and performance measures.

Undoubtedly, other geographic trends should be considered in the strategic plan as well—including such considerations as wetlands losses, related wildlife habitat conditions, and changes in storm-surge protections. Corps responsibilities for stewardship of the nation's water resources—which are shared with other federal agencies, state and local governments, businesses, and the non-profit sector—cannot be well met without some foresight of this nature.

Watershed studies and plans

Studies and assessments of water-related resources within a watershed would be jointly designed, and possibly conducted, by the Corps and other stakeholders. Though the definition of

“watershed” is flexible, ultimately and ideally, nested studies would build from smaller watersheds to the larger river basins identified across the nation. Inter-disciplinary, inter-agency, and inter-governmental viewpoints would be sought, along with meaningful input from affected stakeholders. Planning would look to a longer horizon. Based on the scientific evidence and stakeholder input, a strategic plan would be developed, focusing on long-term—as much as 10-20 years—goals and objectives. The plan would include performance objectives and measures.

More focused studies as well as development of alternative approaches would benefit from this same broad-based input and would lay the ground-work for short-term programs identifying specific actions/projects to undertaken. These studies would be scoped as appropriate for the specific problem or goal being addressed. The approaches considered could include a wide range of options, not just those the Corps has authority for. For example, they could include changes in local or state policies and procedures, or actions by private industry or non-profits.

These short-term programs would be prioritized based on stakeholder assessment of tradeoffs between pros and cons of the options, as well as the importance of the various goals established in the long-range plan. Equally important to the process, both the short-term plan and the annual budget request would include only those projects for which federal funding could reasonably be expected and for which any needed non-federal funding was available.

Roles of the Corps and other stakeholders

The role of stakeholders is critical to this systems-based approach. All appropriate stakeholders would be actively and meaningfully engaged in scoping the underlying studies as well as assessing and selecting alternative approaches. This collaborative process helps ensure the best “mix” of projects is identified, based on the broad interests and expertise it brings to the table. The process would be open and well-documented.

The headquarters role evolves further in this stage. It would continue its critical role in setting guidelines for studies and plan content, that is, any plan that contained Corps-funded or implemented projects would have to meet Corps-specified guidelines, consistent with legislated planning and project assessment criteria. But short-term budgeting decisions within a watershed would be determined by the stakeholders as part of the plan development. The Corps—and the ASA/CW—would make decisions (set priorities) for Corps funding among watersheds based on assessments of performance.

Performance based accountability

As noted above, long-term watershed plans would include objectives and performance measures by which stakeholders could assess progress and, where necessary, change plans and programs to better meet goals. Since the Corps is only one player (though in most cases a major player) in implementing the plan, watershed-wide goals may not adequately reflect Corps-specific goals. This may require the Corps divisions and headquarters to agree on more specific performance measures. The divisions would then be assessed on the Corps’ progress in supporting the overall watershed objectives as measured by the Corps-specific, division objectives. Funding could be based at least in part on that success or lack of success. This performance budgeting approach

would be designed to demonstrate results annually in the Corps' Performance and Accountability Report and every three years in OMB's PART review. The current status of the Corps' PART reviews is described in Appendix H.

Precedents

The Corps has undertaken several watershed-type efforts that demonstrate the capability of the Corps to implement this kind of approach, as well as some of the difficulties it faces in doing so. Several of those cases are described in more detail in Appendix E.

Another effort within the Department of Defense merits notice here: the Quadrennial Defense Review. This review operationalizes many of the concepts supporting integrated systems management. As required by law, every four years the Department conducts a comprehensive examination of the national defense strategy, force structure, force modernization plans, infrastructure, budget plan, and other elements of the defense program and policies. The purpose of the review is to develop a 20-year defense program. (<http://www.defenselink.mil/qdr/>) This review recognizes that there is not enough funding to meet all needs, and provides a process for identifying mission objectives and linking them to funding requirements with analytical support. All integrated systems are reviewed, the strategy looks upon long-term needs and goals as "living" manifestations of current conditions that need to be reviewed and revised periodically.

Several other federal agencies have extensive experience with broad-based systems planning. Perhaps the most fully developed model of this systems-based planning and budgeting approach is in the transportation area. EPA also has been planning in watersheds for many years, and has recently taken additional steps in that direction. More recently, the U.S. Department of Agriculture's Forest Service and the U.S. Department of Interior have jointly become involved in intergovernmental planning efforts to mitigate the risks of wildfires. These experiences are summarized below.

Transportation Planning Model

Systems planning has been legislatively required in the transportation area since 1962. Planning has evolved over time into a dynamic and effective mechanism for meeting the nation's transportation needs. There is now a very robust nationwide program of metropolitan and statewide planning programs that produce intermodal surface transportation plans that are used to justify all federally funded transit and highway projects.

The metropolitan plans are developed and adopted through an increasingly sophisticated 3-C process—comprehensive, coordinated, and cooperative—that is federally funded through matching grants. The 3-C process involves extensive public meetings that engage local elected officials as well as local and state agency representatives, and that encourage effective public participation. The plans establish long-range strategic goals (using at least a 20-year time horizon) that are linked to coordinated three-year Transportation Improvement Programs of projects—at both the state-wide and metropolitan levels—that are prioritized to effectively implement the long-range vision of the region. And the plans must be fiscally constrained, that

is, designed to be implemented within the funding reasonably expected to be available during the planning period.

As this planning program has matured, it has added increasing numbers of concerns and standards that must be considered and balanced with each other within the adopted plan. Elements now required to be reconciled within these plans include such things as congestion management, operating efficiencies, intermodal connections (to railroads, ports, airports, and ferry systems), safety improvements, security, air quality, storm water run-off, noise abatement, wetland preservation and replacement, and social equity (in service levels, relocations, and levels of environmental protection). The planning must include alternatives analysis, such as no-build alternatives, different mixtures of multiple modes of transportation, and operational enhancements.

The planning program is complimented by an established process for performance monitoring and setting targets for improvements in system performance. Beginning in 1993, under a mandate from Congress, the Department of Transportation has issued a biennial *Report to Congress on the Status of the Nation's Highways, Bridges and Transit: Conditions and Performance*. This combined report brings together previously separate reports on highways and transit, and provides data on performance and system investment requirements to inform the integrated surface transportation planning process. National experts in the transportation field have identified this process as a precedent for establishing a reporting process to support coordinated decision-making by federal agencies, including the Corps, that oversee the nation's marine transportation infrastructure.⁸⁰

The transportation program parallels the circumstances faced by the Corps in two important ways. First, is the parallel between metropolitan transportation plans and systems nesting within statewide plans and systems, and water resources tributary plans that nest within river basin plans. In both, individual projects are vitally inter-related with larger systems, and need to nest efficiently and effectively to be of greatest benefit to the nation. A second parallel is the fact that both programs rely on joint funding for their success. Box 5-5 summarizes some key benefits of the transportation model over the Corps' current process.

⁸⁰ See the recommendations of Special Report 279, *The Marine Transportation System and the Federal Role: Measuring Performance, Targeting Improvement*, issued by the National Academies' Transportation Research Board in 2004.

Box 5-5: Benefits of the Transportation Systems Planning Model

Compared to the current Corps planning and budgeting process, the transportation process

- is more transparent to the public; decisions are made mainly in public rather than in the internal confines of the President's budget process
- produces a collaboratively developed and publicly adopted plan with a list of priority projects that is the basis for project funding
- requires a wide variety of standards to be met explicitly within the planning process
- applies fiscal constraints and intergovernmental financial planning, and emphasizes operating efficiencies as an alternative to new construction
- emphasizes performance monitoring and setting targets for improvements in system performance
- requires that even congressionally earmarked projects—which are common in the surface transportation program—be reconciled within the system-wide planning process

EPA Planning

EPA has increasingly focused its efforts on watershed-scale, integrated approaches. The Agency's 2006-2011 strategic plan places an increased emphasis on using watershed-based approaches across its core water programs, identifying the approach as one of three key strategies driving the attainment of its water quality goals. A prime example is set forth in its approach to meeting its goal related to healthy communities and ecosystems.

The plan expands upon the agency's place-based ecosystem strategy to target additional high-priority ecosystems for restoration and protection. In addition to wetlands areas, the National Estuaries, Great Lakes, Chesapeake Bay, and the Gulf of Mexico, which were identified in the 2003-2008 plan, EPA has targeted Long Island Sound, the South Florida Ecosystem, Puget Sound and the Columbia River Basin. EPA has identified specific strategic targets and performance measures for improving the health of each targeted ecosystem. EPA recognizes that improving the health of these ecosystems will require a mix of regulatory and partnership approaches. The EPA focuses on these specific at-risk regional areas to develop and implement practices and tools for managing water quality as appropriate. The EPA intends to transfer lessons learned in dealing with each region to other ecosystems around the nation. As outlined in the plan, EPA's strategy includes, among other things,

- **multi-year funding** strategies that will enable states to implement measures to reduce nutrients
- **collaborative monitoring** and assessment to measure the performance of nitrogen reduction efforts

- **updating information**, in partnership with USGS and sub-basin committees, on flow, nutrient concentrations, and loadings at the mouths of each major sub-basin.
- **modeling** of hypoxic zones
- **cooperatively implementing** industry-led non-point source nutrient reduction strategies
- **re-assessing** nutrient load reductions achieved and the response of the hypoxic zone; water quality throughout the basin; and economic and social effects of Gulf of Mexico hypoxia

Wildland Fire Mitigation

The 2000 National Fire Plan established an intensive, long-term program to reduce hazardous fuels in the nation’s forests. As part of that congressionally recognized plan, a Comprehensive Strategy was jointly developed by the Departments of Agriculture and Interior, together with the Western Governor’s Association, the National Association of State Foresters, the National Association of Counties, and the Intertribal Timber Council.⁸¹ This strategy lays out a framework for collaboration and identifies four goals, including the reduction of hazardous fuels. In keeping with this goal, the Comprehensive Strategy calls for the prioritization of hazardous fuels reduction based on the relative risk posed by wildfires in different locations.

This planning effort was supported and complemented by the Administration’s Healthy Forests Initiative, launched in August of 2002, and the Healthy Forests Restoration Act, enacted in December of 2003. Under this initiative, the Departments of Agriculture and Interior are improving their regulatory processes, including procedures for developing guidance on assessing short-term risks against long-term benefits of fuel treatment projects. The Healthy Forests Restoration Act requires that priority be given to protecting “at-risk” communities using projects that are consistent with land management plans.

Progress and changing conditions are monitored through the National Fire Plan Operations and Reporting System, which was developed by the Forest Service and the Department of Interior to establish centralized and standardized reporting for the agencies. Data in this system are used to plan hazardous fuels reduction projects and to report performance to agency managers and stakeholders.

In 2006, the Department of Agriculture’s Inspector General reviewed implementation of the Healthy Forests Initiative. The report recognized the importance of prioritization efforts based on performance-based goals, and emphasized the importance of being able demonstrate and communicate progress toward those goals. Table 5-1 summarizes the basic tasks of the Healthy Forest planning effort, the elements of the current process, and the Inspector General’s recommendations for improvement.

⁸¹ A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-Year Comprehensive Strategy was issued in August of 2001. This strategy was most recently updated in December 2006.

Table 5-1: Recommendations for Improving the Healthy Forests Initiative

TASKS	CURRENT PROCESS	RECOMMENDED PROCESS
<p>1. Assess level of wildfire risks that communities face.</p>	<ul style="list-style-type: none"> • Risks identified by individual Forest Service field units • No consistent criteria or database • Benefits of risk-reduction projects not documented 	<ul style="list-style-type: none"> • Establish national guidelines for assessing relative risks and the benefits of specific fire reduction and ecosystem restoration projects • Establish consistent national database of current conditions to guide future assessments • Assess risks consistently among regions, forests, and districts • Establish benefits and cost effectiveness of each type of wildfire reduction project
<p>2. Prioritize federal spending to obtain greatest reductions of community risks.</p>	<ul style="list-style-type: none"> • No basis for prioritizing risks across the nation 	<ul style="list-style-type: none"> • Prioritize most effective projects in each location • Ensure that federal funds are distributed to regions and communities where the highest concentrations of risks are located
<p>3. Demonstrate progress in reducing community risks.</p>	<ul style="list-style-type: none"> • Numbers of acres treated, recorded and reported • No measure of risk reduction • Cannot demonstrate to stakeholders that threats of catastrophic wildfires are being reduced, or that federal money is being spent the right (most effective) way on the right (highest risk) places 	<ul style="list-style-type: none"> • Demonstrate results to stakeholders with outcome-oriented performance measures showing risks reducing the amount area protected and percent of high priority acres treated • Breakdown accomplishments reported by region, noting changes in risk conditions and sustainability of risk reductions

The lesson of these three examples is that federal agencies are taking stewardship responsibilities for achieving, and measuring progress toward, national performance goals—unlike the Corps.

Anticipated benefits of integrated systems performance management

A more fully integrated systems-based approach to the Corps’ programs—similar to that taken by Transportation, EPA and the wildfire agencies—would be more difficult to implement than the current or improved versions of the project-by-project approach used by the Corps. However, it would more effectively address the types of concerns discussed in Chapter 2 and could achieve the Corps’s stated goal of implementing a systems-based, watershed management approach. It would build on the benefits of the functional systems planning model. Most importantly, however, this integrated approach broadens the focus from individual functions and specific types of stakeholders, providing the capability to make tradeoffs across Corps missions.

- A fuller range of factors could be considered in prioritization. Concerns about failure to consider important factors in setting priorities, in most cases, would be eliminated. As with functional systems planning, the wide array of stakeholders, positioned at the local (watershed) level, is empowered to consider a broad set of criteria, and, in fact, could be required to do so. Factors such as human safety, environmental impact, social equity,

security could all be considered, and weighed as seen as appropriate by those most affected by the decisions. Having all players with all implementation authorities at the table in this broad policy-making environment would help ensure a wide range of alternatives are assessed, and that those with authority for various alternatives would play their rightful parts in the decision and funding process. By encompassing the entire needs and resources of the watershed, tradeoffs between new construction and operations and maintenance—including maintenance for which Corps is not responsible—as well as tradeoffs between construction and non-construction alternatives could be facilitated. Sound scientific study would also support them in making tradeoffs among those many factors.

- Transparency would be further improved. As with the functional systems approach, this process would be carried out in public. All stakeholders would have input, and the process would be thoroughly documented. All local stakeholders would know why decisions are made and have access to the supporting data. Local decision-makers could be held accountable for their decisions. Decision-makers above the watershed also would have that information to help them in their deliberations, including cross-mission decisions. And accountability would be clearer at the higher levels. Although the federal budget process would remain internal and privileged, differences that occur at this stage would be obvious, and there would be public expectations that they be explained.
- Project continuity would be improved. Again, as with functional systems planning, project continuity could be better-ensured. Expectations for continuity and completion of project and plan (system) implementation would be explicitly spelled out. Deviations could be specifically attributed to those who cause them. Public accountability would be clear. The more comprehensive stakeholder buy-in and scientific grounding also might be expected to enhance the continuity of system-wide implementation. Systems would be planned initially within realistic fiscal constraints. Sustainable financial plans would be developed side-by-side with physical plans. Additionally, decisions at the headquarters level would address larger issues than under the current system or functional systems planning, and projects would be less likely to move in and out of the budget from year to year, as now happens. Emphasis at the national level would focus on program performance and results, rather than on project management. New projects would not begin until federal and non-federal funding was relatively secure. New projects—that may be supported by members of Congress or other parties—would be undertaken in ways found to be consistent with and supportive of the long-range and short-term program. Long-term funding would be better assured based on acceptance of fiscally constrained, stakeholder supported, watershed plans.
- Broad environmental justice issues could be addressed. A fully integrated systems-based plan will allow a more proactive approach to addressing environmental justice issues. The foundation watershed assessment would include overall consideration of location and benefit levels of target populations. As indicated by the studies, program goals could include overcoming any inequities that are found. Plans and programs would seek from the start to address environmental justice issues. Stakeholder participation by targeted groups would be integral to the overall planning process. As with functional systems planning, the kinds of environmental justice criteria discussed in Chapter 4 would be used

at the watershed program level as well as headquarters to make budgeting decisions. Performance measures could be developed at the watershed and agency level to more clearly assess success in addressing these issues and link that success to budget priorities.

CONSTRAINTS ON THE CORPS' WATERSHED MANAGEMENT

As noted in Chapter 2, the concept of watershed planning for water resources is far from new. The Corps points out, in fact, that the organization of the Civil Works field offices around geographic "basins" demonstrates the Corps' historical understanding of the necessity of managing water resources activities within a watershed context. Broad systems studies and planning were the "norm" for many years until the mid-1980s.

In recent years, the Corps has begun to emphasize the concept again. The Corps' 2004-2009 strategic plan, along with other planning guidance, endorses the concept and encourages it. In 2002 testimony before the Senate, the then Chief of the Corps of Engineers stated his belief that "...the future is to look at watersheds first; then design projects consistent with the more comprehensive approach." (quoted in NRC, *River Basins*, 2004) In spite of policies that are clearly supportive of watershed planning and management, however, the extent to which the Corps actually accomplishes this goal is limited. Individual project planning assessments remain the operating norm, and, in practice, watershed planning, and broad, systems approaches, are only taken when specifically mandated, and funded, by Congress.⁸²

Several extensive studies of the Corps' planning process emphasize the need for the Corps to work toward accomplishing its missions in the context of a watershed perspective. These studies also point to several significant obstacles the Corps faces in doing so. In some cases, the Corps can take further steps to overcome these obstacles; in others, action is needed at higher levels.

This section reviews the most significant obstacles to the Corps' implementation of watershed management; obstacles that will complicate the adoption of the functional systems management and integrated systems approaches discussed above. The key factors discussed are:

- unclear and conflicting national water policy
- project-focused authorization and appropriation procedures
- project-focused cost sharing and evaluation procedures
- existing Corps NED-oriented guidance and project-oriented culture
- cost and time constraints
- lack of regional watershed planning structure

⁸² NRC attempted to determine the extent to which even project-specific plans were conducted with a "watershed perspective," but could not come to a conclusion based on the information it had available. (NRC *River Basins*, 2004)

- limitations of data and analytical techniques

Unclear National Water Policy⁸³

NRC has pointed out that national water policy is unclear, and is contained in numerous laws and executive orders that set forth diverse objectives and goals. As evidence of unclear policies, NRC points to diverse, conflicting, and overlapping missions assigned to as many as 34 federal water resource agencies. A 1999 NRC report cites fragmentation and lack of clarity about how to resolve disputes caused by conflicting missions as a key factor inhibiting successful implementation of a watershed approach. (NRC, *New Strategies*, 1999; *New Directions*, 1999)

In its 2002 report on integrating watershed planning, IWR also concluded that “fragmentation of government authority may be the most basic constraint” on the watershed planning process. By its very nature, the size and complexity of the federal structure complicates cooperation and coordination. But additionally, declining budgets have compounded a natural tendency of agencies—sometimes negatively depicted as turf-guarding or empire building—to compete for resources and to focus on their central mission. In planning, agencies tend to seek problem solutions that coincide with their authorities. (IWR, 2002)

Within the Corps itself, several current and former officials voiced concerns over lack of clarity in mission. Put another way, there are so many missions, set forth in so many legislative provisions, that it is difficult to know where to focus effort.

Another outgrowth of this unclear policy is that there is often keen competition between “traditional” water constituencies and the environmental interests that place priority on the more recently legislated goals for ecosystem restoration and sustainability, as well as those who press for social equity goals. Absent clear national policy, it often falls to Congress to set priorities or resolve conflicts on a project-by-project basis. (NRC *River Basins*, 2004) Others have pointed to constituents’ reliance on the courts to settle these conflicts. In these situations, decisions are seldom made in the context of the watershed. (Kenney, 1995) The history of water management in the Apalachicola-Chattahoochee-Flint (ACF) River Basin demonstrates the difficulties that can exist in developing compromises in the face of competing interests and goals. (See Box 5-6)

⁸³ Lack of a national policy also is an important obstacle faced in the current budgeting prioritization process as well as the improved approach discussed in Chapter 4.

Box 5-6: Difficulties in the Apalachicola-Chattahoochee-Flint Basin

The ACF Basin runs through Georgia and Alabama and Florida, emptying into the Gulf of Mexico. It is the primary water supply for the city of Atlanta. The Corps operates storage reservoirs and maintains the upper basin navigation channel. For the last three decades, the three states have been at odds over management of the basin. In the early years, upstream interests (Georgia, Alabama, and the Corps) sought navigation improvements; the state of Florida was increasingly concerned about environmental effects and commercial seafood interests associated with the river and bay. More recently, Atlanta's water supply has been a focus of contention.

After several failed attempts at a negotiated settlement, and several suits, the states signed the Apalachicola-Chattahoochee-Flint River Basin Compact, creating the ACF Basin Commission. This Compact was the first interstate water compact signed since the passage of major federal environmental legislation and its efforts highlight the complexity of issues faced in resolving water resources issues today. These were complex, high-stakes issues, with many unknowns.

The Commission was charged with developing an allocation formula to apportion the surface waters of the Basin among the states. The Commission consisted of the three governors, with negotiations to be conducted by their representatives. A federal commissioner also was appointed and given power to accept or reject any formula agreed to by the states. But the Commission was unable to reach agreement on an allocation formula. After years of indecision, in 2003, the three governors signed an agreement that, in essence, adopted a Georgia proposal that Florida had already rejected many times. (The Florida negotiator was not involved in developing the agreement.) Florida provided an alternative proposal. Georgia rejected it. Florida refused to extend negotiations past the scheduled termination of the Compact. The ACF River Basin Compact has been terminated, and the allocation issue seems likely to go before the Supreme Court again.

(See case description in Appendix E for more information.)

Many observers familiar with issues relative to the nation's water resources see a lack of national will to address what they see as critical problems. They believe that the nation's water resources infrastructure is not now a national priority. Various assessments give low ratings to the condition of the nation's water resources infrastructure, and water resources management must compete for federal funds against many other critical needs (such as health and national security) that have greater visibility. In the face of this competition, funding for the Corps has been declining, in relative terms, for some years. See Appendix D for a summary of the Academy-sponsored Thinkers Session discussion.

Project-Focused Authorization and Appropriation Procedures

The current authorization and appropriation mechanisms work against watershed-management in at least two ways. First, since the early days of the Corps, Congress has authorized and appropriated the bulk of the Corps' Civil Works budget for specific projects on an annual basis.

The Corps has traditionally presented its budget as a list of projects and studies to be funded, and did so even when watershed planning was more the norm. This project-by-project approach contributes to an “individual project focus” in Corps thinking. Some may criticize the Corps for capitulating to this political reality and others may recognize that the Corps is responding in a “rational” way to the Congressional reality that controls its budget. Nonetheless, the existing annual project-by-project approach to authorizing, budgeting, and appropriating Corps funds is a significant factor moving the Corps away from watershed planning. And Corps officials characterize the resulting agency interaction with Congress as being focused on the wrong questions, looking at specific projects rather than national priorities and agency goals. (The cost-share provisions required for most Corps projects and studies, discussed below, also push the Corps toward an individual project focus.)

Second, annual appropriations for individual projects also limit the Corps’ ability to work “adaptively” in a watershed; that is it makes it difficult to implement changes to project design or timing when project outcomes or changing circumstances indicate the changes are needed.

As early as 1999, NRC reported the need for stable funding for watershed management.

Watershed management seeks to develop careful, long-term solutions to problems and provide sustainable access to resources and thus it benefits the nation. The President and Congress should consider establishing some stable mechanism to fund the federal contribution to watershed management partnerships, such as a revenue-sharing strategy or trust fund. This funding should be available to state, regional, and local organizations for research, planning, implementation, and ongoing peer evaluation of watershed initiatives. (NRC, *New Strategies*, 1999)

Congressional insistence on the project-by-project funding approach can be attributed to many factors, depending on your point of view. To some, it allows appropriate Congressional oversight, especially in light of what some on the Hill see as the Corps’ inability to explain its project selection decisions, and findings from GAO that the Corps was “reprogramming” extensive amounts of funding. (GAO, 2005) To others, it speaks to Congressional “pork barrel” spending, and Congressional members’ focus on local needs at the expense of national priorities. Whatever the reasons, project-focused funding perpetuates an individual project focus in Corps operations. Whether the Corps can move to a new watershed-scale focus or the Congress will change its approach to funding, are significant questions.

Cost And Time Constraints

Systems-based planning and management on a watershed scale can be, at least in the near term, a costly undertaking. And, given concerns about the condition of the infrastructure, comprehensive assessments of watershed conditions and needs are likely to develop costly programs of improvements. Though regional prioritization will take into account the limited funding available, it becomes apparent that additional funding is needed and that the federal government cannot be the only source of those funds.

Regardless of final decisions on the extent of funding made available to address a watershed's needs, the initial study to assess those needs will, in most cases, be significantly broader in scope and depth than is the case for Corps reconnaissance and feasibility studies. The kinds of broad-scope, multi-dimensional, multi-stakeholder analyses envisioned in a fully developed watershed management approach, or even for more limited studies of functional systems, involves significantly more time and resources than does the more limited, project-specific approach.⁸⁴ Although the adage "you get what you pay for," may apply, finding the funds and getting the necessary agreements to go forward with the studies that lie at the heart of this approach can be daunting.

As discussed in Chapter 2, planning was made more project-specific, and less well integrated, by the local cost-sharing requirements enacted in 1986. As anticipated at the time, local participation in Corps planning has increased, and many also believe that fewer "marginal" projects have been undertaken. But a negative effect has been what NRC has recognized as "subtle, but real" incentives for the Corps to focus on local projects. (NRC, *River Basins*, 2004) Neither feasibility studies⁸⁵ nor project construction can take place without local sponsors who share the costs. Local sponsors tend to propose projects with single purposes and local benefits. They may be unwilling or unable to consider wider implications (e.g., economic, social, or environmental) of projects. They may also be unwilling to devote the extra time to planning studies that consider these systems aspects, and unintended consequences, of projects.

NRC has identified funding limitations as a major obstacle to broad-based watershed planning by the Corps. Among other things, NRC has recommended that Corps reconnaissance studies include an integrated evaluation of project benefits and impacts and that, while the cost-sharing requirements for the portion of studies that meet local needs be retained, full federal funding be provided for those portions that integrate evaluation of project benefits at broader spatial and temporal levels. (NRC, *River Basins*, 2004) NRC has also recommended a new study authority (in support of the report's recommendation for portfolio management) be given to the Corps to allow it to conduct broad evaluations that include, for example, existing infrastructure and non-structural alternatives as well as new construction, and economic issues at not only the national, but regional and international levels. (NRC, *New Opportunity*, 2004)

⁸⁴ The need for broad-based study is exemplified in NRC's discussion of the Missouri River. NRC noted that there is an extensive body of scientific research on the Missouri River, but very few of the over 2000 studies that have been completed on the ecosystem in the past 30 years have taken a systems approach and considered interrelationships among various components (e.g. physical, geochemical, biological and anthropogenic). NRC cites a need for more integrated planning and management. (NRC, *River Basins*, 2004)

⁸⁵ Reconnaissance studies, done to determine if there is a federal role in a proposed project, are fully federally funded, but are limited to \$100,000. Feasibility studies can be broader in scope, but non-federal sponsor must contribute 50 percent of the cost. Though potentially broad in scope, these studies are focused on individual projects, and do not constitute the type of study of watershed condition that would form the basis of a truly watershed-based, systems approach.

Limitations in Existing Guidance and Culture

Though Corps policies encourage a watershed perspective in planning, the detailed guidance and requirements do little to move planners in that direction. The organizational culture that has grown up in response to these long-standing practices also presents a significant challenge.

Federal guidance focuses on individual projects and only a few criteria for assessing priorities

At the federal, multi-agency level, policies for water resource studies are set forth in the WRC's P&G. This 1983 guidance is widely seen as outdated for a number of reasons. In 1999 NRC recommended that the executive branch review the P&G and modify it to incorporate "contemporary analytical techniques and changes in public values and federal agency programs." (NRC, *New Directions*, 1999) In 2004—noting that no significant action had been taken on that recommendation, in spite of the fact that it had been "voiced multiple times by previous groups"—NRC again recommended that the P&G be revised to "better reflect contemporary management paradigms, analytical methods, legislative directives, and social, economic, and political realities." (NRC, *Analytical Methods*, 2004; *New Opportunity*, 2004)

Chief among the reasons to make these revisions is that the P&G clearly establishes economic development as the primary criteria in selecting water resource projects, thereby minimizing the importance of many other goals, and making it difficult to seek to meet many stakeholders' needs. The P&G requires that alternative plans be evaluated for each proposed project and that each alternative plan have information presented in four "accounts:" national economic development (NED), environmental quality (non-monetary effects on natural and cultural resources), regional economic development, and other social effects (effects from perspectives that are relevant, but not included in other areas). However, the guidance also states that—absent an exception granted by the Secretary⁸⁶—the preferred plan for any given water resources project should be the one that maximizes national economic development, consistent with protecting the nation's environment.

Other federal guidance for water resource management is much more broadly focused on watersheds and seeks to accomplish multi-agency coordination. In FY 2000, the Corps, along with seven other federal agencies, adopted the *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management*⁸⁷. The policy states two goals: (1) use a watershed approach to prevent and reduce pollution of surface and ground waters resulting from Federal land and resource management activities, and (2) accomplish this in a unified and cost-effective manner.

It should be noted, however, that this broad policy is not a requirement for any of these agencies. The policy specifically notes that it will be implemented at different rates by different agencies

⁸⁶ Provisions are made for exceptions that are justified by other national priorities or local preference.

⁸⁷ The other agencies are: the Departments of Agriculture, Commerce, Defense, Energy, and Interior, along with EPA, and TVA.

as resources are available. Additionally, the policy only applies to activities on federal lands⁸⁸ and, as with many other watershed-based efforts, this policy is focused on a specific objective, meeting the requirements of the Clean Water Act. It has no direct relationship with budget priorities. Box 5-7 provides a summary of the guidance set forth in this policy.

Box 5-7: Key Components of the Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management

The policy commits the agencies to using a consistent and scientific approach to manage federal lands and resources and to assess, protect, and restore watersheds. It seeks to build upon existing cooperative relationships among federal agencies and with tribal, state, and local governments, as well as including dialogue with private landowners. Among other things, this policy calls for federal agencies to coordinate in

- conducting watershed assessments to guide actions
- identifying “priority” watersheds (defined in part as those with substantial portions of federally-managed land, significant impairments of water quality or flow, or substantial public interest)
- identifying those watersheds with significant health, ecosystems or public use values in need of special attention
- focusing funding and resources on priority watersheds
- improving watersheds through adaptive management
- identifying needed research and, where appropriate, conducting that research

The policy identifies other expectations: that coordination and cooperation will be improved among federal agencies; that they will share training, information, and technical expertise; and that they will be encouraged to pool funds to focus on priority efforts.

Corps guidance is changing, but is still limited.

In spite of the fact that its strategic plan identifies the benefits of a watershed planning and endorses this approach, until very recently, the Corps planning guidance has mirrored the P&G emphasis on individual project planning and focus on one or two criteria—economic development and ecosystem protection—as opposed to working toward balancing competing objectives to make best use of the nation’s water resources.

The Corps’ strategic plan highlights four key concepts, similar to those discussed earlier in this chapter, as key watershed management characteristics: systems approach, spatial or geographic integration, balance across multiple uses or functions, and a collaborative approach. But it does not set out a strategy for getting there. Also, it does not link objectives to meaningful, performance-based outcome measures and does not set goals. It perpetuates the focus on individual projects and views the Corps as a “service provider” to cost-share sponsors, rather than an organization with responsibilities for the water resources system as a whole and a

⁸⁸ IWR points out that although focused on federal lands, the policy is expected to apply to 40 percent of the watersheds in the nation, and encompasses state and local collaborations and partnerships. (IWR, 2002)

steward of national interests. By focusing on the management of projects, rather than on vital outcomes, it provides little guidance for project prioritization.

Following the guidelines in the P&G, the Corps has planned on a project-level basis for many years. Even where the Corps encourages a ‘watershed perspective,’ it is most often addressed in the context of planning for a specific project in a local area. IWR reviewed the planning frameworks used by three agencies: EPA, U.S. Forest Service and the Corps, with the goal of beginning to develop an integrated watershed planning framework for federal watershed agencies. IWR noted that EPA and the Forest Service frameworks are more “programmatic” in nature, while the Corps is focused more on individual projects. Additionally, a comparison of the key steps in the three agencies’ approaches showed that two key elements not directly included in the Corps steps are overall watershed condition assessment and evaluating results (IWR, 2002).

NRC points out that the Corps’ guidance, especially its *Planning Guidance Notebook*, provides relatively limited guidance on watershed-based planning, especially when compared to the detailed guidance for economic evaluation of water projects. “Neither spatial integration of projects within a watershed nor evaluation of the cumulative effects of multiple projects within a watershed is incorporated as an explicit element” of planning.... Procedures for implementing a watershed approach...are not identified.” NRC has recommended that the Corps improve day-to-day planning by reviewing and revising its planning guidance to bring it into conformance with its stated objectives of integrated water resources planning. (NRC, *River Basins*, 2004)⁸⁹

As described in Box 5-8, the Corps’ experience in coastal Louisiana after hurricanes Katrina and Rita highlight the limitations of the current guidance.

⁸⁹ NRC specified that this should be done, even if the executive branch does not revise the P&G.

Box 5-8: Policy Exceptions Facilitate Corps' Systems Approach in Coastal Louisiana

The Corps is working to implement a risk-informed, systems approach as it plans to help coastal Louisiana rebuild and improve protection from storms. Exceptions to its usual project planning policies enable the team to operate with more flexibility to meet this urgent need.

- The study is neither a reconnaissance study (limited to \$100,000) nor a feasibility study (requiring a 50 percent non-federal cost-share).
- It is not being developed according to all of the policies that guide formulation of project plans and selection of alternatives.
- Recommendations will not be limited to the traditional focus on the goal of national economic development, but will also be based on an assessment of non-economic factors at risk and on consequence analyses.

One important policy has not changed, however. The Administration intends that any federal funding for additional analysis or for construction would be subject to annual budget requests and necessary authorizations. This annual funding mechanism was a chief concern raised by a working group of scientists and engineers who studied Katrina's aftermath and lessons learned. They concluded that a major part of the funding should be "programmatic."

(See the case description in Appendix E for further information.)

Recent policy changes have attempted to move to a more balanced focus. For example, the 2002 Corps Environmental Operating Principles (<http://www.hq.usace.army.mil/cepa/envprinciples.htm>) highlighted the importance of developing "the scientific, economic and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions." More recently, in 2005, the Corps expanded guidance in furtherance of its ecosystem restoration mission. Among other things, the "Guidance on Planning in a Collaborative Environment" emphasizes the need to plan projects in the context of all federal goals, not just the Corps', and encourages collaboration with federal, local, state, and other stakeholders. This new guidance also removes the presumed preference in project planning for the alternative plan that maximizes national economic benefit. It requires that information for all four types of criteria specified in the federal guidance (national economic, regional economic, environmental, and social) be developed and that "[A]ny alternative plan may be selected and recommended for implementation if it has, on balance, net beneficial effects after considering all plan effects..." This May 2005 guidance is contained in EC 1105-2-409; it expires on September 30, 2007.

The corps faces an uphill battle in implementing these policies. One obstacle in recent years has been OMB's budget guidance, beginning with the 2005 budget, directed the Corps to prioritize projects based on the RBRC ratio. Later guidance specified exceptions to that rule, most specifically allowing exceptions where significant loss of life might occur, but the clear message throughout the Corps is that economic benefit, in the form of RBRC ratio, is the primary objective sought for non-ecosystem construction projects.

Additionally, although Corps officials have said that the P&G allows sufficient flexibility for them to accomplish these broad objectives, it may continue to represent a significant obstacle. For example, to implement the recent guidance allowing a non-NED alternative to be the preferred alternative, planners must still meet the P&G requirement to justify that choice as an exception to be approved by the Secretary. Flexibility is there, but emphasis remains on economic development as far as meeting P&G requirements.

More importantly, the Panel is concerned that the P&G, while arguably flexible, is far from the positive driver it should be. It still emphasizes economics over risk, the environment, and other important goals; it is dated in terms of analytical methods; it fails to recognize evolving legislative and social realities; it does not emphasize performance measurement; it does not facilitate working with other agencies; and it does not provide guidance to drive the Corps to integrated watershed planning. Likewise, existing Corps guidance does little to move planners to the agency's more generally stated goals.

Culture

Moving to a fully integrated systems planning and management approach will also require a significant change in the Corps' culture. The culture is now focused on identifying and solving individual problems, and on assessing alternatives on primarily quantitative economic and engineering terms. Especially since the ascendancy of project sponsors, the Corps seems to see itself in a reactive, rather than a proactive, role.

It also may be difficult for many in the Corps to move to the more abstract, often qualitative, analysis that will be necessary for a systems-based approach rooted in risk analysis and social equity analysis. IWR raised this concern in a 1996 study. Although progress may have been made since then, at that time IWR pointed out that engineers are frequently not trained in risk-informed decision-making, though certain design standards incorporate implicit tolerance for risk, and that management often has difficulty in incorporating risk considerations into the culture of an organization. The IWR report notes that the Corps' organizational culture needed to be changed. It also concludes that:

If an effort to advance risk assessment approaches is to succeed, factors as obvious as the way the review process is structured, the way budgets are allocated and the commitment of the organizational hierarchy may be as important as writing new rules or technical training. (IWR, 1996)

Some also wonder whether the Corps has a sufficient body of people who are comfortable working in a broad, systems context. The concern is that engineers—the bulk of the Corps' workforce—think differently than systems analysts and social scientists. Engineers are expert in solving specific, often in themselves extremely complex, problems, but are not experienced in working through the complex, often abstract and non-quantitative, issues addressed in a multi-faceted, systems-based, risk-focused, watershed approach.

Other cultural change may be even more difficult than moving to a systems approach. Some suggest that the engineering culture may not fit well with the experimental nature of multi-

objective, adaptive management, discussed later in this chapter. Finally, the organization may find it difficult to move beyond thinking in terms of its individual mission to seeing itself in relation to other governmental agencies and in relation to larger national goals.

Lack of an Organizational Structure for Regional Watershed Planning

The Panel recognizes that the Corps is not in control of many of the relevant elements in a watershed and that the Corps does not have the authority to mandate, or even oversee, the coordination of the many authorities dispersed among the federal water resource agencies, as well as other governmental and private stakeholders. Since the demise of the WRC and regional commissions, there is no nationally recognized, established organizational structure through which all the stakeholders—including the many federal, state, and local governments, and other organizations—can work to plan and manage water resources on a regional, watershed basis.

NRC has recognized the need for a body charged with coordinating water policies and activities among the various federal agencies, the Congress, and the states. It has recommend establishment of a process to resolve differences that agencies cannot resolve among themselves. (NRC, *New Opportunity*, 2004) Legislation creating the WRC and the Title II commissions has not been repealed. The potential benefits of reviving that structure (or creating some other formal national or regional structures) to implement integrated watershed planning are substantial. But efforts to do so would need to consider concerns about further bureaucratization and creation of more layers of government.

Nevertheless, coordination among the stakeholders is critical to effective watershed management, and the Corps can play an important role, even without revitalization of the WRC and regional commissions. As noted earlier, for example, the Corps is actively engaged in the Delaware River Basin Commission, which has successfully implemented water resource management efforts in many areas beyond those traditionally under the Corps' authority. The Panel believes the Corps could take the lead in many such efforts without formal authority. It is also important to note that the Corps may not always be the lead agency in such efforts, but would be a major participant. For example, the Corps is actively involved in efforts to clean up the Chesapeake Bay, work that is led by EPA and involves a host of state and local governments as well as stakeholder organizations. (See Box 5-9)

Box 5-9: Cooperative, Multi-party Efforts to Clean up the Chesapeake Bay

EPA's approach to the clean up of the Chesapeake Bay illustrates the potential benefits of a cooperative, multi-agency, multi-stakeholder approach, as well as the challenges faced in such an effort. With Congressional authorization, the EPA set up the Chesapeake Bay Program Office in 1984. The watershed covers two EPA regions, parts of six states, and approximately four thousand local jurisdictions. The Office reports to the region in which it is located, not to EPA headquarters; it is two layers removed from the top leadership. Decision making authority is vested in an interstate Executive Council with membership including governors, legislatures and other government entities. The Council functions as a board of directors for EPA's Chesapeake Bay Program Office, and adopts Bay-wide agreements to clean up the Bay. The Corps built the original physical model of the Bay (since replaced by a computer model) to develop a scientific base to inform policy decisions. A particular weak point in the system was the local jurisdictions charged with Bay clean-up responsibilities at the tributary level. They have not been effectively organized to meet these responsibilities. Although the EPA enabled the development of these intergovernmental arrangements, it has no authority to require it, and is still trying to achieve its goals by energizing inter-agency, inter-governmental, and public-private partnerships.

(For more information see *Taking Environmental Protection to the Next Level*, Academy Panel on Environmental Service Delivery Systems, Washington, D.C.: National Academy of Public Administration, forthcoming in 2007).

Limitations of Data and Analytical Techniques

Advances are needed in the quantity and quality of data available, in modeling capabilities and other scientific areas, to most effectively carry out watershed-based systems planning and management. In recent years both IWR and NRC have pointed to weaknesses in water resources research as well as in research to support the broader issues and tradeoffs at the heart of watershed planning and management. (NRC, *New Opportunity*, 2004; IWR, 2002)

Some concerns mirror those related to lack of a national water policy. For example, there is no national water research agenda and no coordination or consolidation of data collection and maintenance. But more specific issues have also been raised. Significant limits still exist in our ability to analyze and predict the physical and biological impacts of water policies and projects. Certain kinds of data are lacking and technology for modeling ecosystem responses is still developing. (IWR, 2002)

Of equal concern are limits in our ability to analyze and predict—and to make tradeoffs among—the wider array of social, economic and cultural impacts that are the consequences of water policies and projects. IWR and NRC, as well as others, have expressed concerns that the scale of issues being addressed exceed science's ability to adequately address them. (NRC *River Basins*, 2004; IWR, 2002)

So, much effort is needed to improve our ability to scientifically assess the many watershed planning issues that arise, and some progress is being made. NRC has pointed to significant

progress in the technology to support systems-based watershed planning. NRC points to hydrologic and other geophysical models constructed by the Corps and the work of IWR in a variety of areas, as well as land-use and population models and data—such as census data and geographic information systems—as significant advances. (NRC *River Basins*, 2004) Additionally, the extensive modeling work being undertaken in places like Louisiana and the Everglades demonstrate the progress being made in conducting these complex systems-scale studies. For example, in Louisiana, one important approach is the use of scenarios to evaluate risk under alternative assessments of the uncertain factors. Key factors to be varied under the alternative scenarios include hurricane probabilities as well as rates of sea level rise, land subsidence, dynamic coastal landscape change/loss, and population return. See Appendix F for more information on risk assessments.

But water resource management must progress, in spite of these data and analytical challenges. The Corps and others need to continue moving towards systems-based watershed management. In doing so, they must use the best science available without losing sight of its limitations.

With that in mind, both IWR and NRC point to the use of “adaptive management” techniques as the best way to deal with the inherent uncertainties of natural processes as well as the existing limitations of science. (NRC, *River Basins*, 2004; IWR, 2002)

NRC describes adaptive management as an iterative learning and management process that provides a means to adjust to changing conditions and to avoid costly mistakes and unintended consequences. It is a method to avoid “large, irreversible decisions” by allowing initial design that utilizes all available knowledge and then adding to that knowledge to work to achieve more desirable ends. This approach relies on monitoring outcomes to increase scientific learning as well as to adjust policies and operations as necessary, based on those outcomes. It requires stakeholder collaboration and seeks to increase knowledge of the links between social and natural systems. NRC noted that the Corps should implement this approach in different ways. For example, a “passive” approach would focus on monitoring the results of specific actions, while a more “active” (or experimental) approach, would design specific actions to test multiple models of system behavior. (NRC, *New Opportunity*, 2004 and *New Directions*, 1999) NRC lists the key elements of adaptive management as:

- a process for reviewing and revisiting management objectives
- a range of management options
- monitoring and evaluating outcomes
- a framework for incorporating new knowledge (e.g. economic, engineering, ecological) into management decisions
- stakeholder collaboration

But adaptive management is also described as an evolving, and largely untested, concept. And it runs counter to historical Corps culture. It emphasizes uncertainty, surprise, and resilience, which

“run counter to traditional engineering planning concepts of deterministic systems, precision, and model predictions.” (NRC, *New Opportunity*, 2004) Implementation is also challenging because the process leaves open the possibility that, often hard-to-obtain, agreements about objectives, scope, and specific approaches to projects may have to change as monitoring data brings actual impacts to light. This issue was faced in the efforts to reach agreement in the Apalachicola-Chattahoochee-Flint River Basin. According to one author, Florida suggested the provisions be made in the agreement to use adaptive management techniques to deal with the significant uncertainty, allowing modifications as ecological changes occurred. But the other states were reluctant to do so. “The real problem was not the information or tools available to the negotiation teams, but the lack of a process to use information collaboratively and lack of trust among the negotiating parties.” (Leitman, 2006)

The Corps, however, has recognized the potential benefits of adaptive management and began in the 1990s to incorporate it into specific projects. Perhaps most notably, the Corps is emphasizing this approach in its Everglades restoration program. (See Box 5-10) And, in fact, Congress recognized that changes may be needed in specifics of the projects it authorized and allowed for that to happen. NRC recommended that the Corps continue to implement adaptive management on different scales and to learn from those experiences.

Box 5-10: Adaptive Management in the Everglades

The Corps' Comprehensive Everglades Restoration Plan (CERP) directs significant effort to monitoring and evaluating the impacts—both environmental as well as those related to the other water goals—of projects as they are implemented. Among other things, interim goals and targets are being established to guide performance assessment. Appropriate baseline data will be collected, and an adaptive assessment protocol will be developed to interpret the responses by natural and human systems during and following CERP implementation. Although not mandated, the team intends to issue an annual Report Card on system-wide responses for a critical set of the measures that will be monitored.

(See case description in Appendix E for more information.)

THE CORPS IS ON THE RIGHT PATH

The Panel strongly supports the Corps' efforts to improve its budgeting process and implement the principles embodied in the “12-Actions for Change” announced in mid-2006. As described in Chapter 2, these efforts re-establish systems-based planning as a Corps objective, and seek to move to a performance-based budgeting model that is focused on the agency's mission. These efforts provide a sound basis for moving through the strategy outlined in this report.

The Corps' leadership has recognized that implementing the 12 Actions will require a significant change in the institution's culture. In fact, the Panel's strong enthusiasm for the 12-point program is tempered by the recognition of the extent of change that will be needed. Institutional cultures are hard to change. These new efforts, for example, still seem largely focused on looking at individual projects or sponsor-identified problems in the context of the watershed,

rather than looking first and broadly at the watershed's needs. The road from "project engineer" to "watershed steward" is likely to be a difficult one.

Whether the Corps can effectively accomplish the goals it has set will depend on the extent to which it can overcome the challenges discussed above how, it operationalizes the 12 Actions, and what kind of support it receives from the executive and legislative branches.

The Corps must answer some important questions about the 12 Actions and what they mean for the organization.

- How will it define "systems" planning?
 - Will it start from the basis of a specific project proposal or identified problem—looking watershed-wide at possible impacts—or will it start with assessments of needs and conditions in a watershed and identify potential solutions and projects only after needs are identified?
 - How broadly will it define "risk?" Will it go beyond the issue of human life and property to additional types of risk, such as social and cultural? Will it include a view to the future, for example, looking at demographic trends and regional and national expectations? Will risks include lost opportunities to create national or regional benefits? How will it assess risk? An Academy compilation of risk assessment and risk management concepts and practices is provided in Appendix F.
 - Will communication and public involvement be focused on particular problems and solutions, or will the Corps create a collaborative process intended to work from all perspectives in the region to identify risks and approaches to addressing risk? Will communication and collaboration go beyond issues of "risk" to broader issues of meeting the many objectives of water resources efforts?
- How will the Corps define outcomes expected from implementation of the principles? How will the Corps assess its contribution to meeting the nation's water resources needs? What metrics will it use?
- Will the Corps limit alternatives considered to those it has authority and funding for, or will it work with other federal, state, local, and private stakeholders to optimize authorities and orchestrate funding from all possible sources? Will cost-share offers continue to limit the alternatives the Corps can consider?
- Will the Corps establish an on-going process to both assess water resources infrastructure, including that turned over to non-federal sponsors for operation, and to assess its overall goals and policies to better ensure that it accomplishes its mission?

It will take time and resources for the Corps to fully implement the initiatives it has underway, let alone to develop the fully integrated systems approach discussed above. That is the reason a

three-stage strategy is proposed. But, steps can begin immediately. The following section provides a viable time line for implementation of the strategy.

TIMELINE FOR IMPLEMENTING THREE-STAGE STRATEGY

In brief, the stages discussed in this chapter and in Chapter 4 build on one to another in the following way.

- The first stage would add several formal prioritization criterion to be applied to all projects (to which they would be relevant), plus a scoring mechanism that would allow the scores earned by each project on each criteria to be combined into a composite score indicating the relative merit of the project compared to all other Corps projects—across all the Corps business lines. Even before planning-based performance prioritization is required, individual projects could be given “extra credit” on their prioritization score if they originate from or become consistent with comprehensive watershed plans that meet specified standards.
- The second stage would require projects to be consistent with watershed-wide, fiscally constrained, system plans for the individual business lines. Under this strategy, the Corps would provide watershed-wide business-line planning studies more consistently within its districts and divisions to more fully justify its construction projects. This stage is recommended as a bridge between stages one and three because it could be put in place more quickly than stage three, and the Panel believes it is important to move beyond stage one as quickly as possible to improve the quality of projects.
- The third stage would require projects to originate in watershed-based system planning integrated across all the relevant business lines operating within the watershed. Under this strategy, the Corps would support multi-stakeholder planning processes within each district and division where significant amounts of Corps activity occurs. Projects in these watershed areas would be generated by the fiscally constrained plans produced by these processes, and would be prioritized within the collaboratively adopted plans themselves—including related implementation programs and project schedules.

Efforts can begin immediately as the Corps executes the 2007 appropriation. That appropriation provides a brief window of “flexibility” because it does not fund individual construction projects. Though it may not be wise to make massive changes in funding priorities, the Corps does have the opportunity to consider more of the kinds of criteria discussed in this report as it distributes the 2007 funds. It can also begin working to develop a method to systematically collect additional information—especially the data that Chapter 4 points to as already available—to help in prioritizing funding for 2007 as well as future years.

The following table and discussion explain how the three stages could be incrementally developed, starting more formally in FY 2008.

**Table 5-2: Key Steps to Achieve a Fully Integrated Systems Management Approach
by FY 2012**

Strategies for Improving Corps Civil Works Investment Priorities	Stages of Implementation				
	FY 08	FY 09	FY 10	FY 11	FY 12
Strategy 1: Improve Project-by-Project Priorities					
• Fund development of additional prioritization criteria	X	X	X		
• Fund development of cross-program prioritization mechanisms	X	X	X		
• Attach dashboards to project justifications (increase # of criteria on dashboard each year)		X	X	X	X
• Add dashboard analysis to projects funded without one		X	X	X	X
• Move toward full-funding of projects		X	X	X	X
• Appropriate funds project-by-project	X	X			
Strategy 2: Refocus Investment Priorities on Business Line Performance					
• Fund business-line planning studies by the Corps; increase stakeholder involvement	X	X	X	X	
• Justify appropriations requests with business-line plans for each Corps Division			X	X	
• Embed project justifications, dashboards, and priorities in business-line plans			X	X	
• Attach business-line plans to appropriations requests			X	X	
• Move toward accommodating lumpiness in capital acquisition accounts			X	X	
• Appropriate business-line funds to Corps Divisions			X	X	X
Strategy 3: Refocus Investment Priorities on Integrated Watershed Needs					
• Fund river basin and watershed planning studies	X	X	X	X	X
• Fund support for multi-party river basins planning councils			X	X	X
• Require all Corps civil works projects to be consistent with river basin plans adopted by the river basin council					X
• Embed project justification, dashboards, and priorities in river basin plans adopted by the appropriate river basin council					X
• Attach river basin plans to appropriation requests					X
• Appropriate funds to Corps Divisions to implement priority projects in river basin plans					X

In FY 2008, the Civil Works budget process would not change significantly. Projects would continue to be prioritized as before, and funds would be appropriated for individual projects. However, four specific actions are needed in FY 2008 to prepare the way for improvements in future years. New funds are needed for

- developing additional criteria for analyzing and prioritizing projects, for use beginning in FY 2009
- developing cross-program prioritization mechanisms (such as report-card type grades on different aspects of a project, and a grade-point average for the project as a whole; or a weighted point-score drawn from a dashboard type of analysis), for use beginning in FY 2009
- beginning to develop business-line plans in each Corps division (and maybe in the districts as well), for use in prioritizing projects beginning in FY 2010
- beginning to develop river basin and watershed planning studies in the Corps division offices for use in prioritizing projects beginning in FY 2012

In FY 2009, each project justification would incorporate a dashboard that would follow it throughout the budget and appropriation process to clearly show the results of analyses leading to its prioritization. In this first year of the improved process, the number of prioritization criteria might be limited to RBRC, risk, and environmental factors—and perhaps facility condition for any projects that have been built or begun. In FY 2010 and beyond, additional criteria would be expected to be added until a complete set is available. These dashboards would be expected to be maintained for each proposed project even after project-by-project appropriations are replaced by business-line and river-basin appropriations after FY 2009. Full-funding of projects would be expected to begin in FY 2009, and become the norm thereafter—potentially using multi-year appropriations for some of the larger projects—as is now done for major weapons systems or full funding agreements as used in “New Starts” transit systems.

Attaching business-line plans for each Corps division to appropriations requests would begin in FY 2010. Those plans would accommodate the lumpiness often associated with large capital asset acquisition programs—in accordance with OMB Circular A-11, Appendix J. This method of appropriating would continue in FY 2011, and would then be incorporated into appropriations by river basin in subsequent years.

Also in FY 2010, appropriations for multi-party river basin planning councils would begin for the purpose of getting them ready to become responsible for developing, adopting and administering the river basin studies and plans begun by the Corps divisions using the funds appropriated for this purpose beginning in FY 2008. These plans would become the primary source of prioritizing Civil Works appropriations from FY 2012 onward.

Complete project detail would continue to be made available even after planning-based appropriations replace most individual project appropriations in FY 2010, but it would be expected that the budget process would respect the results of the field level collaborative planning and prioritization processes for the most part. The switch to planning-based appropriations would substantially unburden the budget and appropriations processes that now must decide on several

hundred individual projects—after having considered an even larger number along the way, including projects that failed to be approved.

SUMMARY

The alternatives presented here, and in Chapter 4, present a strategy, moving along a continuum, from a fairly limited process focused on individual projects to a robust planning and management process in which individual projects emerge as parts of comprehensive systems. Corps officials are, and have been for many years, supportive of the concepts presented here. They have efforts under way that begin moving the Corps in the direction of integrated, systems-based, watershed management. Table 5-3 provides a synopsis of each of the stages of the strategy presented, compared to the current process, and how they differ in regard to the key budgeting issues discussed in this report. The table also serves as a guidepost for the Corps as it moves forward with the “12 Actions” and other initiatives.

Additionally, though the examples offered in this chapter or in Appendix E do not all constitute fully integrated watershed planning, they do serve as examples of various aspects of such efforts. The Corps is actively involved in all of them and can apply lessons learned in those activities to developing agency-wide policies and procedures.

But the Corps faces many obstacles in implementing its on-going initiatives and in moving farther through the strategy presented. Some key obstacles are lack of clear national—and therefore agency-wide—water resources goals, limited funding, guidance focused on individual projects rather than watersheds, project-specific appropriations, and lack of watershed organizations.

The Corps can proactively take steps to overcome some of these problems. It can, as it is seeking to do, develop better analytical methods, such as those related to risk, and can expand the criteria used in its budgeting decisions. Also, for example, it could require that projects be planned in context of the watershed they are found in and provide better guidance on how to do that.

But it cannot succeed alone. To answer the questions posed above and to deal with the constraints identified, it will need to enlist the support of other key players. The Congress, the Department of the Army and OMB need to support and facilitate the Corps’ on-going efforts, as well as the more far-reaching efforts described in this report.

Table 5-3: Progression of Stages of Strategy to Implement Integrated Systems Planning

FEATURES	ALTERNATIVES			
	Project Management (Current)	Improved Project Management	Functional Systems Management	Integrated Systems Management
Objective of Alternative	Best allocation of limited funds within administration guidance	Best allocation of limited funds, improved by more robust criteria and methods	Begin to move Corps to watershed approach; best allocation to meet functional system goals	Support the Corps' participation in true, systems-based, inter-governmental, multi-party watershed planning; best allocation to meet national and regional goals
Budgeting Approach	Project-by-project	Enhanced project-by-project	Partially integrated planning	Fully integrated, watershed planning
Army/Corps HQ Role	Definitive: final decision-makers on all projects proposed for funding	Still definitive, but based on a broader set of explicit prioritization criteria	Shifting to more strategic guidance, better, results-oriented performance assessment, and cross-watershed allocation of resources	Concentrated on performance and results assessment; determinative across watersheds
Stakeholder Role	Front-end role has little impact at budgeting stage	Front-end role a little more influential (multiple criteria), but still little direct budgeting influence	Moderate impact; influential in functional systems planning	Determinative within the watershed—with few exceptions
Range of Factors Considered	Primarily RBRC, with some exceptions (and cost-effectiveness for ecosystem projects)	4-5 main criteria, systematically applied	Limited system planning and alternatives analysis	Expansive and fully interactive (alternative simulations)
Transparency	Process/reasoning unclear to those not part of budgeting process	Criteria clearer, process still not public	More transparent at field level; headquarters criteria clearer but process still not public	Fully transparent at all levels except final budget process, which would be less project-specific
Project Completion and Continuity	Considered, but discontinuities occur	Considered, but discontinuities occur	Explicitly considered in functional system plans; discontinuities still possible, but less likely	Explicitly considered in programming and as results are demonstrated; discontinuities much less likely
Flexibility	Project changes easy to make, project in and out of budget	More factors considered; changes not based primarily on a single dominant criterion	Functional plans may reduce arbitrary changes; changes made would be based on agreed-upon criteria and goals	Sound science/buy-in help ensure changes are adequately considered and beneficial; specific processes for plan amendments and periodic reassessments

CHAPTER 6

FINDINGS AND RECOMMENDATIONS

Budgeting for civil works construction projects at the U.S. Army Corps of Engineers is complex and controversial. Project selection decisions, in conjunction with Congressional funding actions, have profound impacts, sometimes of life and death importance, on local, regional and national interests. This was the genesis of the Panel’s study—is it possible to improve the prioritization of projects during the budgeting process? As the Panel studied this question, it became evident that project prioritization was only the tip of the iceberg.

Clearly, the criteria and process used to select projects for the budget have important ramifications. Yet, the most important criterion is how projects relate to and support agency and national goals. The Corps is not in a position to answer that question. Consequently, the Panel was drawn to address a wider issue: to assess the context in which the budget process is carried out and to better ensure that Corps efforts are focused on the nation’s most important water management priorities from the viewpoints of human safety, ecological health, systems performance and reliability, and much more.

The preceding chapters examine the current process for developing and justifying the Corps’ Civil Works construction budget, as well as legislative, administrative, and financial factors that drive the process. This chapter recommends a three-stage improvement strategy aimed at transforming the analytical methods and scope of the budget process and, more important, the planning that underlies it. The ultimate goal is to better ensure that more of the projects funded are of the highest quality and will reliably provide the greatest benefits to the nation. To most effectively do that, the Corps must evolve from the role of “project engineer” to “watershed steward” and become a convener of intergovernmental prioritization processes.

THE CURRENT PROCESS

The current process focuses largely on a single measure to assess the benefits of each project and set priorities for implementation. A type of benefit-cost measure is the main prioritization criterion for flood and storm damage reduction, commercial navigation, and hydropower construction. However, risk criteria are used instead of benefit-cost for projects in the flood and storm damage reduction program if human safety is at issue. Meanwhile, environmental criteria, not benefit-cost, are used for ecosystem restoration projects. Formal budget prioritization lists are developed separately for each business line.

The Panel believes that over-reliance on single-dimension criteria, coupled with the inability to prioritize across business lines, presents serious problems that should be corrected as quickly as possible. The Corps actually uses multiple criteria to develop and analyze its construction projects, but the additional information is not systematically used to prioritize projects for budget purposes. The most commonly considered additional criteria are:

- Does the project save lives?
- Can risk and uncertainty be more accurately estimated and mitigated?
- Are environmental considerations given sufficient weight in projects other than ecosystem restoration (where they are already central)?
- Are current methods of project evaluation biased against less affluent and/or minority populations?
- Does the spending profile for individual projects allow them to be started and completed within a reasonable and predictable time period?
- Are the one-year funding amounts provided by annual appropriations consistent with a longer-run (e.g. five-year) planning horizon?
- Is proposed spending consistent with “systems” and “watershed-based” planning?
- What other performance measures should be used to demonstrate expected benefits?

The Panel believes that multiple criteria should be used, and it has presented an analysis to help the Corps do so. It is also important that the Corps make its budget process as transparent and participatory as possible, articulate how the multiple criteria were used and explain the decisions made. One approach is to develop an understandable means of comparing projects across the criteria. Using comparable prioritization criteria and measuring them with reliable and widely accepted means would facilitate prioritization across programs. The report suggests various methods to do this, including a visual “dashboard.” The process would incorporate collaborative inputs by funding and other partners. The goal would be to provide visible means of assuring budget-makers at each stage of the process—within the Corps and Department of the Army, at OMB and during Congressional deliberations—that the projects being funded are the ones that best satisfy multiple stakeholders and objectives. For example, objectives should go beyond achieving economic benefits to include ensuring safety from natural hazards, enhancing homeland security (critical infrastructure protection), ensuring no net loss of wetlands, achieving equitable distribution of benefits, and enhancing ecological integrity.

Ensuring that Projects Support Goals

This report describes the benefits of managing the nation’s water resources on the basis of watershed and river basin needs and resources. It also discusses the influence of several factors that drive the Corps to focus on solving specific problems rather than assessing and working to meet water resources needs in a systems context on watershed and river basin scales. By correcting the factors that emphasize specific problems and work against an integrated systems approach, the Corps can improve the pool of projects that it is prioritizing and better meet national needs. Among the important structural features of water resources policy that drive narrow rather than system-wide problem solving are the following: current cost sharing

requirements; existing project-focused planning guidance; and the annual, project-specific, appropriations process.

The Corps has recognized the need to plan and implement solutions within fully integrated systems frameworks, that include watershed approaches and collaborative planning, and has begun several key initiatives to begin addressing many of the concerns raised in this report. The Panel strongly endorses these moves and encourages Congress and the Administration to continue support for them. Nevertheless, more can and should be done to improve water resources solutions and investments through broader integration.

The Panel believes that it is essential to move away as rapidly as possible from the current norm of individual projects—toward projects that are drawn increasingly from watershed and river basin planning. Projects should be generated within more comprehensive multi-objective and multi-dimensional planning. These more comprehensive plans should be developed with the full collaboration of all relevant federal agencies, the affected state and local governments, and other interested stakeholders. Collaboration will help optimize benefits and minimize negative consequences, as well as better ensure support for, and funding of, selected projects.

In achieving more fully integrated planning at the watershed and river basin levels, the federal participants should recognize and support the leadership roles of states in water resources management, as they help to establish priorities among watersheds, mobilize non-federal resources on a scale sufficient to plan and implement collaborative watershed-wide solutions, and enable the creation and empowerment of watershed level non-federal institutions to serve as integrators in their respective watersheds and river basins. Although it is essential to maintain non-federal cost sharing, it is also important to seek new, innovative ways to finance projects, looking to many sources and funding mechanisms, including many that may not involve federal dollars.

Recognizing the long-term nature of this transformation and the need for action not only by the Corps, but also by other key stakeholders, the Panel recommends several important actions. They are presented below in six areas: integrated systems planning, periodic mission reviews, a restructured strategic plan, partnerships with other stakeholders, maintenance of Corps-built structures, and cost-share requirements.

RECOMMENDATION 1: INTEGRATED SYSTEMS PLANNING

The Corps and the Department of the Army, along with OMB and Congress, should begin immediately to implement the three-stage strategy outlined in this report to reshape the Corps' budget process. The goal is to transition the Corps as quickly as possible to a strategic budget process supported by performance-oriented and systems-based watershed and river basin planning and implementation programs. This effort should include amending the Water Resources Development Act and revising the *Principles and Guidelines* (P&G). These steps would provide a stronger basis for reformulating the Corps' budget process, but should not be allowed to delay this urgently needed transition.

Work should begin immediately on the Panel's recommended three-stage strategy to implement the budget process transformation. The first stage—improving project-by-project prioritization—would continue to drive the appropriations process for the next two fiscal years as the planning-based intergovernmental strategy processes gear up. The second stage—functional system, business-line planning—would provide limited performance-based priorities to guide appropriations in fiscal years 2010 and 2011, before being incorporated into the third stage. The third stage—integrated watershed and river basin planning—would provide the most fully justified funding priorities beginning in fiscal year 2012 and continuing beyond.

In the immediate future, project priorities would be determined by improved project metrics, including a larger array of prioritization criteria that are considered simultaneously through a composite scoring or grading procedure. As more broad-based planning processes become available, project priorities should come increasingly from collaboratively prepared and adapted plans. When the Corps, the Army, OMB and Congress need to identify the next highest funding priority, they would consult the strategic plan for the Corps division with the most urgent unfunded need and find the implementation project next in line for funding on that division's five-year program of system implementation projects.

A timeline and set of activities for implementing the recommended three-stage strategy is set forth in Chapter 5. The following implementation steps should be taken:

- **The Secretary of the Army and the Chief of Engineers should continue to revise Corps planning and budgeting guidance.** With support from Congress and the Administration, the Army and the Corps have made significant progress in revising planning guidance to achieve water resources solutions that meet contemporary needs in collaborative ways. But further revisions are needed, especially in the Corps' *Planning Guidance Notebook* and the "Budget EC," to:
 - Emphasize project planning and development in a collaborative, watershed or river basin context, building on the Collaborative Planning guidance issued by the Corps in May 2005.
 - Move from the existing mechanical project prioritization process—that overemphasizes economic benefits—to a process that considers multiple factors, and gives priority to activities selected from collaboratively developed plans. More deliberate and systematic consideration of human risk should be a top priority. The revisions should also include expanded guidance for assessing and addressing environmental justice concerns that relate to Corps projects.

The Panel also recognizes that the Corps and Department of the Army are limited in the extent to which they can achieve this goal on their own. Congress and the Administration also will need to take action to allow the Corps to fully implement this strategy. Therefore:

- **Congress should amend the Water Resources Development Act to support the collaborative planning concept and allow greater latitude for planning-based project initiation.** Requirements for non-federal cost share should be retained, but cost

sharing commitments should be consistent with collaborative planning activities. Project sponsors should make the case for proposed projects in the collaborative planning and prioritization process, and agreements for meeting the statutory cost share requirements should be determined in the collaborative process with all the stakeholders, including the Corps, other federal agencies, and state and local governments. Collaborative plans should provide for long range solutions—as long as a 20-year time horizon—but should include five-year implementation “programs” that are based on realistic budgets. The collaborative plans should become the basis for authorizing, de-authorizing, and appropriating in order to:

- Get rid of the backlog of projects that have little chance of being funded
 - Ensure efficient and effective completion of projects that are funded
 - Improve performance of the nation’s water resources systems
- **The five-year “program of projects” designed to implement the long-range plan should be financially constrained.** It should contain only those projects for which there is a reasonably expected and specifically identified funding source. Funding sources for which the intergovernmental and other partners in the planning process have responsibility should be included—whether federal, state, local, tribal or private. This means that governors, mayors, elected county officials, legislators and others with financial responsibility for proposed projects should be parties to the process.
 - **The P&G that provides the underlying guidance for Corps planning and priority setting should be revised.** This important interagency guidance should explicitly strengthen the Corps’ evolving performance-based planning and budget prioritization process. It has not been updated since 1983—several years before the *Government Performance and Results Act* (GPRA) became law, and does not even mention the present performance-based ways that federal agencies establish their goals, priorities, and accountability mechanisms. In fact, the P&G leads in a different direction than GPRA. Although the Corps regularly updates its own budget and planning guidelines—and does not see the P&G as a barrier to good budgeting practices—Corps guidance remains remarkably consistent with this older, out-of-date guidance. And, to the extent that the Corps moves away from the P&G on its own, its practices may diverge from those of other federal water resources agencies. It is important to have consistent and current policy guidance for all federal water resources agencies to help them work more closely together.

OMB is in the best position to coordinate revisions to this multi-agency guidance, and it should work with the appropriate water resources agencies to do so. The Panel believes it is better to proactively revise this underlying guidance than to continue to work around it. The Corps should be a strong advocate with OMB and other federal agencies for revising the P&G in order to balance the current overemphasis on economic benefits and to broaden the factors considered in selecting project alternatives; expand and update the analytical approaches used; emphasize the need and provide guidance to consider system

needs and resources on at least a watershed scale (if not a whole river basin); provide for intergovernmental collaboration in setting priorities; and incorporate social equity considerations into the fundamental planning process.

The most critical element to successful revision is the need to permanently remove restrictions on Corps planning that limit planning to formulating alternatives that consider only features or elements that can be implemented by the Corps. It is essential that a planning study be fully integrated to provide for formulation and consideration of comprehensive alternatives that include the meaningful participation during implementation of the other federal agencies, the state and non-governmental entities, as well as the Corps and the non-federal sponsor. Therefore the Corps must not limit studies to formulation and evaluation of “Corps only outputs.”

The Panel recognizes that this interagency guidance (like any interagency policy document) will take a significant amount of time and leadership to revise, and does not propose the Corps wait for it to be completed before proceeding as far as it can on its own with the recommendations above.

- **States should take the lead to create and nurture watershed organizations within their boundaries and to work with other states to form appropriate multi-state watershed and river basin coalitions where problems warrant.** State water management leadership is essential to creating the institutional responses needed to transform the Corps budget to a fully integrated systems-based program. Without effective intergovernmental institutions at the watershed and river basin levels, the integrated approach cannot succeed. More often than not states do and will lead the management of water resources. Federal cooperation is important where states lead management of water resources within their jurisdictions and work with other states to settle complex issues of interstate significance. The federal government should support the states and invest alongside them where appropriate.
- **To support the states, the Corps should take the following initiatives:**
 - Support state water planning. The Corps, working collaboratively with states and other stakeholders, should anticipate national and sub-national needs and conflicts, and establish strategies for meeting them in ways that improve opportunities for economic and environmental well-being—consistent with efficiency and harmony among federal and state goals. When individual states have sound water plans, they will be able to work more effectively together to avoid or resolve interstate issues and create the non-federal institutions essential to successful watershed and river basin approaches.
 - Support national needs assessment. When states prepare good water resources plans, the federal government and the Corps will have the means to assess national needs using these state building blocks.

- Identify roles. State water planning, supported by the federal government and the Corps, will assist the nation in determining roles for meeting the identified needs. These state plans can become a strong basis for setting priorities among watersheds and establishing the appropriate watershed level leadership to support collaborative plans.
- Provide technical assistance to states. The federal government and the Corps should be empowered to provide their technical expertise to state and local governments.
- **Congress should move appropriations from a project-specific basis to a functional system and then watershed or river basin basis as the intergovernmental partnerships mature to support such budgeting. Individual project earmarks should be replaced with division-by-division appropriations to the Corps, scaled to meet the strategic performance priorities in each geographic area established by the collaborative planning process.** Annual appropriations for specific, individual projects, or project segments, are not conducive to efficient and effective completion of major infrastructure systems; they often do not adequately support system-wide performance improvements. In contrast, the individual projects funded through the new systems improvement appropriations should be consistent with the collaboratively developed long-range strategic plans and five-year schedules of projects in the plan's financially constrained implementation program—and should be expected to improve system performance. Until this planning and programming process becomes available, the Administration and Congress must agree on a funding approach that can make full funding secure for projects once they are begun.

To facilitate these broader appropriations, the Corps should move, in developing its budget requests, toward giving budgetary priority to activities identified in state and regional water planning efforts, eventually replacing individual project requests with requests for division-wide, watershed and river basin activities supported by plans collaboratively developed with the states and river basin councils.

- **Congress should authorize and fund multi-party river basin planning councils where necessary to significantly increase the effectiveness with which the nation's watersheds are managed.** Integrated systems planning over large-scale watersheds and river basins would be greatly facilitated by creation of recognized organizations, with funding and staff, charged with coordinating requisite planning and management functions for whole river basins. Absent these formal organizations, the Corps should work with OMB to take the lead in developing partnerships (as discussed in recommendation 4), and providing the funding and authority needed to make them effective.
- **Congress should allocate adequate funding to fully support needed collaboration, planning, and technical assistance at the state and multi-state levels, as well as to strengthen the Corps' ability to perform integrated, systems-based, watershed and river basin studies unconstrained as to formulation of alternatives.**

A major advantage of shifting to this planning-originated, performance-based, intergovernmentally-supported budget process is that it would shift policy makers' attention to issues of national significance rather than to project-specific particulars. This would be very beneficial for performance management and demonstrating nationally significant results of federal programs.

The Civil Works Program should be viewed as having a primary role in supporting the nation's economic and physical development, global competitiveness, energy policy, and environmental policy. Comprehensive thinking is needed to carry out these responsibilities. The present project-by-project approach, with lagging project completions, on-again-off-again construction schedules, and disappointed cost-share sponsors that do not know what they can count on, is not the best path to continued national prosperity.

RECOMMENDATION 2: PERIODIC MISSION REVIEWS

The Corps should conduct periodic reviews as a means to identify key missions and allocate efforts among them. The results of these reviews, similar to Quadrennial Defense Reviews, would support the Corps' budgeting effort—and planning and management activities—by providing a foundation for setting mission performance goals and resource priorities, and for guiding decision-making within and among watersheds and river basins. They would also provide an important forum and catalyst for the intergovernmental and other dialogues necessary with all the stakeholders to help the nation articulate its water resources goals and resolve project backlog issues.

RECOMMENDATION 3: RESTRUCTURED STRATEGIC PLAN

The Corps' strategic plan should be restructured around key national outcome goals for which the Corps has implementation responsibilities; it should contain long-range national goals and annual targets for achieving them for both the nation and specific watersheds and river basins. This recommendation is intended to focus collaborative planning on critical national interests. The Corps provides engineering and construction services that are vital to achieving the nation's economic development, environmental, public safety, and homeland security goals, and the Corps' objectives, therefore, should key off of those goals to effectively further the nation's top priorities. OMB's PART reviews of Corps performance should be reshaped around these new national priority goals and Corps mission accomplishment.

RECOMMENDATION 4: PARTNERSHIPS WITH OTHER STAKEHOLDERS

The Corps should partner more effectively with other federal agencies, state and local governments, and non-governmental co-providers of watershed-based facilities and services.

This recommendation is key to accomplishing recommendations 1, 2 and 3. Working through the states and intergovernmental river basin councils offers the best opportunity for successful watershed and river basin management. Until and even after the states and councils are actively engaged in planning, collaboration through partnerships will be critical. This is especially true where multiple federal and state agencies, local governments and special districts have intricately interrelated responsibilities for wetlands, estuaries and major ecosystem restoration programs. It also will be critical where concerns exist about the unintended consequences of Corps facilities that are built, operated and maintained for potentially conflicting purposes. Each agency and unit of government has a unique contribution to make; together, they can be most successful if they work closely together and align their activities and resources with common goals and plans.

Effective “partnering” goes beyond consultation. OMB is best positioned to foster policies and practices to encourage and facilitate the interagency collaboration and cooperation needed for effective interagency partnerships. The Corps and OMB should consider using the Academy’s *Principles of Effective Consultation* and *Principles for Federal Managers of Community-based Programs* to strengthen inclusive collaborative efforts based on the extensive experience that the Corps and other agencies have in applying them.

RECOMMENDATION 5: MAINTENANCE OF CORPS-BUILT STRUCTURES

The Corps should take further steps to ensure that Corps-built facilities turned over to non-federal sponsors are adequately maintained. Before projects are turned over to a sponsor for operation and maintenance, Corps policies require the sponsor to demonstrate that it has the authority and financial capacity to fulfill its responsibilities. The Corps is responsible for inspecting the facilities and following up with the sponsors on any problems detected. Flood control levees clearly demonstrate the importance of sponsor maintenance. The effectiveness of the levees may significantly deteriorate over time if they are not properly and continually monitored and maintained. Corps inspections have varied in terms of detail, and limited funding has resulted in reduced efforts. Inspection of completed projects is one of the Corps’ “12 Actions for Change.” The Panel strongly supports the Corps’ efforts in this area.

RECOMMENDATION 6: COST-SHARE REQUIREMENTS

The Corps should implement the ability-to-pay provisions provided for in the Water Resources Development Act of 2000. It should review the current provisions for flood damage reduction programs to determine if they are too stringent and, if so, make appropriate changes. Cost share requirements serve important purposes, but they also can negatively impact low-income areas that might not be able to fund “optimal” projects. Not only does this raise issues of equity, but the result can be mismatched projects and “systems that aren’t systems.” These results can be deadly. Under current regulations, the ability-to-pay provisions appear to have little practical impact, raising the question of whether they effectively accomplish Congressional intent.

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THINKERS SESSION OVERVIEW

The Academy Panel on Prioritizing Corps of Engineers Civil Works Projects sponsored a stakeholder workshop, the “Thinkers Session,” on December 4th 2006. The workshop was attended by representatives of a wide array of stakeholder organizations. (A list of participants is provided at the end of this appendix.) The purpose of the workshop was to allow the Panel to obtain stakeholders’ views about the Corps’ budgeting process and their recommendations for improving it. This report summarizes the views expressed by the participants.

HIGHLIGHTS

The discussions clearly illustrated participants’ broadly held view that budgeting for water resources investments is part of a larger set of issues about how the nation makes decisions about its water resources infrastructure. Making improvements to the budget process can help, but it will require tackling a range of tough issues to really fix the vital water resources problems confronting America. As one participant said it, “[W]e can’t prioritize our way out of this problem.” More money will be needed—from somewhere.

A significant number of participants recommended the Panel consider the following improvements to the budget process (among others):

- Establishing national water resources goals and priorities to guide the project development and budget processes.
- Requiring integrated plans and planning to identify needs and requirements in a comprehensive fashion, with stakeholder involvement
- Addressing the project backlog, and underperforming projects that are weighing down investment
- Adopting programmatic funding and budgeting tied to a five-year planning horizon
- Improving the transparency and presentation of budget information
- Requiring fiscal constraints on project authorizations
- Updating and broadening benefit-cost accounting rules, and perhaps the “Principles and Guidelines” as well

Participants very strongly endorsed the need for including risk to human health and safety as a primary budget prioritization factor, along with economic justification. Almost half also supported the view that projects should be developed and prioritized as part of a public planning process that employs a system or basin-wide framework.

SUMMARY OF STAKEHOLDER RESPONSES TO DISCUSSION QUESTIONS

The workshop employed facilitated group discussions focused on the following questions:

1. What does success look like regarding an “*improved budget process*?” What results (i.e., kinds of water resources investments, decision making environment, etc.) would be achieved by an improved budget process?
2. How should investments be selected in an improved budget process?
 - Choice and use of ranking criteria (e.g., B/C, RBRC)
 - Budgeting approach (e.g., project-by-project, “systems,” watersheds)
 - Funding (e.g., yearly, five-year plan)
 - Balancing top priorities (e.g., business line, region, risk)
3. How should key constraints and inhibitors be addressed?
 - P&G
 - Administration Guidance
 - Congress (e.g., project-by-project authorizations, earmarks)
 - Other
4. What key recommendations for achieving an improved process should come out of the NAPA study?
 - Top recommendations the Panel should make
 - Other advice for the Panel

Participants first engaged in discussion at small tables with 5 – 7 other participants to present their views on questions. Oral reports from these table discussions to the entire group were then solicited for each question. Additionally, attendees were invited to submit written input concerning criteria and weights to be used in the budgeting process (question 2); and concerning suggested recommendations for improving the budget process (question 4).

The following sections report briefly on the main points made in workshop discussions, and culled from reviewing the submitted written input provided to address questions 2 and 4.

Discussion Question 1: What Are the Features of a Better Budget Process?

Key points made in discussion about this question:

- **Address project backlog.** Some resorting and/or restudy of the projects constituting the estimated \$50B backlog of projects must be factored into a better budgeting process. They suggested that a process similar to the Base Realignment and Closure Commission type process might be useful to clear the backlog.
- **Ensure design quality.** Budgeting criteria need to include concern for the 3-Rs of project development: robustness, redundancy, and resiliency at both the project and system level. It is a given that large, complex intergovernmental systems will fail. It is critical,

therefore, that sufficient robustness, redundancy, and resiliency are included in project designs and budgeting ensures that such features are not eliminated because of “penny wise—pound foolish” decisions.

- **Require consequence management.** It is important to require consequence management as part of large investments or investments that have significant health and human safety implications.
- **Ensure a national perspective.** The Corps has a national responsibility to taxpayers to ensure the nation is getting a good return on the use of federal funds. It must re-establish a commitment to providing a national perspective and ensuring that standards of design, safety, level of protection, and quality are adhered to. This can be hard to accomplish when operating as a contractor to local sponsors. Cost sharing dynamics and national standards may be in conflict. The budget process should ensure that investments meeting these criteria are selected.
- **Require planning before authorization.** There is too much appropriation without requisite planning. Projects selected for funding need to have been part of some planning process—preferably some sort of system planning to consider the investment in relation to other parts of the system.
- **Employ fiscal constraints.** Fiscal constraints need to be included in authorizing and budgeting. Projects should not be authorized unless there is a clear commitment made that funds will be available for construction and operation.
- **Public education.** The water resources development process is currently in maintenance mode. But, there is only a limited understanding on the part of the public as to why infrastructure investment is critical and why additional funding is needed.
- **Stakeholder input on priorities.** Diverse groups of stakeholders could probably agree on the top 10 percent of projects that need to be funded in each of the Corps’ business lines. That’s all you need in today’s constrained budget environment, so the need for complicated budgeting tools may be overstated.
- **Employ kick-outs.** Kick-outs are needed for some prioritization criteria. Kick-outs are pass/fail indicators that eliminate projects from consideration if the criteria are not met. Health and human safety is one such criterion.
- **Reassess Corps missions.** The Corps has been asked to do a lot of things. It has many civil works missions, and is being asked to do more. The time is right to reexamine these missions and other functions to see if they are all necessary or might be accomplished in some other manner.

Discussion Question 2: How Should Investments Be Prioritized in an Improved Budgeting Process?

Participants were provided with a form with the potential criteria shown below. They were asked to assess the importance of each criterion as “high,” “medium,” or “low” or provide a numeric score of between 0 and 100 points. The tally below shows those criteria that received “high” ratings or which had the highest numeric ratings. Two factors, Economic Benefits² and Risk, were rated as being most important. Three factors, Planning Justification, Environment, and Facility Condition, were rated as medium in importance, and everything else was rated of low importance. While the focus on national economic benefits is current practice, there was also a strong advocacy of risk as a high-priority budget criterion. Currently, risk is only used in a limited fashion in budgeting. Other factors receiving moderate support as budgeting criteria included: linking a project for budgeting to a planning process (and preferably, as most participants noted, to a systems or basin level study planning process); ensuring environmental outcomes are met; and maintaining existing infrastructure, especially, if there is a risk of a dangerous failure.

² It should be noted that most attendees further specified that they were focusing on national economic benefits in making their choices in contrast to focusing on regional benefits.

Table D-1. Participants’ Ranking of Possible Selection Criteria

Factor	Percentage (total = 100) or High, Medium and Low	Reasons (discuss) (*Illustrative Reasons)
Economic Benefits: <ul style="list-style-type: none"> • National • Regional 	<p>“High” Ratings: 23 (Note: High ratings generally applied to National benefits only)</p> <p>Rank: #2</p>	<p>*This is the fundamental basis for what we do (national benefits)</p> <p>*Must balance against intangible environmental benefits—can’t simply do rote economic analysis</p> <p>*Regional economic benefits are often a “cost” to other regions</p>
Risks to: <ul style="list-style-type: none"> • Property • Lives • Injury/Disability • Disruption • Other 	<p>“High” Ratings: 24</p> <p>Rank: #1</p>	<p>*Preservation of human life is the essential value behind all water resources projects</p> <p>*Avoid projects that will induce development in risky places</p> <p>*Emphasize human life over property damage</p>
Environmental Outcomes: <ul style="list-style-type: none"> • Wetlands/storm protection • Habitats/species • Water pollution 	<p>“High” Ratings: 13</p> <p>Rank: #5</p>	<p>*Give priority to renewable resource values</p> <p>*Need to identify national needs for biodiversity</p>
Social Equity —differences in: <ul style="list-style-type: none"> • Emergency response and recovery • Service levels • Costs imposed • Disruptions 	<p>“High” Ratings: 4</p> <p>Rank: #7 (tie)</p>	<p>*Responding to the needs of the underserved is a key government responsibility</p>
Program Performance - targets: <ul style="list-style-type: none"> • Met • Missed • Exceeded 	<p>“High” Ratings: 5</p> <p>Rank: #6</p>	<p>*Outcome-based management is essential</p>
Project Completion	<p>“High” Ratings: 4</p> <p>Rank: #7 (tie)</p>	<p>*Finish fewer projects faster to begin accruing benefits.</p>
Planning Justification: <ul style="list-style-type: none"> • Project study only • System plan • Integrated plan 	<p>“High” Ratings: 16</p> <p>Rank: #3</p>	<p>*Projects that fulfill a component of a holistic, integrated plan should receive a higher priority than projects that are developed outside a planning process</p>
Existing Facility Condition: <ul style="list-style-type: none"> • Well Maintained • Falling Behind • Dangerous 	<p>“High” Ratings: 14</p> <p>Rank: #4</p>	<p>*Maintaining existing infrastructure in an acceptable state should be the top priority.</p>
Other -Projects must represent federal interest -Higher priority to multiple-purpose projects -Include funding set-aside for earmarks -Don’t believe it appropriate to identify priority factors		

Discussion Question 3: What Are the Barriers to Improving the Budget Process?

Key points made in discussions included:

- Many participants believed that the 1983 Principles and Guidelines (P&G) may be a barrier; others, however, thought that they were not. Those believing that the P&G is a barrier called attention to the over-weighting of national economic benefits in the P&G, which tends to reduce focus on other considerations, such as environmental and social equity, that don't enter into the benefit–cost calculations. Others argued that such impediments were more perceived than real, and that new Corps guidance circulars were being promulgated that address such issues.
- Cost sharing requirements have created first-class and second-class customers. Those who don't pay don't get listened to very well. Cost sharing will likely complicate the drive to do basin level or watershed planning to help better identify water resources requirements comprehensively. There is no incentive for local cost-share sponsors to provide added funds for study of issues beyond their interests. State-level sponsorship for broad planning studies or federal funding for such studies may be ways of addressing this barrier.
- There is no national policy about water resources to help guide the investment decision process. A comprehensive water vision is needed to provide goals and objectives.
- Congressional culture favors project-by-project authorization and budgeting.
- There is a lack of dedicated funding sources for water resources. The transportation model with a programmatic budgeting process and dedicated funding source merits study.
- A question that the Academy Panel needs to consider more explicitly: “What’s the barrier as regards addressing public health and safety more forcefully in the budgeting process?”

Discussion Question 4: What Recommendations Would You Make?

Key points made in discussions included:

Establish national water resources goals and priorities to guide the project development and budget processes.

- Congress needs to establish strategic directions for water resources—e.g. national maritime transportation policy, national coastal management policy, and national estuarine management policy.
- Policy makers need to more narrowly define what the Corps should do and not do.
- Leadership needs to say what it is that the Corps is working toward. Without having a sense of where the agency is going in the long run, the debate about priorities takes place

annually. I don't have a clear sense of what the agency is expected to accomplish in the next five or ten years, so that if it doesn't happen someone can ask "why?"

- Assess national water resources needs. Prioritize needs. Match projects to priorities. Establish national goals for water development that reflect national assessment.
- Set up national needs analysis to determine "real" universe of projects to choose from.
- The problem is bigger than the Corps. There are no goals, objectives or national policy that is defined. If the goals of the civil works program were defined then project selection would be greatly simplified.
- Create a prioritization system first with general principles, then establish specific criteria; otherwise the "haves" and the "winners" of the current system will stymie efforts.

Require integrated plans and planning be done to identify needs and requirements in a comprehensive fashion, with stakeholder involvement.

- A risk-based approach with a five-year stakeholder/Corps plan should guide funding decisions and identify consequences (risk/reliability) of not providing funding
- Require project plans to comport with relevant comprehensive plans as the Federal Energy Regulatory Commission does.
- Establish large, overarching national goals for the Corps mission and program—a unifying theme or purpose. Use these to guide basin-wide planning. Projects (and project rankings) should emanate from basin-wide plans and directly contribute to the national goals. Get input from state governments (i.e. governors) in developing priorities. Get input from other federal agencies in developing priorities.
- Give the Corps a general planning tool that operates at a higher level than project-level reconnaissance and feasibility studies to deal with the big water resources challenges of today. Use this tool to develop concept-level plans (like the MR&T) to address these large, national and regional challenges.
- Provide more funding support for system-wide studies.
- A systems plan would allow most critical needs to be met.
- Tie the budget process to an integrated, outcome-oriented planning process that is intergovernmentally driven.
- Require states to be cost share partners on all watershed studies.

Address the project backlog, and underperforming projects that are weighing down investment.

- The backlog of projects previously authorized but unbuilt should be privatized. For instance, they could be auctioned off to bidders who could find investors to finance construction with market-based user fees or other cost recovery mechanisms.
- Establish watershed-based objectives by business line and prioritize existing projects based on their linkage to how they achieve these objectives. Establish a commission similar to the Base Realignment and Closure Commission to terminate the rest. Take a similar approach for de-authorizations.
- Do not allow any new starts until backlogged projects are funded or removed from list.
- Provide ways to decommission or reduce investments in underperforming projects to free resources for more productive investments.

Make improvements in programmatic funding and budgeting.

- Establish a dedicated funding source so the uncertainties of annual appropriation through a highly political forum can be reduced.
- Support full funding of projects up to \$100 million.
- Begin to add funding to support projects through a grant process.
- Begin to move away from only project-by-project funding.
- Support or develop programs with their own funding to fund system-wide studies.
- Support small projects and technical assistance to localities through expanding the Flood Plain Management Services and Planning Assistance to States programs.
- Move from projects to programs. Do not ignore the Continuing Authorities Program and Flood Plain Management Services Program. Corps programs need dedicated funding sources.
- Adopt a multi-year budget for civil works projects with active congressional oversight.
- Broaden the range of factors used in budgeting and implement five-year budget plan.
- Do not re-rack projects each year. Do not start projects unless the government is willing to continue funding.
- OMB should set criteria for the budgeting of projects, but should not recommend which projects should be funded or how much funding they should receive.

- Do not provide funding for projects that aren't on a five-year priorities list. Move to approach taken in funding military construction.

Improve presentation of budget information.

- Corps should develop a more user-friendly presentation of its budget information. The project dashboard concept offers a promising approach.
- Develop an enhanced Corps project data sheet with more metrics. Require the sheet to be updated either annually or every two years and publish sheets not only for projects budgeted but also for projects not budgeted, along with an explanation of why they were not budgeted.
- Present data, criteria, and assumptions used to evaluate projects for budgeting. The budget might also explain what is not funded and why.

Other Recommendations for Improving Budget Process:

- Constrain authorization of projects to funding that can be reliably delivered in the next four to six years.
- Authorization and appropriations subcommittees should work jointly to provide oversight and to make longer-term funding decisions.
- Update benefit-cost accounting rules
 - Institute a rigorous process of independent review for large and controversial projects.
 - Put environmental considerations on a par with economics.
 - Consider equity impacts (e.g., assess relative impact of property loss on poor and rich).
- Increased Corps funding is the answer. Next to nothing is getting funded as new starts and improving the prioritization process will not improve that. Without funding increases, the risk of catastrophic events will not be lessened.

Recommendations Related to Top Investment Priorities

- Fund projects in Corps mission areas. (Those most frequently mentioned include navigation, flood damage reduction, environmental restoration, hydropower, beach nourishment.)
- Manage residual risk associated with flood damage reduction projects.
- Support national goals and priorities.

- Address O&M needs of existing Corps infrastructure.
- Conduct basin-wide planning to develop integrated multi-purpose plans.
- Give priority to projects that have been endorsed by watershed or basin groups, especially governmental groups.
- Give priority to projects that address human health and safety issues.

Other Suggestions

- Create other user groups in other business lines like the Waterway Users Board to advise and influence budget priorities.
- Integrate the navigation business line into a national transportation plan.
- Report on the actual versus predicted performance of Corps investments.
- Reduce stakeholder involvement. It only leads to logrolling.
- The system plan for the Ohio River developed by the Lakes and Rivers Division is a good model for identifying requirements and budgeting.
- Eliminate or curtail the local cost-share requirement. It encourages lowest-common-denominator projects that don't necessarily satisfy a national need.
- A balanced, independent assessment of water resources needs is required, but the Corps may not be objective enough to do this.
- Look at Oceans Commission Report, National Shoreline Management Study, and talk to others.
- Modernize the P&G.
- Convene an NRC or Academy Panel to suggest new funding sources in addition to Energy and Water appropriations.
- Disconnect district salary and operating budgets from funding obtained from projects.

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Roger Cockrell, U.S. Senate, Appropriations Subcommittee on Energy and Water Development
Vaughn Collins, Ducks Unlimited
David Conrad, National Wildlife Federation
Kevin Cook, House of Representatives, Appropriations Subcommittee on Energy and Water Development
Edward Dickey, Independent Expert
Frank DiGiammarino, National Academy of Public Administration
Mark Dunning, National Academy of Public Administration
Steve Ellis, Taxpayers for Common Sense
Peter Evans, Interstate Council on Water Policy
Marco Giamberardino, Associated General Contractors of America
Worth Hager, National Waterways Conference, Inc.
Eric Hansen, Office of Management and Budget
Ruth Ann Heck, National Academy of Public Administration
Barry Holiday, Dredging Contractors of America
H. Steve Hughes, Congressional Research Service
Merrie Inderfarth, Association of State Floodplain Managers
Jennifer Kefer, Environmental Defense
George Lea, U.S. Army Corps of Engineers
Gary Loew, U.S. Army Corps of Engineers
Pete Luisa, U.S. Army Corps of Engineers
Bruce McDowell, National Academy of Public Administration
Jim Mietus, Office of Management and Budget
Paul Mogan, National Academy of Public Administration
Barry Palmer, Vessel Alliance
Mark Pisano, National Academy of Public Administration
Tony Pratt, Coastal States Association
Kyle Schilling, Independent Expert
Tim Searchinger, Environmental Defense
Harry Shoudy, American Shore and Beach Preservation Association
George Sorvalis, National Wildlife Federation

Norman Starler, Institute for Water Resources

Bob Stearns, National Academy of Public Administration

Michael Strachn, National Academy of Public Administration

Jonathan Tucker, National Academy of Public Administration

Joyce Wu, American Rivers

WATERSHED PLANNING CASES

As discussed in Chapters 2 and 5, watershed planning is not a new concept. Although it is no longer the norm in Corps planning efforts, there are many on-going projects by the Corps and others that demonstrate both the benefits and difficulties in effective watershed planning.

This appendix provides brief descriptions of seven of those efforts.

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- Delaware River Basin CommissionE-7
- Everglades RestorationE-13
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- Sacramento and San Joaquin River Basins Comprehensive StudyE-35
- Sacramento and San Joaquin Delta Levees StudyE-39

**APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN
CASE DESCRIPTION:**

Opportunity Missed:
Failure to Resolve Conflicting Goals on the Apalachicola River³

Context

The Apalachicola-Chattahoochee-Flint (ACF) Basin drains almost 20,000 square miles through Georgia and Alabama, emptying into the Gulf of Mexico through the panhandle of Florida. It is the primary water supply for the city of Atlanta. The Corps operates storage reservoirs on the Chattahoochee (the Flint has limited storage capacity) and maintains the upper basin navigation channel; other Federal agencies, such as the U.S. Fish and Wildlife Service, also have responsibilities in the basin. Although the Southeast U.S. does not have the long tradition of interstate water disputes that exists in the arid West, differing priorities increasingly are raising challenges to water resource managers in the area. Throughout the 1970s and 1980s, tensions among the states rose over management of the Apalachicola river basin; despite considerable efforts by many parties, those tensions have not been resolved. See Figure E.1 for a map of the ACF Basin.

History

The ACF was one of the river basins impacted by the demise of the Water Resources Council in the early 1980s. The WRC's 1978 national water assessment identified the ACF basin as the area in the South Atlantic-Gulf region most in need of a regional (watershed) study. But Florida would not agree to such a study unless the Apalachicola Bay was designated a National Estuarine Sanctuary (under the Coastal Zone Management Act). The upstream states resisted this move, fearing it would result in significant limits on future water diversions and navigation projects. Ultimately the designation was made (in 1979) and Florida agreed to the study. But the WRC was disbanded before the study could be started.

The diverging interests continued to play an increasing part in ACF activities. Upstream interests (Georgia, Alabama, and the Corps of Engineers) sought navigation improvements, while the state of Florida was reluctant to issue needed permits. Florida was increasingly concerned about environmental effects and commercial seafood interests associated with the river and bay. Navigation interests sought help in Congress and through the Corps, but Florida continued to withhold the needed permits. Animosities among the states increased.

Negotiated Agreement

Wanting to avoid litigation, the three states and the Corps finally agreed to a negotiated resolution in 1983. Under this agreement, Florida consented to navigation improvements in the upper basin—which were made within the year. In exchange, the other states agreed that the management of the river would be addressed in a more holistic manner; that basin-wide studies

³ Information in this case description draws heavily from the following sources: Kenny, 1995; Leitman, in Scholz and Stifftel, 2005.

would be conducted, and that drought management and navigation maintenance plans would be developed. Additionally a new coordination mechanism—the Interim Coordinating Committee⁴—was established to oversee implementation of the agreement and to provide a forum for addressing the remaining unresolved issues.

In addition to the immediate navigation improvements, a preliminary Corps basin study (1984), a Navigation Maintenance Plan (1986), and an Interim Drought Management Plan (1985) were completed. But by the mid-1990s environmental interests became disappointed because a detailed basin-wide water management strategy had not been developed. Controversy re-emerged. Also, by this time, the issue of Atlanta's water supply had become, and remains, a significant source of interstate disagreement. Again, upstream interests were at odds with downstream interests.

Since 1981, controversy had surrounded a Corps proposal (based on a study mandated by Congress) designed to improve Atlanta's water supply. The Corps' original 1982 proposal faced strong opposition from environmental constituencies. So, in 1989, the Corps proposed another alternative that had been identified in its earlier study. This plan was to reallocate some of the water stored in Lake Lanier away from hydropower to meet Atlanta's water supply needs. This plan faced opposition from the downstream states. Alabama's primary concerns were municipal water supply, hydropower, and navigation access to inland ports. Florida's chief focus remained on supporting the seafood industry at the lower end of the river, plus ecosystem preservation and restoration. Alabama sued—claiming, in part, that the Corps did not meet the requirements under NEPA—and Florida was considering joining the suit.

Another Attempt to Negotiate Agreement

And once again, rather than rely on the courts, the three states and the federal government agreed to stay the suit pending completion of a comprehensive study of the river basin. That study ultimately took eight years to complete. The outgrowth of the completed study was the Apalachicola-Chattahoochee-Flint River Basin Compact, signed in 1997. This Compact was the first interstate water compact signed since the passage of major federal environmental legislation and its efforts highlight the complexity of issues faced in resolving water resources issues today. These were complex, high-stakes issues, with many unknowns.

The Compact established the ACF Basin Commission, which was charged with developing an allocation formula to apportion the surface waters of the basin among the states. The Commission consisted of the three governors, with negotiations to be conducted by their representatives. Also, a federal commissioner was appointed and given power to accept or reject any formula agreed to by the states. The Corps' comprehensive study had concluded that the allocation formula would have to be changed over time. If a formula had been written into the compact or law, legislation would have been required to change it. Delegating the formula to the three states avoided this possibility.

But the Commission was unable to reach agreement on an allocation formula. After years of indecision, the three governors signed a memorandum of understanding (MOU) in 2003 that, in

⁴ This Committee was later renamed the Interstate Coordinating Committee

essence, adopted a Georgia proposal that Florida had already rejected many times. (The Florida negotiator was not involved in developing the MOU.) Florida provided an alternative proposal. Georgia rejected it. Florida refused to extend negotiations past the scheduled termination of the Compact. The ACF River Basin Compact has been terminated, and the allocation issue seems likely to go before the Supreme Court again.

Implications of the ACF Experience

Leitman identifies many factors that contributed to the failure of the ACF Compact.⁵ Chief among them was the competitive, rather than collaborative, approach taken by the three states. From the outset the process was hindered by competition and a lack of trust among states. Each of the three states were unable or unwilling to develop a compromise, but instead approached the negotiations as a competition. Additionally, in the midst of the negotiations, the Governors of Alabama and Georgia changed, and the change in these administrations brought changes in the representation of each state and changes in their negotiating positions.

In this atmosphere, some key factors prevented movement toward a compromise.

- The process used in the negotiations hindered development of trust and collaboration. Chief problems were: (1) a neutral mediator was not used to stabilize the process, explore common ground, and keep the process moving forward; (2) goals were not clearly defined (what would a fair formula look like?); (3) negotiators considered both policy and technical issues, issues often outside their own expertise; (4) negotiators came to the table with full proposals rather than working together to develop various alternatives. When states came close to agreement, interest group opposition caused states to alter their positions, thwarting agreement once again.
- The states included stakeholders in varying ways and to varying degrees over time, but with limited effectiveness. Essentially, stakeholders were not sufficiently educated about the issues or included in the process in ways to allow them to effectively participate. “In the end, this left the state negotiators with little public support for their draft formulas, the potential for major confrontations from [sic] any formula they proposed, and ultimately the termination of the ACF Compact.”
- Though there was a good deal of solid scientific information and models to help inform the process (from the Corps comprehensive study and support from the Corps’ IWR), the negotiators could not agree on how to use it. They could not decide on how the data should be analyzed (aggregated into monthly or annual increments), and mountains of data were not well organized by the “non-technical” negotiators. Each party presented the data in a way that supported a specific position. In one key area, ecological impacts and insufficient knowledge did cause some problems. To deal with significant uncertainty, Florida suggested that provisions be made, through adaptive management techniques, to allow modifications in the formula as ecological changes occurred. This

⁵ Leitman’s analysis is centered on characteristics of “adaptive governance”: representation, process design, scientific learning, public learning, and problem responsiveness. (See Scholz and Stiffler for further discussion of adaptive management).

**DELAWARE RIVER BASIN COMMISSION
CASE DESCRIPTION**

Intergovernmental Planning:
Learning from Forty-Five Years of Experience

Context

The Delaware River is the longest un-dammed river in the east. It extends 330 miles, drains parts of New York, New Jersey, Delaware, and Pennsylvania and covers over 13,000 square miles. Nearly 15 million people rely on its waters; almost half of them live outside the basin, in New York City and northern New Jersey. The basin also has significant military, economic, and recreational importance. See Figure E-1 for a map of the Delaware River Basin.

Water disputes had festered in the basin since at least the early 1900s. Several attempts to resolve issues through negotiation and interstate commissions failed, or were only temporarily successful. A lack of adequate, agreed-upon scientific data, combined with the lack of incentive for New York State, the upstream jurisdiction, to compromise, made the attempts adversarial rather than collaborative. The Supreme Court imposed water allocation formulas on at least two occasions. (Lord and Kenney; 1993)

By 1961, over 40 state agencies, 14 interstate agencies, and 19 federal agencies exercised powers and duties over the watershed. The most pressing issues surrounded water usage, especially by New York City, during times of drought.

Creation of the DRBC

In 1961 the four basin states, along with the federal government, signed the Delaware River Compact, which created the Delaware River Basin Commission (DRBC). The Compact's "chief cannon," as cited by DRBC, is that the water and related assets of the basin are vested with local, state, and national interests for which there is a joint responsibility. In addition to a primary focus on water supply and drought management, the DRBC program includes water quality protection, regulatory review (permitting), water conservation, watershed planning, flood control, and recreation. (DRBC *Overview, Milestones*)

This concurrent Compact legislation created, for the first time, a regional body in which the federal government and a group of states joined together as equal partners to oversee a unified approach to managing a river system without regard to political boundaries. The five commissioners—the four governors and the federal representative appointed by the President—appoint alternate commissioners. (DRBC *Overview*) Until at least the mid-80s the federal appointee was usually the Secretary of the Interior. (GAO, 1986) More recently, the Commander of the Corps' Civil Works North Atlantic Division has served as the federal commissioner.

Each commissioner has one vote and, for most issues, the majority rules. The Compact accepted a water apportionment decreed by the Supreme Court in 1954 and renounced the rights of all parties to return to the Supreme Court for a reconsideration of the allocation. But the Court's

formula was inadequate for times of drought, and the Compact incorporated emergency powers allowing a negotiated agreement in a drought situation. (Lord and Kenney, 1993)

The operation of the Commission itself is funded primarily by the signatory parties. The Commission is supported by a full-time professional staff, and has been fortunate to have executive directors who have remained for long periods of time. The Commission relies heavily on the staff for analysis in carrying out its emergency powers. Projects are funded by different mixes of federal, state, and local sponsors. A Commission official said that the staff works to help identify the most likely source of funding (for example, the federal or state agency with the most directly linked mission) and, if necessary, to bring together multiple sources of local funding to meet cost-share requirements.

The First Comprehensive Plan

The Compact required that DBRC develop and adopt a comprehensive plan for managing the basin's water and related resources, with an aim of bringing the greatest benefits and producing the most efficient service in the public welfare. A critical element of the DRBC's coordination role is that no project can be undertaken in the basin without DRBC's agreement that it is in accord with the adopted Comprehensive Plan.⁷

The first Comprehensive Plan was developed with input from the Corps, Department of Agriculture, and state agencies, and was adopted by the Commission in March 1962. The Plan focused on construction or expansion of 20 projects, with completion dates through 2010. Although many of the projects had been completed by 1986, several key projects had not even been started, largely because by this time concerns about the possible environmental impacts of constructing dams and reservoirs had grown. (GAO, 1986)

In addition to completing the first Comprehensive Plan, DRBC points to several key accomplishments in its early years, such as:

- successful negotiation of water supplies during times of drought
- construction of one of the reservoirs included in the Comprehensive Plan
- adoption of comprehensive water quality standards, tied to an innovative waste load allocation program
- initiation of a water conservation program and issuance of related regulations
- issuance of regulations restricting development in the 100-year flood plain and prohibiting it in the floodway
- listing two reaches of the Delaware River in the National Wild and Scenic Rivers System

⁷ The concurrence of the federal commissioner is needed to bind the federal government to the Comprehensive Plan. (GAO, 1986)

Revised Comprehensive Plan

One of the projects not completed was the “core” of the original Comprehensive Plan. The Tocks Island Dam was anticipated by the Plan to provide needed support to sustain the basin in times of drought. By 1975, a majority of the commissioners recommended against construction because of the dam’s potential environmental and economic impacts. Recognizing the need to reformulate the plan, DRBC initiated a long-term study to provide the necessary data to address issues of water supply. That study, completed in 1981, refocused the commission’s efforts on water conservation rather than construction.

At the same time, however, with its long-term drought solution rejected, DRBC was working to address the issue of drought management. Efforts at negotiation failed, in part because of lack of convincing scientific data and in part because a chief player, New York City, was not part of the Commission and, therefore, not part of the negotiations. In 1978, an ad hoc group composed of the states and New York City was established. Relying on the data from the long-term study, the ad hoc group approved the Interstate Water Management (“Good Faith”) Report in 1983. (Lord and Kenney, 1993) Among other things, this “Good Faith Agreement” laid the framework for a drought operating plan, which has been used successfully in water emergencies since then.

With this foundation, DRBC points to several additional accomplishments, such as:

- expansion of a successful ground water management campaign
- issuance of regulations concerning discharge of toxic pollutants
- construction of a new reservoir by in-basin electrical utilities, who were told they would face cutbacks in water during drought if they did not build the facility
- significant progress in improving the quality of the river
- completion of flood stage forecast mapping for a major portion of the river

In 1999, the four basin governors directed the Commission to develop a new Comprehensive Water Resources Plan for the basin. The governors challenged the basin community to play an active role in drawing up a new vision for the region, and created a Watershed Advisory Council to help support the plan development. That new plan was adopted in September 2004.

In 2003, a sub-basin (the Christina River) received a \$1 million federal Watershed Initiative grant to help preserve and protect this interstate sub-basin. DRBC is a member of the Christina Basin Clean Water Partnership. In another important recent action, the Commission set a goal of reducing PCBs in the river by 50 percent in five years and adopted a rule to establish pollutant minimization requirements for point and non-point discharges of PCBs. The action embodied the principle of adaptive management, which calls for measurement and readjustment of rules, depending on early effects.

Implications of the DRBC Experience

The DRBC has over 40 years of experience with watershed management, and credits its actions with making significant progress toward improved water quality, success in managing water through several droughts, and a more secure water supply. Clearly, the inter-governmental compact providing broad authority provides an unusual level of power to the Commission. But DRBC's history provides several key lessons with regard to what does and does not work in a multi-jurisdictional context.

- The history of the basin demonstrates the consequences of failure to arrive at mutually acceptable compromises among states. When decisions are made by the courts, flexibility is lost—the stakeholders cannot change the decision without going back to court—and stability is lost—one or more stakeholders can force a change by going back to the courts.
- The authority of the commission, by itself, would not allow it to achieve much. The ability of the commission to decide key issues on a majority vote and the corollary inability of one party to prevent action—as New York City did before the “Good Faith Agreement”—appear to be critical to its success.
- The importance of including all key players in decisions is demonstrated in the early days of the Commission. Negotiating water allocations without New York City at the table proved unsuccessful. Including New York City (and providing some assurance that sound allocations could be based on sound data) allowed the agreement, which has guided the commission through several droughts since 1983.
- Having sound data—that negotiating parties agree are both authoritative and objective—is central to the ability to develop negotiated decisions. In the days before the Commission, lack of data made it difficult for the states (and New York City) to come to a binding agreement, forcing the issue to the courts. In later years, the development of needed hydrologic and other data under the auspices of the Commission gave the parties more confidence that effective solutions could be found. (Lord and Kenny, 1993) This is cited by some as one factor in negotiation of the “Good Faith Agreement,” which allowed the flexibility to impose emergency allocations to be developed when needed. It also is important in forming the trust necessary to allow all parties to agree to allow majority rule and to forego taking issues to the courts.—That’s not to say that there isn’t a continuing need for sound data and that lack of data has not, at times, hindered Commission actions.
- Having a dedicated support staff can provide continuity and support to activities. The Commission staff plays an important role in day-to-day activities of the Commission, in developing regulations and other policy and procedural documents, and in providing the analysis necessary to implement the emergency provisions of the “Good Faith Agreement.”

Figure E-2. Delaware River Basin⁸



⁸ Adapted from a map of the Delaware River Basin provided by the Delaware River Basin Commission.

EVERGLADES RESTORATION CASE DESCRIPTION

Integration Pursued:

Efforts to Restore the Florida Everglades while Meeting other Water Needs

Context

The Everglades is an enormous wetlands that dominates the south Florida ecosystem, stretching from Orlando to the Keys. It includes over 18,000 square miles and 16 Florida counties. Beginning as early as 1850, the state, the Corps, and others worked effectively to harness the waters supporting the Everglades in an effort to “tame the wild Everglades for the productive use of society.” Projects were undertaken to “reclaim” land for agricultural and settlement purposes, and then to protect that land and those living on it from floods and other disasters. (Boswell, 2005)

In 1948, Congress approved the Central and Southern Florida (C&SF) Project. It included a network of canals, levees, water conservation areas, and water control structures, and sought to achieve multiple goals, including flood control, water supplies, preservation of fish and wildlife, recreation, and navigation. The project continued the alteration of the natural landscape that had been in progress for 100 years. (USACE, C&SF/CERP, 2005)

By the early 1970s, the Corps’ efforts were complete; the waters of the Everglades were under the control of a system of canals, dykes, and pumps. But, the unintended effects were enormous. Water quality had declined, other areas were in decline, and it appeared that the urban and agricultural water demands of the dramatically increasing south Florida population could not be met into the next decade. Ultimately, over one half of the Everglades’ geographic scope has been permanently lost as a functioning wetlands ecosystem and habitat for rare and declining species of flora and fauna.

Governmental Institutions Begin to Address the Problems

State, local, and federal institutions responsible for water resources and the ecosystem in South Florida began responding to these adverse impacts in the 1970s. Several key governmental actions recognized the need for environmental protection of the remaining Everglades and potential restoration of their natural functions. Among these: (1) Congress passed legislation to guarantee water flows to Everglades National Park; and (2) the Governor declared a “water crisis,” held a Conference on Water Management in South Florida, and issued numerous recommendations. Only limited actions were undertaken, however, until unusually high rainfall in 1983 required heavy, undesirable regulatory releases of water into Everglades National Park. An environmental emergency was declared in the Park and a seven-point plan for immediate action was developed. The state endorsed the plan along with several other projects aimed at Everglades restoration. (Boswell, 2005)

By the mid-1990s, two key independent efforts came together in support of a congressionally directed comprehensive study. The Governor’s Commission for a Sustainable South Florida was created in 1994 to ensure that a healthy Everglades ecosystem could coexist with, and support, a healthy south Florida economy. Additionally, a congressionally established task force—The

South Florida Restoration Task Force—was created in 1993. It included active participation by state and regional agencies and was created to guide Everglades restoration based on principles of ecosystem management.

In 1992, Congress had directed the Corps to restudy the C&SF, to determine if changes were needed as a result of changed biological, demographic, or economic conditions. This directly expanded the scope set by Congress for the original 1948 study by including a clear focus on environmental quality. Both the Governor’s Commission and the Task Force guided the Corps in preparing the Central and Southern Florida Project Comprehensive Restudy (C&SF Restudy). The Corps study—a full review of the original plan it developed in response to the 1948 legislation—resulted in the 1999 Comprehensive Everglades Restoration Plan (CERP). Figure E-3 provides a map of the CERP project area.

CERP is a Long-term, Integrated Effort

In WRDA 2000, Congress authorized implementation of the CERP. The plan consists of 68 projects to be implemented over 30 years, at a current estimated cost of almost \$11 billion. This cost is to be shared equally between the federal government and multiple local sponsors. (USACE, C&SF/CERP, 2005) The underlying C&SF Restudy took a holistic (systems-based) approach to the issues. It looked broadly at ecosystem integrity, sought to encompass all known variables, integrated governance through inter-agency cooperation, and integrated human and natural systems.

In support of this holistic approach, the process involved broad and varied steps to include all key stakeholders and to obtain support from all appropriate governmental and non-governmental institutions, as well as all needed expertise. The Restudy Team “...included biologists, ecologists, economists, engineers, Geographic Information System specialists, hydrologists, planners, public involvement specialists, and real estate specialists from a number of ...agencies.” It included staff from 27 federal, state, local and Tribal agencies. (USACE, quoted in Boswell, 2005)

There are over 60 individual CERP components which are expected to enhance the ecological functioning of more the 2.4 million acres of the south Florida ecosystem. At the same time, these components are expected to improve regional water quality conditions, deliveries to coastal estuaries, and urban and agricultural water supply, and to maintain existing levels of flood protection.⁹ The Corps and the Department of the Interior are the lead federal agencies responsible for undertaking many of the efforts in partnership with the main state partner, South Florida Water Management District (SFWMD), and other partners. The state is also constructing several projects in the plan through its own planning process. A wide variety of projects are included, for example reservoirs, seepage management, canals, and raising trails. (USACE, C&SF/CERP, 2005)

⁹ A recreation portion of the Plan is also being developed.

CERP Takes an “Adaptive Management” Approach

Adaptive management is a mechanism widely recognized as providing a workable approach to environmental restoration efforts, which necessarily involve high degrees of uncertainty because of limitations in our ability to predict natural processes. Adaptive management is the continuous process of seeking a better understanding of the natural system and human environment and seeking continuous refinement and improvement to the plan. CERP embraces adaptive management. The plan directs significant effort to monitoring and evaluating the impacts—both environmental as well as those related to the other water goals—of projects as they are implemented. Congress recognized this concept in passing WRDA 2000. The Senate Report on the bill indicated that it was expected that changes would be made in the specifics of the authorized plan as new information, better modeling, and performance results became available. (S.R. 106-362)

Among other things, interim goals and targets are being established to guide performance assessment. Appropriate baseline data will be developed. An adaptive assessment protocol will be developed to be used to interpret the responses by natural and human systems during and following CERP implementation. Although not mandated, the team intends to issue an annual Report Card on system-wide responses for a critical set of the measures that will be monitored.

Status of CERP Implementation

In an October 2005 report to Congress, the Assistant Secretary of the Army (Civil Works) reported progress on CERP implementation.¹⁰ He reported that, since passage of WRDA 2000, the Corps had focused on constructing the “foundation projects”—projects begun before authorization of CERP that the CERP plan assumed would be completed—as well as issuing project implementation reports and developing the mechanisms and guidance for the considerable coordination that is, and will remain, critical to CERP success. He also emphasized the progress in working with the restoration partners and stakeholders to lay the groundwork to successfully complete the restoration. In various places he pointed to delays in efforts, resulting from, for example, requirements in WRDA 2000, extensive public participation efforts, and new information that extended the length of studies.

Some other highlighted accomplishments included:

- development of the draft Master Implementation Sequencing Plan, which sets forth the roadmap for implementation; the plan focuses on allocating resources in 5-year bands
- initiation of many studies of alternatives for specific projects
- completion of a plan for resolving disputes between the federal government and the state of Florida, should they arise

¹⁰ Section 601(1) of WRDA 2000 requires that the Secretary of the Army and the Secretary of the Interior, in consultation with the EPA, Department of Commerce, and the State of Florida, jointly submit to the Congress a report on the implementation of the CERP every five years.

- creation of an independent review panel (convened by the National Academies of Science)
- issuance of program regulations to guide implementation
- significant progress in establishing interim goals and targets for plan performance
- acquisition (by the state, with financial help from the Departments of Interior and Agriculture as well as from local governments) of over 50 percent of land needed for implementation

Implications of the Everglades Experience

It is much too early to predict the success or failure of the CERP. Some progress (for example, in terms of improved ecology) has been reported for the foundation projects begun prior to authorization of CERP, but as of the end of 2005, none of the CERP projects had been constructed. Further, Boswell reports that some participants in the CERP are already coming to believe that the process has produced too little change. However, some lessons can be identified in the progress to date. The following discussion draws heavily from Boswell, 2005.

A holistic and systems-based approach is better able to incorporate the many objectives set forth in public policies and identified by stakeholders. But doing so presents significant challenges.

A key challenge is finding ways for many governmental agencies with competing and conflicting authorities—sometimes defined by sectors, such as health or environment, or jurisdictions, such as a state or regional water district—to work together to develop and adopt a comprehensive plan. Agencies must establish boundaries that encompass multiple sectors through an integrated approach and interagency cooperation. One way to accomplish this is through multi-agency task forces, as was done in CERP through the legislatively created South Florida Ecosystem Restoration Task Force.

Another challenge is supporting effective participation. Through the involvement of the various commissions and task forces associated with the CERP, competing interests were able to come to agreement on an integrated set of projects for the Everglades. Significant support for CERP was achieved. However, true collaboration involves not just participation in a decision, but shared power in making the decision. The C&SF Restudy was broadly inclusive, and the Restudy Team worked hard to make sure the public was informed about its participation opportunities. But, inevitably, the process will place limits on true representation; agencies and organized groups are more likely to have the knowledge and the ability to influence decisions. This was true in the Restudy effort where the Corps maintained significant control of the decision process. Boswell concludes that, in fact, “pure democratic” decision-making is difficult, and that, rather than work to afford more democratic power to the public, planners should make great efforts to ensure that public values and opinions are objectively measured and fully represented.

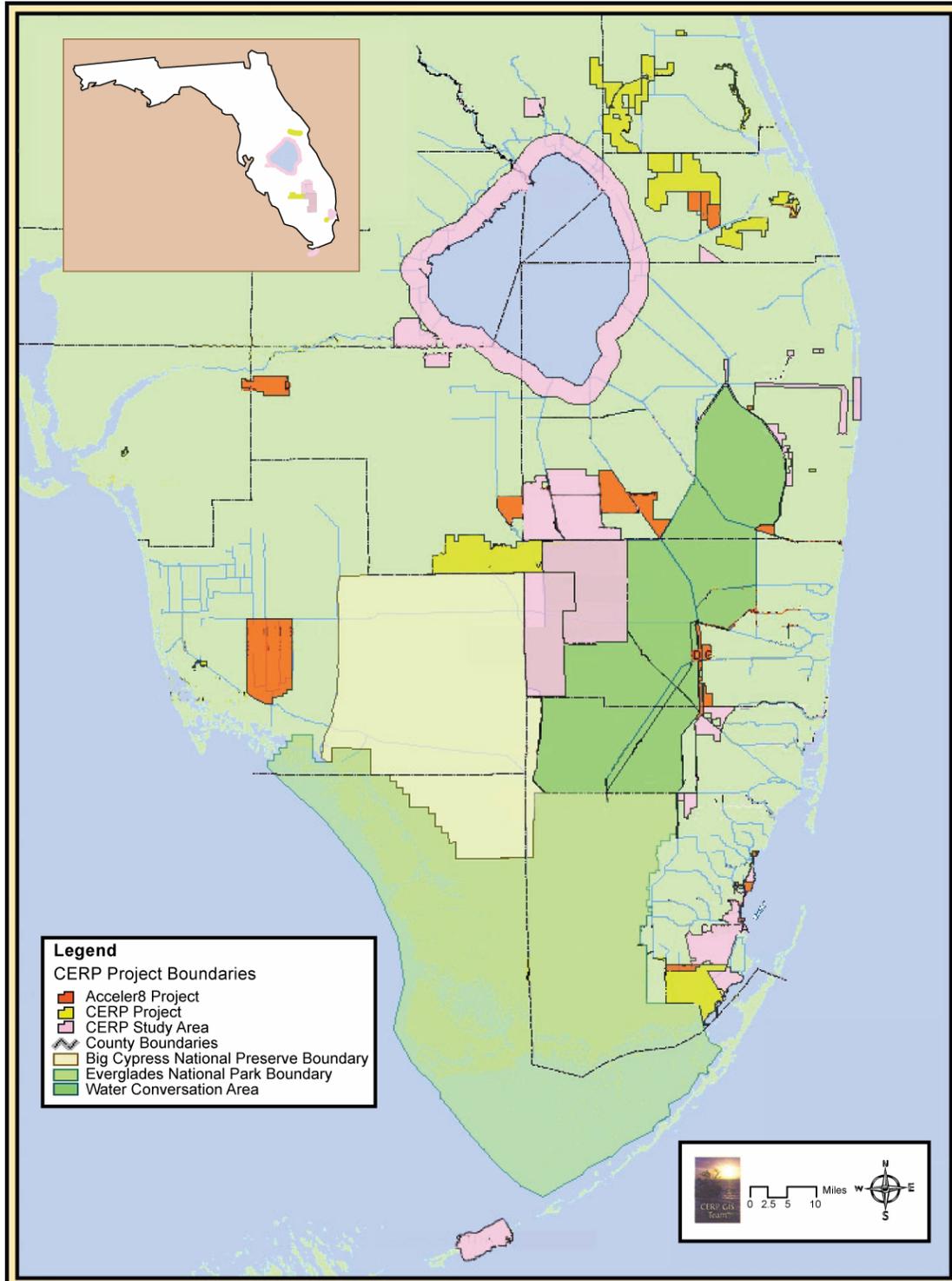
Limitations of science present a third challenge. Science can seldom provide the clear, unqualified conclusions that political decision-makers would like. And, the broader the issues

and areas included, the more uncertainty is built into the process. Adaptive management is designed to help deal with that uncertainty. But, “pure” adaptive management is predicated on treating project implementation as “experimental,” and in some cases this concept cannot be fully implemented. Boswell quotes a report by the U.S. Fish and Wildlife Service, indicating that there may never be enough management flexibility in the Everglades to allow the necessary manipulation of the system. The Corps has responded to this limitation by relying on modeling rather than true field experimentation.

But Boswell points to a possibly more critical issue with regard to adaptive management: “Whether the decision makers can develop an operational consensus and maintain a political coalition in the light of new discoveries and crises remains to be seen.” There are potentially big winners and losers in the Everglades, and new and emerging information may redefine who they are. The agreed-upon process for resolving disputes between the state and the federal government may help to overcome this inherent problem.

One final implication bears discussion. It is doubtful that the progress made to date would have occurred without Congressional direction. Key components that have supported the success—the interagency task force, the Restudy and its inclusion of ecological issues, the strong federal involvement in the plan development and implementation, and, of course federal funding—were all specifically authorized by Congress.

Figure E-3. Comprehensive Everglades Restoration Plan (CERP) Projects¹¹



¹¹ Adapted from a map provided by the Corps.

MISSISSIPPI RIVER AND TRIBUTARIES PROJECT CASE DESCRIPTION¹²

The Role of Stakeholders, Intermediary Institutions, and Science in System Level Planning and Implementation of Flood Control along the Lower Mississippi

Context

Commonly referred to as the Mississippi River and Tributaries (MR&T) “Project,” it is in effect a Corps program, with its own budget account and its own organic legislation in the form of an authorized plan providing authority for a broad array of projects to achieve multiple objectives along the lower Mississippi River and its tributaries.

The MR&T Project area covers the lower alluvial valley of the Mississippi River. This valley begins just below Cape Girardeau, Missouri, is roughly 600 miles in length, varies in width from 25 to 125 miles, and includes parts of seven states: Missouri, Illinois, Tennessee, Kentucky, Arkansas, Mississippi, and Louisiana. Today, the MR&T project area is encompassed by the Corps’ Mississippi Valley Division, and includes parts of three of the Division’s engineering districts. Figure E-4 provides a map of the MR&T Project area.

The creation of the MR&T was preceded by a long-standing involvement of the federal government in engineering operations along the Mississippi River to provide navigation improvements and flood control. In 1879, the Congress established the Mississippi River Commission (MRC) and directed it “to take into consideration and mature such a plan or plans and estimates as will correct, permanently locate, and deepen the channel and protect the banks of the Mississippi River, improve and give safety and ease to navigation thereof, prevent destructive floods, promote and facilitate commerce, trade, and the postal service.”¹³ At that time, jurisdiction of the MRC encompassed the length of the Mississippi, from its source in Lake Itasca to the Head of Passes near its mouth.

In response to congressional project authorizations, the MRC took on an expanding range of engineering operations along the main stem of the Mississippi River. An independent engineering agency with its own field districts, it worked in conjunction with the Corps, which operated primarily on the tributaries.

The MRC constructed an extensive system of levees along the Mississippi to provide flood control. It maintained a controversial “levees only” policy on flood control. This policy was discredited by unprecedented flooding in 1927 that caused loss of life and extensive damages. At this time, the federal government revisited the approach to controlling flooding on the Mississippi.

¹² This case description draws heavily on information from an official Corps history that covers the period extending through the Flood Control Act of 1941, which authorized the remaining features of what is considered to be the modern MR&T Project. See Camillo and Pearcy, 2004.

¹³ The MRC was authorized by the Mississippi River Commission Act of 1879. The MRC in 1879 (as it does today) consisted of seven members. Members included three officers of the Corps, one of whom serves as president; one member from the National Geodetic Survey; and three civilians, two of whom must be civil engineers.

The Jadwin Plan

Two separate flood control plans were developed simultaneously. The MRC's plan, developed at the direction of the Secretary of War, was delivered to the Corps' Chief of Engineers for approval. At the same time, the Chief of Engineers, General Jadwin, with the tacit assent of the President, developed his own plan.

The MRC's plan was developed, in part, based on input from listening tours and reflected broadly held expectations of stakeholders in the lower Mississippi Valley. Important elements of the plan included controlled spillways and reservoirs in addition to levees.

One of the main objectives of the Chief of Engineers' alternative plan was to provide a flood protection system at lower cost so as to enable the President to maintain a balanced budget. General Jadwin worked with the President and the Secretary of War to minimize civilian input. Moreover, he suppressed the MRC plan, which was considered too expensive. While drawing from the MRC plan, the Jadwin Plan substituted less expensive features, most notably fuse plug levees and uncontrolled floodways in place of controlled spillways and reservoirs. The plan submitted to Congress called for a cost-share requirement of 20 percent of the cost of construction, which exceeded the usual local contribution requirement at the time.¹⁴ In addition, sponsors would be required to provide right-of-way and flowage rights.

When the Jadwin report was released, it met with sharp criticism of all its elements. The related issues of using fuse plug levees and compensation for properties in floodways were a particular focus of conflict. Fuse plug levees were designed to fail during floods at certain points along the river and vent floodwaters onto low-lying lands abutting the levees and reduce the level of the river and thereby lessen flooding downstream. The land behind a failed levee was expected to serve as a natural floodway. This approach offered a relatively inexpensive approach to flood damage reduction. Criticism of this approach focused on the uncertain performance of fuse plug levees and the prospect of damages that might be sustained by owners of lands within floodways. By contrast, controlled floodways were designed to release floodwaters at a certain level through designed openings along the river and channel those floodwaters through built structures. Controlled floodways offered more predictable performance both in terms of venting water and controlling the path of floodwaters released. However, this approach was substantially more expensive.

The requirement for local contributions also received broad-based and intense criticism. Opponents argued that cost-share requirements should be waived in light of the extraordinary burdens imposed on local sponsors by flood damages.

Despite an extended period of jousting and negotiations between the Congress and the Administration, the main engineering features of the Jadwin Plan were authorized in the Flood Control Act of 1928. However, the requirement for local cost-sharing was not authorized, so MR&T projects were fully federally funded.¹⁵

¹⁴ Current Corps policy requires 35 percent local cost-share on flood control projects.

¹⁵ The Flood Control Act of 1965 instituted cost-sharing requirements on new projects authorized. However, by this time all basic elements of the MR&T were authorized, and long under way or complete.

The 1928 Act represented a departure from the traditional approach of authorizing individual engineering projects one at a time. It authorized a comprehensive construction plan, consisting primarily of the list of projects identified in the Jadwin Plan, to provide flood control along the main stem of the lower Mississippi River.

The flood control plan is unique in its authorized level of protection. Rather than being designed to provide a standard level of protection based on probabilities (e.g., a hundred-year flood), it was designed to control for the “project flood”, that is a flood larger than the record flood of 1927.

The Role of the Mississippi River Commission

Another element of the Jadwin Plan was a provision recommending that the MRC be brought under the direct authority of the Chief of Engineers. The Chief of Engineers already had veto power over project plans proposed by the MRC.¹⁶ But, the Plan proposed to give the Corps positive authority to direct planning and construction along the Mississippi. The Congress conferred the positive authority to the Corps for the prosecution of the MR&T, but left intact the general authority of the MRC to direct other engineering operations along the river. However, a new President of the MRC worked in conjunction with General Jadwin to bring the MRC under the Corps chain of command and merged the MRC’s districts with those of the Corps. The MRC was reduced to purely an advisory role; with the appointment of its President as the commanding officer of the Corps’ Lower Mississippi Valley Division, the MRC became associated closely to the lower Mississippi Valley and the MR&T project in particular.

The MRC continues its inspection tours along the Mississippi. These tours became an important vehicle for gathering and communicating stakeholder interests and concerns during implementation of the Jadwin Plan. Testimony taken during these tours would inform future revisions to the Plan in subsequent authorizations. The MRC was called upon to do a restudy and develop alternative plans in 1935. These plans informed major amendments to the plan in the Flood Control Acts of 1936 and 1941.

Evolution of the Flood Control Plan

While the Jadwin Plan was written into law, opponents remained active and continued to push for changes in the plan. The implementation of the plan was marked by conflict from the beginning, in particular over the use of fuse plug levees and uncontrolled floodways. Construction on two floodways was stalled by a lawsuit brought against the government by an individual with property along the proposed Boeuf Floodway. The owner claimed compensation for lost real estate value following from the prospect of flooding as part of the flood control plan.

While this conflict was being played out, the Division Engineer for the Corps’ South Atlantic Division, Colonel Harley Ferguson, proposed an approach that might make the floodways unnecessary. He proposed a series of projects to reshape the River along a critical stretch above the Boeuf Floodway. The basic idea was to release the energy of the river by shortening,

¹⁶ This veto power was established by the River and Harbor Act of 1905.

straightening and deepening it, and thereby increasing its capacity to transport flood waters safely downriver. The velocity of water flow would be increased and streamlined to lower water levels to avoid flooding that would occur from water being trapped in river bends. Thus reshaped, the river would dredge itself to a large degree through the force and direction of the water.

This proposal was championed by Major General Brown, who had assumed the position of Chief Engineer following General Jadwin's retirement earlier that year. Incremental field testing was approved by Congress and laboratory experiments were conducted at the Corps' new hydraulics laboratory, known as the Waterways Experiment Station. The Station had been established by Congress at General Jadwin's urging in 1928. Field experiments quickly yielded results and were followed by successful lab experiments.

Demonstrated success of the approach changed the dynamic of conflict over the main engineering features of the Jadwin Plan, calling into question the use of uncontrolled floodways in the lower part of the project area and causing decisions about necessary levee heights to be reconsidered.

The Flood Control Act of 1936 authorized Ferguson's plan, which came to be known as the channel rectification program. It also authorized dozens of reservoirs in the backwater areas.

With the passage of the Flood Control Act of 1941, major disputes constraining progress were resolved. Contention over the use of floodways was resolved with the Boeuf and Eudora Floodways deemed no longer necessary due to channel rectification and the future creation of reservoirs. A long-standing dispute over levee heights on the east and west sides of the river was also resolved by the benefits of channel rectification.

With the revisions to the plan authorized by the 1941 Act, the basic elements of the modern MR&T were put in place. The four major elements of the Mississippi River and Tributaries Project are: *levees* for containing flood flows; *floodways* for the passage of excess flows past critical reaches of the Mississippi; *channel improvement* and *stabilization* for stabilizing the channel in order to provide an efficient navigation alignment, increase the flood-carrying capacity of the river, and for protection of the levees system; and *tributary basin improvements* for major drainage and for flood control, such as dams and reservoirs, pumping plants, auxiliary channels, and the like.

While the primary focus of the MR&T was flood control, improved navigation also was an explicit objective from the beginning. Some elements of the flood control plan are closely linked to the navigability of the river. This connection became more prominent in later versions of the plan, most notably with the focus on channel improvement.

The Flood Control Act of 1928 authorized work that would give the various basins protection against Mississippi River floods only, although the tributary streams within the basins caused frequent flood damage that could not be prevented by the main stem Mississippi River protective works. The Corps plan, with its focus on channel rectification, had come to rely heavily on the

backwater areas to deal with flood water. This role was recognized in the 1941 Act, which authorized work to reduce flooding along the tributaries.

Later Developments

While the basic features of the MR&T system plan have remained largely the same, the plan has evolved over time in response to major events and changing circumstances. A major flood in 1973 led to significant new investment and some modifications in the system. Increased attention to environmental values has led to conflict over traditional approaches and particular projects. Unfinished portions of some projects have been restudied and modified to reflect environmental objectives.

Implementation of the Modern MR&T

The preceding discussion focuses on the conflict and cooperation over the basic features of the MR&T Project plan that were authorized in 1941. This section focuses on the implementation of this plan after its main features were authorized. Implementation is discussed with respect to two primary factors: 1) the special budget status of the MR&T Project, and 2) the political coalition organized around the MR&T.

As a rule, projects proposed by the divisions for inclusion in the Corps' budget are considered as a group in three budget categories: studies, construction, and operation and maintenance. The MR&T has its own budget account that includes studies, construction and operation and maintenance. In practice, a separate budget account for MR&T projects has meant that they do not compete directly with other Corps projects. Consequently, MR&T projects have enjoyed a somewhat privileged hold on resources.

The geographic scope of the MR&T translates into a large constituency for projects. Not only is the constituency large, but, historically, it has been well organized politically. Institutions such as the MRC and an active regional flood management association have facilitated organization and dispute resolution among groups within this constituency. Consequently, this constituency has been able to agree on basic priorities and manage conflict among individual interests. For instance, stakeholders with authorized flood control projects on the tributaries were willing to wait until work was done on the main stem. The MR&T project area covers parts of seven states, which means that an array of Senators and Congressmen are available to push for funding and to fight any significant alterations in timing and sequence of individual project funding.

These two factors—the special budget status of the MR&T project and the political coalition organized around it—can come together in positive and negative ways. On the positive side, it can enable Corps staff to pursue projects in a systematic way with stable support. Staff has the discretion and the resources to pursue projects based on their judgment of how best to build the system. On the negative side, a strong political coalition together with privileged budget status can make headquarters oversight of MR&T budgets more difficult. Also, the broad, cohesive coalition can make it difficult for the Corps or Congress to reduce funding for projects included in the plan and authorization that may no longer be justified in the face of changing circumstances.

Recent changes in the Corps' approach to budgeting have reduced discretion of Corps field staff. MR&T projects now are combined with other Corps projects and go through the same process of ranking and budgeting within and across business lines. Some have suggested that this process lessens the ability of Corps staff to make decisions with due consideration to system-wide performance. However, no examples have been identified.

Implications

This section examines the lessons learned from the history of the MR&T through the establishment of the modern project with the Flood Control Act of 1941. The MR&T experience may be evaluated against the principles of the watershed approach described in Chapter 5 of the report. These principles include: appropriate geographic scope to address problem; an integrated or systems approach; balance of multiple objectives; collaboration with stakeholders; adaptive management approach; and the use of science.

Watershed Scale and System Approach

The Flood Control Act of 1928 authorized a comprehensive plan, the "Jadwin Plan," for pursuing flood control as well as navigation objectives along the lower Mississippi River. The plan was comprehensive in that it called for a functionally interrelated set of projects intended to control flooding continuously along the main stem of the Mississippi throughout the lower river basin.

While the plan was comprehensive, it was not based on a comprehensive study. Instead, it drew on the past work and experience of MRC and Corps staff, and was not drawn in any great detail. It was left to the MRC and Corps staff to undertake the studies and planning necessary to undertake the specific projects envisioned by the plan.

A systems approach relied heavily on the discretion of field staff to implement the plan, as well as on political compromises among important stakeholders that allowed staff to set and maintain priorities among projects. This manifested itself in the agreement of stakeholders along the main stem to defer flood control projects on their part while other parts were attended to, and subsequently on the willingness of stakeholders to defer flood control projects on the tributaries in favor of completing projects on the main stem.

Stakeholder Involvement

The Jadwin Plan was developed without significant public input. The MRC plan, which reflected the expectations of a wide range of stakeholders in the lower Mississippi Valley, was suppressed. The choice of engineering features in the Jadwin Plan, aimed primarily at reducing cost, ran against broadly held expectations and led to years of conflict and halting progress in the provision of a flood protection system. While the Administration was able to win passage of the engineering features of the Jadwin Plan, active opposition of major stakeholders to features they had no part in choosing undermined the Plan's implementation.

Stakeholders, however, were able to voice their concerns during the Plan's implementation. The MRC's listening tours provided a venue for the expression and recording of public views on the Plan and its implementation. These views were reflected by the MRC in future testimony before Congress when amendments to the Plan were proposed, and when the MRC was called upon to produce alternative plans in later years. These plans met with much less resistance.

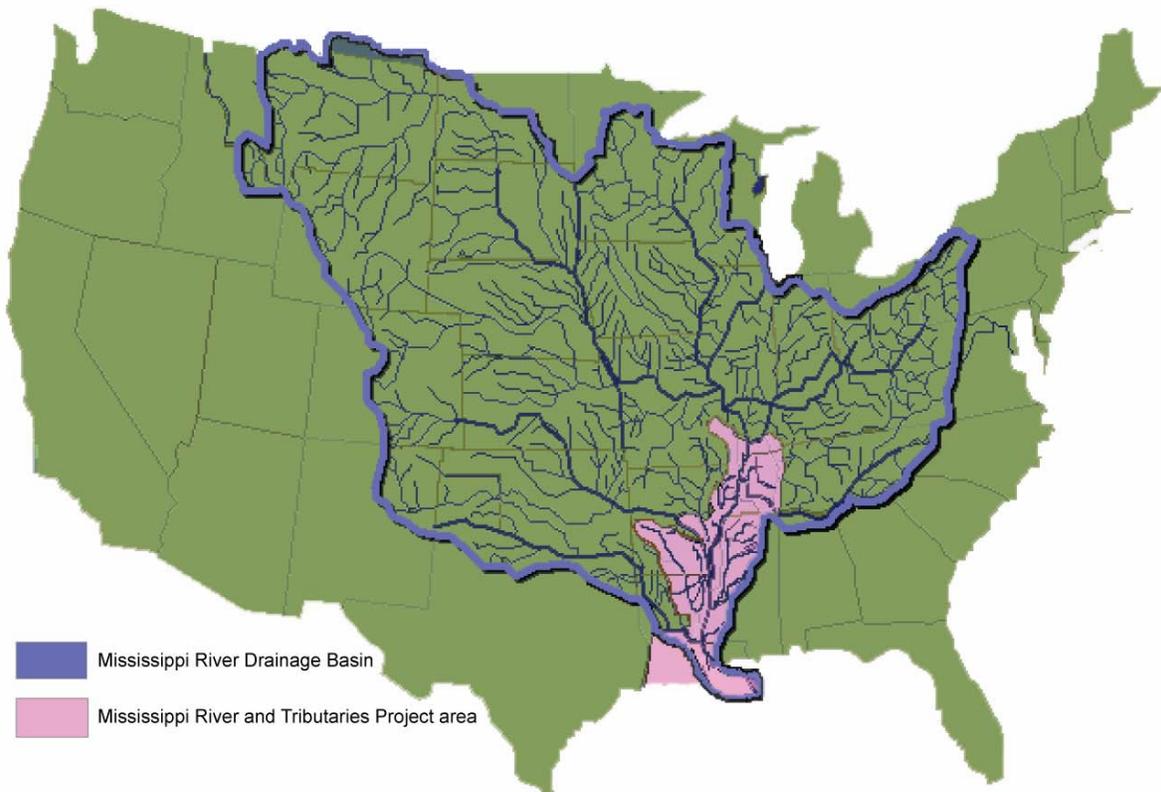
Adaptive Management

Unlike the original MRC plan, neither the Jadwin Plan nor its authorizing legislation made provision for a process by which to review progress and consider changes to the plan in response to changing circumstances. Changes in the plan were driven in large part by continuing legal and political challenges to the major engineering features of the plan.

Amidst this ad hoc conflict over the engineering features of the plan, the MRC played an important role in enabling informed and representative amendments to the plan. The MRC offered a combination of expertise and openness to a range of stakeholders that allowed it to play a constructive role in proposing change when political opportunities arose.

Use of Science

The opportunities suggested by the Channel Rectification Program fundamentally altered the dynamics of the conflict over the main engineering features of the Plan. Science was harnessed through a Congressional Resolution allowing limited pilot projects in the field and by simulations funded at the Corps' hydraulics lab. Vision supported by science enabled a reshaping of the Plan, and helped to resolve critical conflicts standing in the way of progress on the MR&T system.

Figure E-4. Mississippi River Drainage Basin¹⁷

¹⁷ Adapted from map of Mississippi River Drainage Basin found on U.S. Army Corps of Engineers website: <http://www.mvn.usace.army.mil/pao/bro/misstrib.htm>. **Note:** The MR&T Project area indicates the area in which projects authorized as MR&T projects are located. The MR&T Project does not include all Corps projects in that area, such as hurricane protection structures in and around New Orleans.

PROTECTION AND RESTORATION OF COASTAL LOUISIANA CASE DESCRIPTION

Disaster Presents Challenges and Opportunities

Context

The Mississippi River is the largest and longest river in North America. It drains over 40 percent of the continental U.S., including parts of 31 states, as well as parts of two Canadian provinces. (See Figure E-5 for map of coastal Louisiana.) Over the last 6,000 years the river and its tributaries have created the seventh largest delta in the world, an ecologically unique coastal zone, mostly of wetlands, which is home to a wide variety of bird, fish, shellfish, and plant species. A prime mechanism that worked to create this area was periodic flooding of the marshlands, which are subject to subsidence (sinking), and subsequent deposits of river sediment. (CLEAR, 2005; Working Group, *Framework*, 2006)

The City of New Orleans was founded along the river, about 100 miles inland from the Gulf of Mexico, in the early 1700s. That city has, of course, grown into one of the nation's economic drivers. Over 30 percent of all oil and gas used in the U.S. goes through its ports, and the strategic oil reserves are located there. It also supports many other important economic sectors, for example, international shipping, shipbuilding, health care, agriculture, recreation, seafood, and tourism. (Working Group, *Framework*, 2006; USACE, *Preliminary Report*, 2006)

History

Human activity near New Orleans, as well as along the upper river, has significantly altered the coast and the ecological systems that created and sustained it. Historically, the most significant threat to populations in New Orleans and along the river was flooding; controlling floods was a prime concern. In fact, as early as 1850, Congress directed the Corps of Engineers to develop a plan to control flooding along the Mississippi. And the Corps is still actively involved in building and supporting levees and other flood control efforts in the river basin, in addition to efforts directed at other missions, such as navigation, flood and environmental restoration.

As the area and the nation reaped the economic and other benefits of these human interventions, the wetlands began to disappear. Levees were built to reduce flooding and expand land development; canals were dredged to enhance navigation and trade; oil and gas production changed the hydrology of the area; and over 1,900 square miles of coastal land, mostly wetlands, were lost.¹⁸ And that loss of wetlands, as well as the related loss of barrier islands and other geologic features, moved the Gulf closer to New Orleans and increased the threat of storms, as opposed to floods, for the city and other coastal areas. Additionally, the sediment from the "channeled" Mississippi, no longer allowed to be deposited on the wetlands, was being deposited in the Gulf, creating a massive "dead zone" with far reaching implications of its own, in terms of ecological harm and related negative economic impacts.

¹⁸ This loss is measured from 1932, at which time, according to Corps documents, there were about 7,000 square miles of coastal wetlands in Louisiana.

As early as 1990, Congress and the State of Louisiana recognized the significance of the loss of the ecologically unique coastal wetlands. Congress passed legislation that provided about \$50 million a year in support of relatively small, short-term projects. Recognizing, however, that these efforts would address only 25 percent of the expected future wetlands loss, the State, along with federal partners, developed a more ambitious restoration plan—the Coast 2050 Plan—aimed at achieving a sustainable coastal ecosystem. A subsequent Corps study led to preparation of a report outlining alternative restoration plans requiring between \$5 and \$17 billion. OMB, however, directed that plan be scaled back to include a limited number of near-term projects, demonstration projects, and scientific assessments. As a result, in 2005 the Assistant Secretary of the Army submitted to Congress a Record of Decision requesting programmatic authority totaling \$1.12 billion to support five near-term critical ecosystem restoration features, a science and technology program, a demonstration program, and other activities. The request was included in the 2006 WRDA congressional deliberations. (CLEAR, 2005; USACE, *Preliminary Report*, 2006)

Then Katrina and Rita hit.

Impact of Katrina and Rita

The storms were a disaster by all measures, human, economic, and environmental. Over 1800 people died. The full measure of economic losses is unknown, but estimates of losses to Louisiana and Mississippi alone top \$150 billion. In the short span of the two storms, 240 square miles of coastal wetlands were lost—an amount that would otherwise have taken an estimated 15-20 years to disappear. The Corps completed emergency repairs to the levees in preparation for the 2006 storm season, and additional work approved by Congress is underway.

There is much work to be done—to stabilize and restore native vegetation, to recapture sediment and nutrients to rebuild the coast, and to clean up the Gulf “dead zone,” all the while rebuilding the area’s infrastructure and improving the storm and flood protection for New Orleans and the many coastal communities. There is no doubt that this work will be costly and take many years to complete. But in the aftermath of the destruction there is opportunity. The discussion—about flood and storm protection and ecosystem restoration—has been taken from theory to reality. The direct relationship between restoration and protection is clear. There is energy and urgency in the planning efforts, and many lessons are being heeded.

Collaboration is Essential

Many federal, state, and local agencies are working to meet short and long-term goals in coastal Louisiana, from restoring storm protection to its pre-storm level and getting housing for the many displaced persons, to working to improve storm protection, redeveloping the city and other areas, and restoring the ecosystem. The Corps is one of three key players in this massive effort, each with mandates that vary somewhat from the others. (Hanchey, 2006; USACE, *Preliminary Report*, 2006)

The Corps’ Louisiana Coastal Protection and Restoration project (LACPR) was authorized and (initially) funded through the 2006 Defense Appropriation Act and supplemental appropriations.

Under the fully federally funded LACPR, the Corps is directed to “...present a full range of flood control, coastal restoration and hurricane (risk reduction) measures...,” including protection against a “Category 5” hurricane. The final report is due December 2007.

The State’s Coastal Protection and Restoration Authority is charged with developing a long-term comprehensive coastal protection plan, combining hurricane protection and the protection, conservation, restoration, and enhancement of coastal wetlands and barrier shorelines or reefs. The plan must address these issues from a short- and long-term view and incorporate structural, management and institutional components. A final Master Plan is due before the Corps’ report, in March 2007.

The Louisiana Recovery Authority is guiding the State’s social and economic recovery. Through the long-term community planning initiative “Louisiana Speaks” and other collaboration efforts, the Authority will work with the Corps and others to keep the public and other stakeholders informed and to feed back their concerns and preferences to the Corps and others. The Authority’s Regional Vision Scenarios will be finalized, again before the Corps’ plan, in April 2007.

The importance of coordination and collaboration cannot be exaggerated. And the stakeholders in Louisiana know it. Stakeholder input, including the public, and various authorities, multiple funding sources, and differing capabilities and expertise need to be optimized to bring back a sustainable ecosystem, society and economy.

A New Approach

The Corps’ preliminary report to Congress on LACPR recognized the findings of post-Katrina studies: the existing levee “system” did not operate as an integrated system. It stated that the current levees were

...a result of a complex series of decisions regarding locations, designs, environmental impacts, and levels of risk reduction governed by local agreements, court cases, and Congressional authorizations and appropriations.

The report also pointed to the need to work on a “systems” basis to move coastal Louisiana forward. It indicated that a strong structural hurricane risk reduction system of levees and other structures must be augmented with a restored and sustainable coastal ecosystem to offer the best opportunity for success to save and protect coastal Louisiana’s citizens and economy. It also noted that other opportunities for risk reduction are open to individuals and businesses, such as elevating structures and improving evacuation plans. In fact, one of the key lessons the Corps has taken from the Katrina and Rita experience—one it is trying to incorporate into its entire planning process—is the critical need to plan water resources projects on a systems basis.

Policy Exceptions Facilitate Systems Approach

To accomplish this systems approach, the LACPR enjoys several exceptions to “normal” Corps policies. The study is neither a reconnaissance study (limited to \$100,000) nor a feasibility study

(requiring a 50 percent non-federal cost-share). Also, although it will conform to environmental laws and be consistent with existing guidance (contained in the Corps' *Planning Guidance Notebook*), it is not being developed according to all of the policies that normally guide formulation of plans and selection of alternatives. The preliminary report states that these exceptions enable the team to operate with more flexibility to meet the urgent need for information. Additionally, the study's recommendations will not be limited to the traditional focus on the goal of national economic development; the team's recommendations will also be based on an assessment of non-economic factors at risk and consequence analyses.

One important policy has not changed, however. The Administration intends that any federal funding for additional analysis or for construction would be subject to annual budget requests and necessary authorizations. This annual funding mechanism was a chief concern raised by a working group of scientists and engineers who studied Katrina's aftermath and lessons learned. Their January 2006 report concluded:

Authorization and funding for the new organizations, planning, engineering and science, and for routine plan implementation should be programmatic. For significant investments the Corps and other agencies should be freed from constraints of the Water Resources Development Act process.¹⁹

Greater Focus on Risk

At the heart of the LACPR activity is development of a risk-reduction decision framework. As envisioned, the framework will provide information on many key decision factors for each of the delineated geographic planning units for coastal Louisiana. Information will include, for example:

- assets at risk
- probability of annual recurrence of "screening storms"²⁰
- development and evaluation of structural, non-structural, and coastal restoration measures
- integration of component measures into alternative plans
- estimation of costs for each alternative
- recommendations for further engineering and design investigations

Efforts will be focused on moving beyond the relatively well-developed national economic development analysis to risk-based models of storm damage and risk to human life and property.

¹⁹ As an alternative, the working group suggested that Congress should charter a new investment corporation what would ensure more expeditious funding and implementation of projects.

²⁰ These are representative storms for which increased levels of risk reduction are to be considered. Congress has mandated one such storm: a category 5 (on the Saffir-Simpson Scale) hurricane.

Though few details are available in the preliminary report, the framework will include information on:

- “Residual” risks. These are risks that result from events that exceed the design of the risk reduction approach; risks that cannot be reduced to zero. These risks may result from exposure of people, property, infrastructure, the ecosystem, the local economy, and social and cultural aspects of the region.
- “Non-structural” measures. These measures could include education, evacuation procedures, flood proofing, elevation, and relocation. They can supplement structural hurricane risk reduction measures and allow for greater project design flexibility. Accomplishing these measures is beyond the authority of the Corps, and could require action by the state and/or local governments.

The Corps’ preliminary report indicates that a draft framework, that could be used to begin to inform decisions, was near completion. However, to produce all the relevant information will take longer. Among other things, the Corps is working with experts to more fully develop the quantitative analysis as well as scenarios and models to support the framework. A team of experts also has been assembled to develop estimates for risks associated with a (Saffir-Simpson Scale) “Category 5” storm, as required by Congress.²¹

Infused throughout the Corps’ discussion of LACPR is the concept of communicating risk to decision-makers and the public. The LACPR preliminary report notes that “...a decision framework that can be well understood by the public and decision-makers is the only means by which priorities for particular alternatives may be confirmed.” In fact, the report states that the purpose of risk assessment is to communicate risks to all interested parties and inform decision-makers as they make choices on managing risks. It also notes that LACPR presents an opportunity to communicate to the public what is involved in protecting the area against a “Category 5” storm.

Implications for the Academy’s Study

Clearly, the need to plan and manage water resources projects on a systems basis has been dramatically reinforced in the aftermath of these storms. It is now obvious that planners need to:

- view pieces of the efforts in the context of the whole
- consider multiple purposes and alternative proposals while developing optimal designs that support them
- assess all kinds of risk, including loss of life and social and infrastructure rebuilding costs, in risk analysis

²¹ Corps designs, and congressional authorizations, have traditionally been centered on what the Corps calls “composite storms” that do not fit the Saffir-Simpson Scale. Hampered, for example, by lack of historical data on “Category 5” storms, the Corps has had difficulty in defining the “Category 5” standard.

It is also clear that doing so is a massive undertaking. The circumstances in coastal Louisiana are unique, and planning, implementation, and management of the effort—given the existing destruction—face unique challenges. But the lessons can be applied universally. Systems planning and management in any context is a challenge. It requires

- participation and collaboration by all levels of government, optimizing existing authorities
- political will on the part of those governments to provide necessary funding and to make the tradeoffs needed to support the extraordinary level of spending that will be necessary
- meaningful participation and input by all stakeholders and the public to ensure that multiple alternatives are considered, needs are met, and unintended consequences are avoided.

Meeting these challenges will require new approaches by the Corps, Congress, and others to identify and address systems-based water resources needs and consider a range of alternatives. Some key needs include:

- new analytical and decision tools to allow informed decisions about the tradeoffs necessary between multiple purposes in face of limited funding
- new funding mechanisms that allow flexibility and timely development and implementation of systems plans; project-by-project annual funding mechanisms run counter to this goal, as do strict limits on the size of studies
- significantly greater emphasis on communicating risk, not only to decision-makers, but to the public who rely on the government's water resource efforts

And, finally, planning and implementation efforts must go on, even in the face of limited tools and funding. Decisions and tradeoffs need to be made based on the best information available and the fullest possible consideration of alternative approaches, while efforts proceed to improve the information and tools that can be used in future decision-making.

Figure E-5. Coastal Louisiana²²



²² Adapted from a map provided by the Coastal Louisiana Ecosystem Assessment and Restoration (CLEAR) program.

**SACRAMENTO AND SAN JOAQUIN RIVER BASINS
COMPREHENSIVE STUDY
CASE DESCRIPTION**

Corps' Comprehensive Study Lays the Groundwork for Collaborative Project Planning

Context

The Sacramento and San Joaquin Rivers drain California's Central Valley, which encompasses a 43,000 square mile watershed. The Sacramento River, flowing from the north, and the San Joaquin River, flowing from the south, come together in a delta east of San Francisco. The Sacramento and San Joaquin River systems are the focus of two overlapping planning efforts: the Sacramento and San Joaquin River Basins Comprehensive Study discussed here, and the Sacramento-San Joaquin Delta Levee Study that is the subject of the subsequent case description. (These case descriptions are followed by a map of the Sacramento and San Joaquin River basins and delta provided in Figure E-6.)

The Sacramento and San Joaquin River Basins Comprehensive Study is concerned with flood management and ecosystem restoration in the channels and floodplains of the two rivers and the lower reaches of their major tributaries. The Comprehensive Study is presented by the Corps as an example of a watershed or systems approach to water resources management and a precedent for the future of the Corps. The Comprehensive Study is defined by a watershed scale; partnerships with key stakeholders; a systems view; state-of-the-art systems tools and models; multiple objectives; integrated approaches and solutions; and multiple Corps roles (Corps brochure, undated).

The impetus for the Comprehensive Study was the disastrous flooding on the Sacramento and San Joaquin Rivers in 1997. In 1998, the Congress authorized the Corps to undertake a feasibility study. The study, known as the Comprehensive Study, was cost-shared on a fifty-fifty basis by the Corps and the study sponsor, the Reclamation Board of California, whose sponsorship was authorized by the California legislature. The Study objectives were to reduce flood risk to human safety and property and restore the ecosystem along the flood plain. These goals represented a shift from prior Corps work in the basins area, which had focused on the management and redirection of flood flows for agricultural use and navigation (NRC, *River Basins*, 2004).

The Study and Report

The original intent of the study was to produce a comprehensive plan that would specify flood damage reduction and ecosystem restoration projects throughout California's Central Valley. While the stakeholders reported consensus on the basic problems, they were unable to come to agreement on specific measures to be taken. Money ran out in the fifth year of the study. An "interim report" was issued in December 2002. It did not recommend particular projects.

Instead of specific projects, the plan laid out in the report establishes a set of general principles to guide the development, operation and maintenance of future projects; an approach to evaluating the system-wide effects of individual projects regardless of their scale; and an administrative

structure to oversee project analyses and to ensure the consistent application of guiding principles.

A major focus of the plan is the development of tools to model the behavior of the whole flood flow system. These tools are intended to improve understanding of the entire system to guide its continued operation and maintenance as well as to evaluate the effects of specific projects. The administrative structure is given tasks such as providing for periodic assessments of the system and projects, updating of databases, developing performance measures, coordinating resource management programs, and managing peer review and on-going technical studies (NRC, *River Basins*, 2004).

Actions Taken Since the Report

The 2002 interim report proposed applying the general principles to developing projects at three scales within the study area: 1) multi-objective, system-wide programs and projects; 2) regional projects; and 3) site-specific projects. Since the report was issued, projects have been launched at all three scales (Ayres and Kirchner, undated).

System-Wide Project: The Enhanced Flood Response and Emergency Preparedness project aims to improve county-wide warning systems and preparedness plans by integrating them into one system-wide plan. This project is currently being pursued through a cost-shared feasibility study with the Corps.

Regional Project: To create manageable projects for modifying existing flood management systems and achieve ecosystem restoration objectives, the study area was divided into regions to enable manageable projects. The plan identified seven regions based on technical analyses and stakeholder input. The Congress has authorized a cost-shared feasibility study for one such project, the multi-purpose Lower San Joaquin River Regional Project. The study has not yet received an appropriation.

Site-Specific Project: The Hamilton City Flood Damage Reduction and Ecosystem Restoration Project is in the Preconstruction Engineering and Design stage. It was not included in the President's budget request, but funds were appropriated by Congress.

Implications

Ayres and Kirchner discuss lessons learned from the experience of the Comprehensive Study. First, a systems approach that engages stakeholders can be useful in developing a common understanding and potential commitments. The Study used modeling techniques that greatly clarified the dynamics and interconnections at a system level. However, some stakeholders found this approach threatening in so far as it also clarified conflicting interests and strategies of stakeholders. In short, the approach made the process "too transparent" for comfort.

Second, adopting a large geographic scope for a study is useful in drawing out interconnections among processes and activities, but defining problems at such a high level can undermine efforts to build consensus and support for specific projects. To gain support, problems must be

translated into “bite-size” project alternatives that stakeholders can identify with their particular interests and invest themselves in.

A third, related lesson is that addressing problems at a watershed scale, especially when multiple objectives are addressed, can be overwhelming. The big picture should be presented, but information must be available to stakeholders in “bite-size amounts” that can be comprehended readily. They must see the big picture but be able to see themselves concretely in it.

A fourth lesson is that collaboration is necessary, but that it is costly and time-consuming. It must be managed with a view toward realistic and achievable expectations in the near and medium terms.

Another lesson offered by Ayres and Kirchner is that a well articulated governance structure is critical to keeping stakeholders engaged and managing the long and complex process of study and planning at system-wide, regional, and local levels in an integrated way.

Finally, the Corps can play important roles both as a neutral facilitator and a source of expert knowledge in its particular areas of competence.

**SACRAMENTO AND SAN JOAQUIN
DELTA LEVEES STUDY
CASE DESCRIPTION²³**

The Corps Prioritizes Near-term Delta Levee Improvements for Federal Funding and Facilitates the Development of a Long-term Strategy for the Delta

Context

The Sacramento-San Joaquin Delta is a largely rural area encompassing 738,000 acres of land in six counties, segregated into eighty tracts and islands with 1,100 miles of levees. The Delta is the hub of California's two largest water distribution systems: the Bureau of Reclamation's Central Valley Project and the California State Water Project. The Delta supplies drinking water to 22 million people in the San Francisco Bay area and in southern California and irrigation water for more than seven million acres of highly productive agricultural land. (A map of the Sacramento and San Joaquin River basins and delta is provided in Figure E-6 at the end of this case description.)

Project levees account for 385 miles of the 1,100 miles of levees in the Delta. The project levees were improved and incorporated into the Sacramento and San Joaquin Federal Flood Control Projects and generally are located along the Sacramento and San Joaquin Rivers. For the most part, the remaining levees are tidal levees and do not meet project levee standards. Both project and non-project levees are maintained by local reclamation districts with assistance from the State.

Even with assistance from the State, local reclamation districts have struggled to improve and maintain the critical levees in the Delta. The districts have limited resources due to the small tax base afforded by an agricultural area. Levees in the west and central Delta suffer from instability, erosion, and seepage. Delta failures cause brackish water from San Francisco Bay to enter the Delta resulting in short- and long-term effects on water quality, supply, and conveyance.

The Delta is bordered on the west by the Suisun Marsh. This is a unique brackish marsh ecosystem and the largest contiguous brackish marsh in the United States. It accounts for ten percent of California's remaining natural marshland. The Marsh is protected by aging levees built over 100 years ago with limited consideration to their soft structural foundations. The majority of these levees are maintained without financial assistance from existing levee maintenance programs.

Government Action in the 1990s

By the 1990s, the Delta was no longer considered reliable as a source of water supply and there was growing concern for many species in the area. In 1994, twenty-five state and federal agencies with management and regulatory responsibilities signed a Framework Agreement and

²³U.S. Army Corps of Engineers. Sacramento District, South Pacific Division. CALFED Levee Stability Program, California Report to Congress on U.S. Army Corps of Engineers Strategy for Action. (May 2006)

formed CALFED with the aim of developing water quality standards and long-term strategies for addressing fish and wildlife, water supply reliability, levee stability and water quality needs.

CALFED began with the development of a comprehensive plan, which was completed in September of 1996. An economic impact report was developed. A record of decision was signed in August of 2000 and a joint federal-state guidance document adopted. The CALFED program is now concerned with the adoption of the preferred alternative.

Role of the Army Corps of Engineers

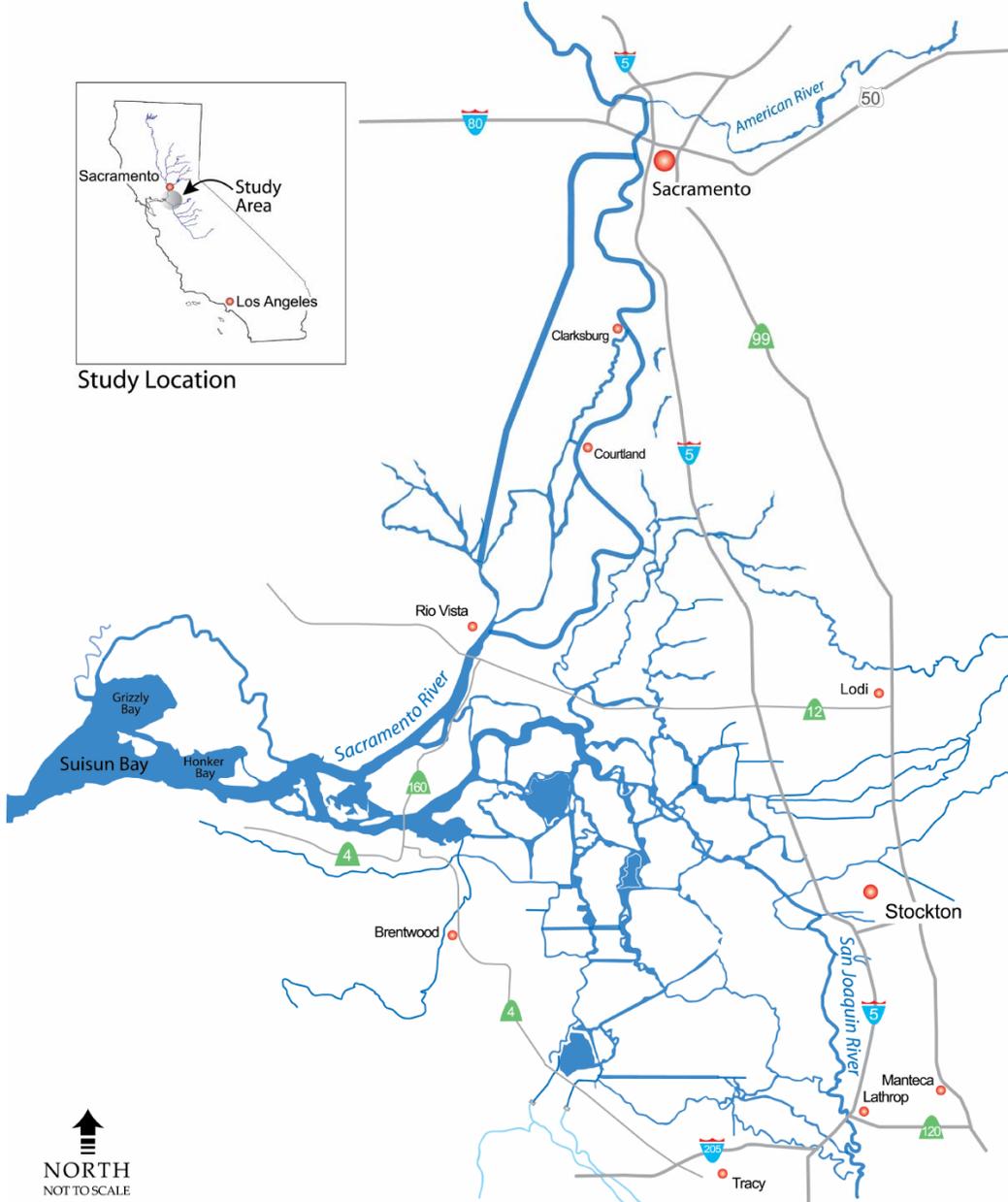
In the early 1960s, the Corps made improvements to the levees in the Delta when it constructed the Sacramento-San Joaquin River Flood Control Projects. Since then, the Corps has undertaken limited studies in the Delta over the years with available funds. The Corps did not have the authorization to undertake a comprehensive study of the area. The main challenges have been a lack of sufficient economic justification and the lack of non-federal cost-sharing partners with funds. The Corps has participated in the development of the CALFED program from its inception, however, providing technical expertise in levee system integrity and water resource planning.

In 2004, the Congress passed the CALFED Bay-Delta Authorization Act (CALFED Act). The CALFED Act directed the Corps to deliver a report that identifies and prioritizes potential levee stability projects in the Delta that could be carried out through 2010 with the authorized \$90 million in Federal funds. The Corps solicited project proposals from Delta stakeholders. The Corps, together with state experts, prioritized proposed projects according to how well they met the Corps' implementation criteria.

The chief objective of the projects envisioned in this short-term construction strategy is protecting the water supply, which is endangered by the deterioration of aging tidal levees. Ecosystem restoration efforts are included as well.

The Corps issued a report on the delta Levee Study to Congress in May 2006. This report discusses the short-term strategy described above as well as a long-term strategy to be developed in the Sacramento-San Joaquin Delta Islands and Levees Feasibility Study. This study will assess existing and future flood risks in the Delta as well as ecosystem restoration, recreation, and water supply needs, and develop a comprehensive plan for future federal participation in the Delta. The Corps' feasibility study will be undertaken in conjunction with the Delta Risk Management Study to be conducted by the California Department of Water Resources. Together these studies will address remaining levee stability work to be done beyond that which is funded under the CALFED Act.

Figure E-6. Sacramento and San Joaquin River Basins and Delta²⁴



²⁴ Adapted from a map of the Sacramento-San Joaquin Delta Islands and Levees Feasibility Study Area provided by the Corps.

RISK MANAGEMENT IN THE U.S. ARMY CORPS OF ENGINEERS

BACKGROUND

The Corps Civil Works Program is, by its very nature, operating in an environment where risk is ubiquitous. Lacking infinite resources, the Corps cannot protect against every possible flood or undertake every project that will benefit our nation. Thus, the civil Works program, by its very nature, involves assessing risk (for both missing opportunities and experiencing negative outcomes) and making investments that produce optimal outcomes for the United States.

The concept of risk as it applies to management and decision-making can be difficult to understand due to the sheer number of different definitions used by practitioners as well as the difference between the “risk management” definition of risk and that used in the vernacular. To introduce this topic, this section briefly examines the key risk concepts involved in decision-making.

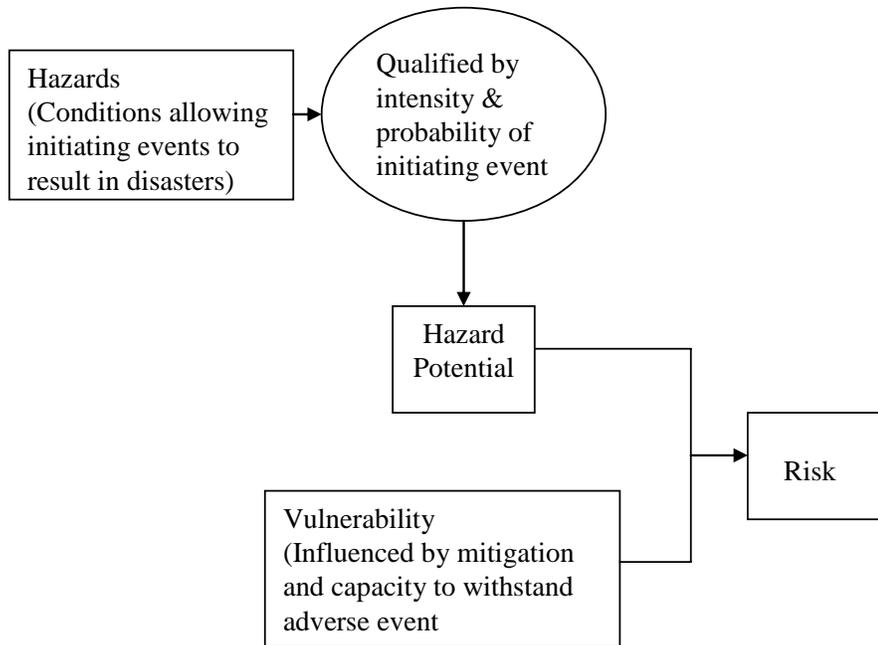
The discussion begins with a definition for the word “disaster.” The definition varies widely. Levitt offers one definition. He maintains that a disaster is not an event, but rather the consequences of an event under which the organization or system cannot function on an “as-intended” basis. For example, the disaster is not the flooding of an area but the consequences to the community which prevent it from functioning as intended. (Levitt 1997)

Hazards are the existing condition or situations that cause risks (to safety, health, finances, organizational reputation, the environment, the public, and so on) when an “initiating event” occurs. An initiating event may be either manmade or a natural phenomenon. Examples of initiating events are severe weather, fire, terrorism, computer virus attack, unfavorable legislation or the like.

“Vulnerabilities” are weaknesses or susceptibilities in a system or organization. Initiating events interact with vulnerabilities in a system or organization to produce disasters. Risk is a probabilistic measure of the various possible outcomes.

Under this definition, “risk” is the chance of something going wrong, and should be measurable. Measurement of risk is the central theme of the field of risk assessment. Figure F-1 and the example below further clarify the relationship between hazards, risk, vulnerability and consequences.

Consider the case of a floodwall that fails during a severe storm because it has not been maintained properly. As a result, ten people die and fifteen homes are flooded. In this case the hazard is the poorly maintained floodwall. The initiating event is a severe storm, and the disaster is the actual outcome, e.g., ten people die and fifteen homes are flooded. A vulnerability assessment of the floodwall prior to the storm would have considered the probabilities of various failure modes under a range of events, and would have identified the expected outcomes. Outcomes identified in these analyses are typically expressed as either an expected value or a range of values with associated probabilities.

Figure F-1: The Relationship Between Hazard and Risk

Clearly, it is in an organization's best interest to manage itself at various levels in order to avoid unintended negative consequences (e.g., disasters). The field of organizational management addressing these efforts is risk management. Even the phrase "risk management" is misleading, because risk itself is a concept describing uncertainty, and uncertainty itself cannot be managed. "Risk management" is actually managing a project (or an organization) in such a way as to anticipate uncertainties and achieve optimal outcomes when things go wrong. The science of risk management has evolved beyond hedging against probable loss into managing for optimal outcomes, considering both negative events and opportunities.

Risk management, then, is a program within the field of organizational management that considers hazards which can threaten vulnerable elements of a system. It provides tools that assist in achieving optimal outcomes. Risk management identifies hazards, assesses risks and consequences, and develops actions. These actions include mitigation, response, recovery, and communication of risk to customers and stakeholders.

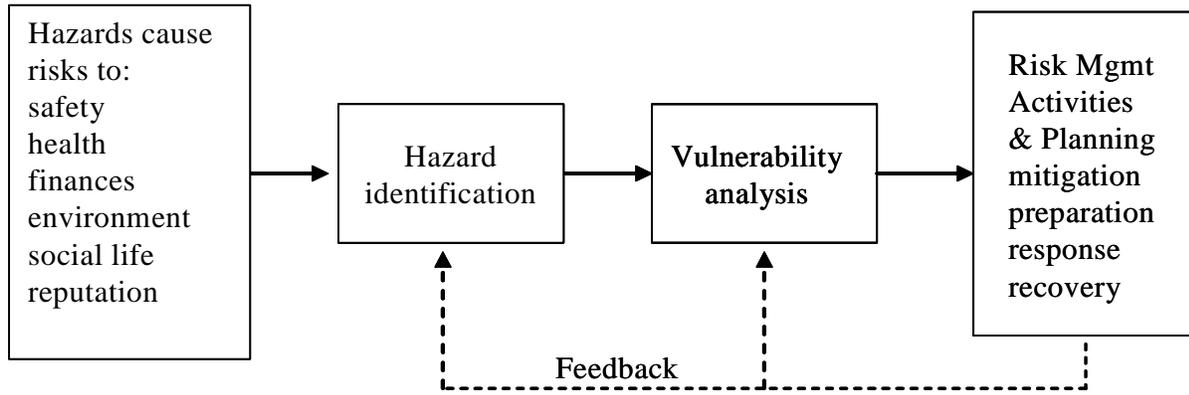
Risk management answers the following questions (Kolluru, 1996):

- What can go wrong and why? (What are the hazards? What disaster can occur?)
- How likely is it? (What is the chance, probability, likelihood?)
- How bad can it be? (Who or what would be affected? What is the vulnerability? What would be the consequences?)

- What can we do about it? (What management actions should be taken—mitigation, response, or recovery?)

The basic paradigm of risk management is outlined in Figure F-2.

Figure F-2: Elements of Risk Management



Elements of plans

- Financial
- Infrastructure and equipment
- Organizational
- Human Resources
- Business plans and processes
- Communication and public relations

HISTORICAL CONTEXT OF CORPS TREATMENT OF RISK

The Corps has been considering risk for a long time, and its understanding of risk has evolved over time. The following historical context is intended to show the progress the Corps has made in this area and to suggest next steps.

Pre-1990s: Deterministic Treatment of Risk—The Use of “Freeboard”

Many flood damage reduction projects involve the construction of levees. The Corps' historical approach to coping with hydrologic and hydraulic uncertainties of large floods was based on a best estimate of the levee height required to withstand a given flood, which was then augmented by a standard increment of levee height called “freeboard”—essentially building in a safety factor.

Many Corps flood damage reduction projects used the standard of “three feet of freeboard” as an engineering rule-of-thumb to account for risk.

Challenges to the concept of a standard levee freeboard emerged in the early 1990s. For instance, it was noted that a standard freeboard did not account for geographic and hydrologic differences at different locations and may thus have provided different levels of flood protection in different localities. Procedures for calculating the economic benefits conferred by levee freeboard were also questioned. The Corps felt that development and application of risk analysis techniques held great promise in addressing these issues, as these techniques aim to quantify and explicitly incorporate uncertainties in hydrologic, hydraulic, and geotechnical parameters into levee design analysis. It was envisioned that proper application of risk analysis could replace the need for the standard three feet of freeboard.

Risk analysis also became part of a federal levee certification procedure jointly conducted by the Corps and the Federal Emergency Management Agency (FEMA). Within the National Flood Insurance Program, FEMA identifies areas that are subject to varying degrees of flood risk on flood insurance rate maps. One of these areas is the Special Flood Hazard Area defined as the area that is inundated by a flood having a 1-percent chance of being equaled or exceeded in any given year (a “1-percent flood”). Property within a Special Flood Hazard Area is subject to mandatory flood insurance purchase requirements and may be subject to local land use regulations, as well. Floodplain property can avoid the Special Flood Hazard Area designation, and the mandatory flood insurance requirements that attend it, if it is protected by a levee certified to provide protection against the 1-percent flood. The Corps is responsible for certifying levees as meeting this safety standard. Because levee certification could exempt a community from flood insurance purchase requirements (and possible exemptions from local land use restrictions), this certification procedure has great local economic and public policy significance.

The historical standard for levee certification was replaced with more dynamic risk analysis techniques in the early 1990s. These techniques are described below.

1990s: More Modern Treatment of Risk to Certify Levees for the National Flood Insurance Program

The single-standard freeboard concept was replaced with a three-tiered system of levee certification based on the concept of “nonexceedance.” Nonexceedance probability is a measure of the likelihood that people will not be flooded (including the probability of failure of flood damage reduction structures, such as levees) in any given year, considering the full range of floods that can occur up to the specified flood protection level (e.g. a 1-percent flood) and all sources of uncertainty. The three-tiered rule was: (1) 3 feet of freeboard, (2) a conditional nonexceedance probability of 90 percent of passing a 1-percent flood, or (3) a conditional nonexceedance probability of 95 percent of passing a 1-percent flood. The concept of exceedance probability provides an integrated measure of all risks related to flooding, and is useful in flood risk communication, as noted in the section below on risk communication.

Although this three-tiered criterion represents a reasonable transition from the former certification criterion into the risk analysis framework, NRC has identified several deficiencies: (1) it still leads to different levels of flood protection for different projects, (2) the three-tiered

decision rule is unnecessarily complicated, (3) the method evaluates levees individually rather than as a levee system that is intended to provide flood protection for a community, and (4) certification is incomplete in that it considers only the 100-year flood, not the full range of floods. (NRC 2000)

The NRC study made several recommendations for the improvement of the Corps' implementation of this more modern treatment of risk.

The committee divided its recommendations for improvement into the following areas: (1) refine methods relating to probabilistic and statistical modeling of floods, performance of flood damage reduction systems (e.g., levees), and flood damage assessment, (2) adopt a consistent terminology for communicating risk analysis concepts within the Corps and to the public, (3) simplify and improve the complex and somewhat confusing criteria for certifying levees for inclusion in the National Flood Insurance Program (NFIP), and (4) move toward a more comprehensive decision making approach in flood damage reduction studies.

Recognition of engineering and economic uncertainties and their explicit quantification in flood damage reduction studies leads to projects that provide more consistent flood protection than did the earlier, deterministic freeboard standard. The analyses performed under this method consider local conditions and historical flood data specifically. The new techniques are a significant step forward and the Corps should be greatly commended for embracing contemporary, but complicated, techniques and for departing from a traditional approach that has been proven inadequate by modern scientific advances.

The Corps' Emerging Approach

In its post-Katrina work with the Interagency Performance Evaluation Task Force (IPET) and on the Louisiana Coastal Protection and Restoration (LACPR) project, the Corps has begun to consider flood risks in a more systematic way.

Appendix 8 of the IPET final report (IPET 2006) describes the use of sophisticated simulation techniques used to increase the understanding of risk across a whole levee system rather than simply as a series of separate levee projects.

In its work on the LACPR project, the Corps continued to develop its treatment of risk by taking a system-wide approach to analyzing flood risk, rather than examining Louisiana coastal protection one piece at a time. The treatments consider the effects of failures in one part of the system on the performance of the system as a whole.

In addition, the Corps contracted with the RAND Corporation to develop a Risk-Informed Decision Framework. This framework recognizes that scenario simulations are a useful tool in situations where the probability distribution of certain factors is not well known.

In summary, it is clear that the Corps has advanced substantially in its treatment of risk, with the LACPR project being the most important emerging example. *However, the IPET and LACPR*

methods of treating risk have not yet become part of regular Corps practice. Part of the agenda advocated in the “12 Actions for Change” within the Corps is to increase the use of this more sophisticated treatment of risk throughout the Corps.

Use of Risk-Informed Decision Framework in Louisiana

The LACPR Preliminary Technical Report describes three main components of the Risk-Informed Decision Framework to be used for the LACPR: Quantitative Hurricane Risk Assessment, Scenario Analysis, and a Risk-Informed Decision Process. (USACE, *Preliminary Report*, 2006)

The Quantitative Hurricane Risk Assessment procedure is based on IPET’s analytic process. This approach accommodates uncertainty through a standard probabilistic risk model. The risk model estimates the probability of various levels of economic and other losses due to statistical characterizations of future hurricane events, protection system performance, assets at risk, and other factors. A typical result is a graph showing the exceedance-frequency for various levels of economic consequence. Decision makers can then choose the alternative which has the most preferred combination of risk characterization and other factors (e.g. cost and environmental effects).

In some situations, including many aspects of the Louisiana coastal analysis, there is insufficient historic data to establish models based on probability. LACPR is using several techniques to assess those aspects for which probability cannot be adequately characterized using standard probabilistic methods. One important approach is the use of scenarios to evaluate risk under alternative assessments of the uncertain factors. Key factors to be varied under the alternative scenarios include hurricane probabilities as well as rates of sea level rise, land subsidence, dynamic coastal landscape change/loss, and population return. Standard scenario practice calls for the development of a few internally-consistent views or projections of the future against which alternative strategies would be evaluated. These scenarios are typically developed by varying only a small number of uncertain factors. The use of sensitivity analysis helps identify the factors that are most important to the scenarios. In sensitivity analysis, simulations are run using different variables for a single factor. If the results show little difference, analysts can eliminate that as an important variable in the scenarios, and vice versa.

The LACPR has identified five levee alignments and it is evaluating each against three coastal landscapes (corresponding to 1956, today, and 2050) through a suite of models to identify their performance. Non-structural and environmental measures are considered during the analysis as alternative options that may be more cost-effective for reducing risk under structural and coastal restoration designs that provide commensurately scaled protection.

The last element of the Risk-Informed Decision Framework is to provide risk information to decision makers in a way that permits them to weigh tradeoffs in performance across evaluation metrics (e.g., asset and life risk reduction, cost, and net environmental impacts) and across alternative scenarios. The LACPR project team is currently seeking strategies and heuristics to do this in a systematic way.

THE CHANGING RISK LANDSCAPE

In addition to this evolution in how the Corps understands and evaluates risk, the landscape of risks that the Corps must consider is evolving. National security and life-safety risks are now demanding attention.

National Security Issues

Significantly increased attention to possible terrorist or other threats to Corps infrastructure is now required. The Corps is cooperating with the Department of Homeland Security (DHS) to develop and implement an assessment of key elements of that infrastructure.

DHS has identified thirteen, often interrelated, sectors that serve as an organizational base for its efforts to assess and protect the nation's infrastructure. Though specific definitions of these sectors are not yet complete, the Corps has responsibilities related to four of them: transportation systems, water supply, energy, and dams. The "dams" sector is defined broadly to include, for example, locks and levees, hurricane protection structures, canals, and aqueducts.

With regard to dam safety, DHS is relying heavily on the Corps' on-going, congressionally mandated, dam safety program. The dam safety community has made great strides in developing assessment approaches. But the types of threats considered by DHS relate to different sources of vulnerability (e.g., intentional damage by terrorists) than those usually considered (e.g., seepage) in dam assessments, or in risk assessments of other types of Corps projects. Additionally, design of new construction projects and major rehabilitation projects may now need to include structural and non-structural features that would reduce vulnerability to such intentional attacks.

Consideration of Human Safety and Other Risks

Katrina highlighted concerns that the Corps does not adequately consider potential risk to human life in its prioritization of projects. Benefit-cost analysis could, in theory, address human safety directly by monetizing the estimated loss of lives and injuries and adding that dollar amount to the cost or benefit side of the ratio, depending on what is being analyzed. In the case of a flood control project, this process would be used to estimate the benefit of preventing loss of life and injury. However, current Corps policies do not allow for the monetization of life and injury. Benefit-cost analyses focus instead on estimating the benefit of property damages prevented.²⁵

At least since FY 2006, the Corps has accounted for risk to human safety by allowing an exception to the maximum threshold for cost benefit. That is, projects addressing what are judged to be a significant risk to human safety may be proposed for funding even if they do not meet the threshold RBRC ratio of 3.0. (See Chapter 4 and Appendix I for a more complete discussion of how the Corps applies the RBRC ratio).

Some critics believe that the Corps' practice of benefit-cost analysis is biased against non-structural alternatives to construction that might increase human safety most effectively and at

²⁵ Some consideration is given also to business income losses and emergency response costs.

least cost. The Corps' regulatory planning guidance requires it to consider non-structural alternatives (e.g., measures such as relocating structures out of the floodplain, flood-proofing or elevating buildings, and warning/evacuation systems) to achieve flood damage reduction goals. However, the 1983 federal *Principles and Guidelines* (P&G) that govern Corps planning studies do not provide for the Corps to claim as benefits flood damages reduced by the relocation of structures from the floodplain. The relocation of structures must be justified largely by off-site and non-market benefits.²⁶ Even if property damages prevented were claimed, the benefits of increased human safety would not be directly accounted for in the benefit-cost analysis.

Some also question whether, and how, the Corps explicitly incorporates other forms of risk into its decision-making processes. A variety of risks underlie project design and selection. Planners must estimate the probability and nature of the types of events that pose risks, for example, the risks of natural disasters, structural or functional failures of existing infrastructure, and the recently emphasized risk of terrorist acts, against the high priority structures built and/or maintained by the Corps. Another aspect of risk assessment is estimating the likely human, economic, and social impact of those events. And with each of those estimates there is an ever-present level of uncertainty.

A 1996 IWR study pointed out that engineers are frequently not trained in risk-informed decision-making, even though design standards are based on some implicit tolerance for risk, and that management often has difficulty in incorporating risk considerations into the culture of an organization. The report notes that the Corps' organizational culture needs to be changed, and concludes that:

If an effort to advance risk assessment approaches is to succeed, factors as obvious as the way the review process is structured, the way budgets are allocated and the commitment of the organizational hierarchy may be as important as writing new rules or technical training. (IWR, 1996)²⁷

These factors in conjunction with Corps' increasingly sophisticated treatment of risk will increase the complexity of Corps decision-making. In order to lend context to this, the following section examines how the Corps uses risk management at the project and organizational levels.

RISK MANAGEMENT AT THE PROJECT AND ORGANIZATIONAL LEVELS

The Corps has been criticized for its hazard identification and risk mitigation strategies and for how these have played out in their decisions on flood control projects. The discussion below examines the treatment of risk at the project and organizational level.

²⁶ Offsite benefits might include the reduction of peak flows and flood damages downstream beyond the boundaries of the project site. An increase in wildlife habitat following the removal of development from a flood plain would be an example of a non-market benefit.

²⁷ A good discussion of history and background of the Corps' use of risk in decision-making as of 1996 can be found in Moser, 1996.

Project Level Feasibility Study

The Corps uses a feasibility study to determine the feasibility of a project and to select the best option from among alternative implementation proposals for a project. Within the feasibility study, several possible methods of implementing a project are outlined and presented in terms of their expected benefits. This information is then utilized to select a recommended option for accomplishing the project as described below.

Each option in the feasibility study is characterized in terms of its cost, damage avoidance impact, economic benefits and other factors. In analyzing each option, uncertainty in parameters such as expected flood levels or drainage characteristics of an area are treated statistically (EM 1102-2-1619). The Corps uses his statistical information to calculate the economic risks and benefits of project options.

With some exceptions, the Corps uses the national economic development contribution as the primary decision-making parameter when considering implementation options for a project and in making funding recommendations among a particular set of projects.

As pointed out by the Congressional Research Service in 2006, the Corps' benefit-cost analysis does not constitute a comprehensive risk analysis, because the consequences considered are largely limited to property damage, leaving out other potential consequences, such as loss of life, public health problems, and economic and social disruption. (Carter, January 2006) The Water Resources Development Act of 1986 required the Corps to address the prevention of loss of life in the formulation and evaluation of flood control projects. Although potential loss of life is noted in Corps feasibility reports, there are no Corps regulations or guidelines for how to incorporate loss of life into the agency's benefit-cost analyses.

Yet, in spite of the fact that it operates in a setting where risk considerations are so universal, the Corps' treatment of risk, as performed at the project level, is not integrated into watershed level planning and is not integrated into organizational and strategic planning. In order to understand this assertion we will examine risk management practices at the organizational level.

Organizational Risk Management

Risk assessment is part of any evaluation of tradeoffs among options for project implementation. A range of risks can be considered, including, but not limited to, possible economic consequences (e.g., property damage from flooding, economic disruption), risk to human life and safety, and environmental degradation.

As the Corps moves towards increasingly integrated, strategic and watershed-based planning, these risks can be fed "upward" into organization-wide planning efforts, both strategic and operational. In both types of planning, senior management establishes organizational objectives to achieve the organization's strategy. Risks that could thwart those objectives are identified, measured and prioritized. Controls (e.g., structures, actions, policies, procedures) are set up to mitigate these risks and to ensure that the objectives are met.

A multi-step approach to risk identification reveals many points at which to make strategic and operational decisions. The approach attempts to capture all significant risks in Corps operations that could materially affect the achievement of the organization's goals. These steps are broadly applicable at various levels of the organization. The risks to be identified include:

- **Policy Risk:** The risk that policy design (congressional or Corps, depending on the level in the organization) is deficient, with the result that policies will not achieve the Corps' goals
- **Operational Risk:** The risk that policy implementation is deficient, with the result that policies will not achieve the Corps' goals
- **Fiscal Risk:** The risk that deficiencies in appropriations or expenditure control will adversely affect achievement of the Corps' goals
- **Reputation Risk:** The risk that a loss of confidence in the Corps could impair resources or programs such that goals cannot be achieved

Integrating risk assessment into all levels of planning and decision-making requires that the results of risk management flow naturally from strategic to project levels. Strategic risk assessment and project risk assessment are linked. The identification of risk in the four strategic areas identified above requires a combination of tools, for example, the assessment of the environment in which the Corps operates, exposure analysis, and threat scenarios. These tools are used together to ensure complete coverage and the identification of the specific sources of hazard and risk. The end product of risk identification will be a list of risks, each of which is associated in some way with the accomplishment of organizational objectives (outputs) which are designed to accomplish the organizational goals for the time periods under study. These same tools are used to address the project level risks within each of the four strategic areas.

Finally, risk management must be linked from the project level to the task level. Risk management principles need to be a part of everyone's job knowledge and practiced as part of the everyday job. Integration of risk management does not require uniform tools and methods; rather, integration of risk management into everyone's job requires a common understanding and commitment in principle to managing risk.

Organizational Risk Management Maturity

Organizations exhibit differing levels of maturity in how they deal with risk, particularly in the context of risk management. It is important that the Corps increase this element of organizational maturity. The contrast between organizations that are mature in the field of risk management with those that are immature in risk management is depicted in Table F-1 below.

Table F-1: Contrast between Mature and Immature Risk Management Organizations (Source: Hulett 2001)

Risk Immature Organization	Risk Mature Organization
Risk management is an "extra" activity	Risk management is required
People pointing out risk are "not team players"	Discussion of risk is encouraged and is safe; risk managers are invited to top planning and strategy meetings
Risk management isn't used to judge success	Risk management is on a level equal to that of cost, time and scope management.
Identifying risks can be career limiting	There is an identified risk management career path
Risk management is subservient to political ends of project	Independent risk managers at corporate level report directly to upper mgmt to protect their independence
Views itself as "one of a kind"	Benchmarks processes & performance against other organizations
Does not highlight risk management activities	Invites outsiders in to evaluate its risk management practices
Keeps project performance metrics murky	Implements clearly measurable project success metrics
May perform risk assessment but not turn it into action	Budgets and schedules risk mitigation actions based on its findings and analysis, demonstrating its belief in the process

A High Reliability Organization

In his book "Managing the Unexpected," Weick discusses the characteristics of organizations that are adept at managing unexpected events, have fewer than their share of accidents, and manage unexpected situations effectively. Weick terms these organizations High Reliability Organizations. Weick lists five characteristics common to these organizations. (Weick 2001)

- Preoccupation with failure: All errors or mishaps are seriously treated as symptoms that something is wrong with the system.
- Reluctance to simplify interpretations: Knowing that the world they face is complex, unstable and unpredictable, these organizations deliberately use more complex and nuanced pictures, position themselves to see more, and encourage critical thinking.
- Sensitivity to operations: Attention is paid to the "front lines" where work gets done, looking for loopholes, weaknesses in the system's safety barriers, defenses and safeguards that hold the *potential* to allow future problems
- Commitment to resilience: They develop the capability to detect, contain and bounce back from errors and unexpected situations
- Deference to expertise: Decisions are made on the front lines by the people with the expertise rather than at the top of the organization.

Weick uses the term "mindfulness" to describe the practices of organizations that incorporate these five principles in order to operate in a conscious fashion that recognizes their need to manage the unexpected. Because of the complexity of the environment in which the Corps

operates and its crucial role in protecting the public, these practices of mindful organizations might significantly benefit the Corps.

RISK COMMUNICATION PLANNING IS NECESSARY

Planning for risk communication is necessary, especially for public sector organizations. Corps guidance for Risk Analysis in Flood Damage Reduction Studies mandates such planning.

All project increments comprise different risk management alternatives represented by the tradeoffs among engineering performance, economic performance, and project costs. These increments contain differences in flood damage reduced, residual risk, and local and Federal project cost. It is vital that the local sponsor and residents understand these tradeoffs in order to fully participate in an informed decision-making process. (ER 1105-2-101).

Many public and private sector organizations face sudden unexpected and significant events and consequences that they need to communicate to the public. Best practices include risk communication as an important part of the charter of the risk management function. Planning for risk communication includes crisis response teams, scenario planning, and contingency plans.

This communication function is a difficult one. As discussed earlier, NRC recommended using “exceedance probability” as an appropriate measure of risk to use when communicating with the public because it provides a single integrated measure of all residual risks. However, engineers are frequently not trained in this form of communication, even though all design standards are based on some implicit tolerance for risk. (NRC 2000)

Successful risk communication faces many challenges and requires special expertise. The public has a very hard time dealing with risk and understanding probability distributions and that every daily activity has risk. The public’s lack of understanding of probability may be best overcome by expressing flood risk in terms of the risk of other everyday activities, such as the likelihood of being killed in a car crash on the way to work.

Risk communication is an integral facet of risk management and involves providing information about the existence and seriousness of a threat as well as steps that can be taken to mitigate the threat. Risk communication may serve to provide a basis for decision-making or to persuade the public to take some recommended action.

Risk communication in the field of flood loss reduction is complex for several reasons. The risk is probabilistic and the public has difficulty understanding probability. Additionally, the array of risk reduction scenarios can be complex.

- Risk reduction can be implemented in different ways and to different degrees, many of which can be used in combinations with one another.

- The alternatives that may be used for reducing risk often differ substantially in cost and benefits.
- Many of the available alternatives may serve several purposes and require consideration of impacts to water supply, electric power generation, the environment and other areas.
- Alternatives often have widespread economic impacts.
- Not all impacts can be easily quantified for consideration.

Communication of information about flood risks and mitigation alternatives is hampered by a generally low level of understanding on the part of public officials and the general public concerning the basic technical facts about flooding. These basic facts include: the major causes and types of flooding; the relationship between flood magnitudes and frequency; the concept of a floodway, including such notions as the floodway and flood fringe; and the reality that severe floods can occur in most areas.

Misconceptions and the general lack of information often result in failure of communities to take any action until the occurrence of a flood has made the risk clear. Once the danger has been made clear, the general lack of understanding makes it very difficult to engage communities in rational choices.

Media coverage also plays an important role in communicating risk to the public. Proper management of media aspects of risk communication are important in order to ensure the Corps' message is communicated accurately and in a timely fashion.

The news media also presents specific challenges since news accounts:

- are event oriented (issues of planning, mitigation and policy alternatives will fail to receive extensive coverage)
- may emphasize victims, primarily through pictures and video (risk coverage through horror stories)
- may emphasize the costs of risks rather than the benefits
- may present conflicting opinions from “experts” of questionable merit

Proper communication of risk with the public and stakeholders is important enough that the Corps may need to develop resources (a Center of Expertise) at the headquarters level to facilitate this. This Center of Expertise should also work to improve risk communication within the Corps' own organization. Technical tasks for the Center of Expertise could also include training Corps engineers in the latest risk techniques used by the Corps and providing expert “consulting” for projects, especially during the planning phases.

ENVIRONMENTAL JUSTICE: IMPLICATIONS FOR CORPS PRIORITIZATION

Often certain groups, including low-income or minority populations, do not share equally in the benefits of government programs or bear additional burdens created by those programs. These populations are less likely to effectively participate in public policy decisions and have fewer resources with which to respond when programs fail to serve them or place disproportionate burdens on them.

For many years now, federal agencies have been required to consider the potentially disproportionate impacts of their actions on these types of populations, and to make “environmental justice” part of their mission. Numerous legal, policy, and regulatory requirements define the concept of environmental justice. Two key sources, which are discussed later in this section, are the 1969 National Environmental Policy Act (NEPA), and the 1994 Executive Order 12898 on Environmental Justice.

The Academy is committed to include social equity considerations in all of its management studies. As part of its deliberations, the Panel considered whether the Corps could more directly consider these environmental justice concerns in its planning and project prioritization.

BACKGROUND

Since at least the 1970s, under NEPA and other legislation,²⁸ all federal agencies have been required to consider the impact of their programs on the “environment,” broadly defined. The 1994 executive order expanded those requirements by creating a more proactive mission for federal agencies, focusing on specific populations. Under the order, each federal agency must, to the extent practical,

“...make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its program, policies, and activities on minority populations and low-income populations in the U.S....”

The Council on Environmental Quality (CEQ) has established basic requirements for implementing the executive order through NEPA (CEQ, 1997). The guidance notes that environmental justice encompasses a broad range of impacts, including those on the natural and physical environment as well as interrelated social, cultural, and economic effects—listing specifically aesthetic, historic, cultural, economic, social or health effects, whether direct, indirect or cumulative.

²⁸ Many other legal requirements reinforce this concept, including several civil rights laws—most notably Title VI of the Civil Rights Act of 1964—as well as the Clean Air Act and the Clean Water Act.

Environmental Justice Goal

Impacts from public programs (transportation, water resources, power plants, health care etc.), or conversely, from the lack of such programs, can be far-reaching. They can successfully improve the economic, social, and/or environmental context in which people live and work. But they can also negatively impact these aspects of life. The tradeoffs between all types of costs and benefits are at the heart of the public decision-making process.

And in making those decisions, policy-makers need to consider the question of equity in the distribution of positive and negative impacts. Protected populations (those protected under civil rights legislation, the executive order, etc.) need to share equally in the improved conditions or services intended by government programs and should not suffer a disproportionate share of the negative impacts.

Scope of Environmental Justice Issues

A robust consideration of environmental justice issues requires a focused look at the protected populations.²⁹ And research supports the need to go beyond the question of whether a particular population is more or less likely to be impacted by a negative event or to “pay a price” for a government action. Even where probability of impact is the same for all populations, these protected populations are more likely to suffer from that impact. Research points to several underlying factors.

- These populations are less likely to effectively participate in the political process that makes these decisions, therefore making it less likely that their concerns and the impacts on them would be identified and considered. Limited education, limited English language skills, lack of understanding of the issues or the process, and fear or mistrust of the process, are among the factors that can contribute to limited participation.
- These populations are less likely to have the needed “safety nets,” insurance, financial flexibility, etc., to help them overcome negative impacts or limited services.

Additionally, discussion of possible impacts related to environmental justice often focuses on impacts to individuals, households, and businesses. But a robust assessment of environmental justice issues would include a wider range of impacts, including those on the institutional and social infrastructure. It would, for example, include not only the cost of replacing or repairing damaged roads, schools, government offices, etc., but recognize the longer-term impacts of these losses on rebuilding the economy and social structure of the area. For example, workers can’t return to revitalize industry if the roads aren’t repaired and if their children can’t go to school.

These kinds of infrastructure losses can impact communities of protected populations disproportionately. Often churches and schools serve as the cultural center, the source of

²⁹ Determining the overall potential impacts of government actions, or inaction, is closely related to overall risk assessment, which is discussed more fully in other parts of this report.

community support, for many ethnic, minority, and low-income communities. Loss of community support may make these populations even more dependent on government subsidy and services to rebuild their lives. Thus they are more likely to suffer if government is unable to meet their needs, and the potential “loss” associate with the negative impact includes increased government costs in terms of social services, health care, and other programs. As shown in Box G-1, the aftermath of Katrina has, in deed, raised these kinds of institutional and social infrastructure issues.

Box G-1: Katrina’s Spotlight on “Social Infrastructure” and Environmental Justice

A wide array of equity concerns have been raised in the aftermath of Katrina. Many of these cannot be addressed by the Corps. But they demonstrate the wide ranging issues that decision-makers can consider in assessing potential risks and in working to ensure environmental justice.

- In the aftermath of Katrina, an Associated Press analysis showed that residents living in white neighborhoods were three times as likely as those in black neighborhoods to seek state help in resolving insurance disputes. An example showed a white family successfully appealing an insurance decision and receiving payment, while a black family did not know they could seek state help in such an appeal.
- A report by the Center for Social Inclusion concluded that the fundamental problem was not the hurricane, but the fact that when the levees broke, too many people were poor, sick, and unable to flee.
- Less than a year after the hurricane, one devastated Vietnamese community had made significant progress in rebuilding, including reopening most of the businesses. People were again living in their homes and some were planting gardens. Much of the credit was given to the self-sufficient nature of the community and to the church’s leadership. (Article by Frank Etheridge)

*(Source: Clark Atlanta University, Environmental Justice Research Center;
<http://www.ejrc.cau.edu/Katrinaupdate.html>)*

In turn, the issues raised in the aftermath of Katrina demonstrate the difficulties planners face in conducting a robust environmental justice analysis. One difficulty, in particular, is that the concerns are multi-dimensional and require attention by all levels of government and by many agencies at each level. Thus they demonstrate the importance of intergovernmental cooperation and collaboration at all levels, not only in responding, but in assessing future impacts and considering alternatives for addressing needs. Another common difficulty, significantly exaggerated by the sheer size of Katrina’s devastation, is predicting future circumstances, such as demographics, in the face of many unknowns. For example as the Corps and others plan their response to Katrina, should they consider impacts on areas where protected populations lived before the storm, or try to predict where they will live when, and if, they come back.

GUIDANCE FOR IMPLEMENTING EXECUTIVE ORDER 12898

For many years before issuance of the executive order in 1994, NEPA had required analyses of a broad range of social and economic effects. However, the order significantly amplified the analyses to be done. EPA’s guidance on incorporating environmental justice into EPA’s own NEPA analyses clarifies how the order changed the then existing NEPA process. (EPA Final Guidance, 1998) Among other things, the guidance points to the

- possible need for more targeted community/public participation
- the need to “more sharply focus” NEPA analyses by assessing, not only the overall impacts, but the distribution of impacts demographically and geographically
- potential need to modify the analytical tools commonly used for analyzing potential impacts to allow this more refined focus

The guidance characterizes the ultimate impact of these more focused analyses:

...[T]he presence of disproportionately high and adverse effects may or may not necessarily change the final decision, but will change the focus of the analysis and may result in additional mitigation measures.

CEQ guidance specifies that identification of a disproportionate impact does not preclude project implementation. Instead, identification of these impacts should heighten the agency’s attention to alternatives, mitigation strategies, and monitoring needs, as well as to the preferences expressed by the affected community population. The guidance does not establish a standard format for identifying or addressing these issues, but requires agencies to integrate analyses of these concerns as appropriate in the NEPA analyses and documents so as to be clear, concise, and comprehensible.

Extensive Project Level Guidance Prepared by Several Federal Agencies

Several agencies have significantly expanded on the CEQ guidance, providing extensive support to aid project planners in identifying and mitigating potential environmental justice concerns. As noted earlier, EPA has developed specific guidance; EPA has also created a substantial body of relevant planning tools. The U.S. Department of Transportation (DOT) is also notable in the extent of effort devoted to these issues.

Since issuance of the executive order, several interest groups have pressed DOT very hard to live up to the intent of the order—including litigation aimed at ensuring attention to equivalent transportation services for low-income and minority populations, and equal protections from adverse environmental and economic impacts. DOT has responded by supporting research to develop and promote planning practices that address these issues. Much of the environmental justice research and information-sharing activity is supported by DOT and the state DOTs through the Transportation Research Board (TRB) at the National Academies of Science, where an Environmental Justice Task Force has recently matured into a regular standing Environmental

Justice Committee. The Corps is a sponsor of TRB. DOT, especially the Federal Highway Administration and the Federal Transit Administration, has allocated significant effort to developing guidance to states, Metropolitan Planning Organizations, and others, in how to incorporate environmental justice concerns into transportation planning.

Among other things, the Academy staff noted that both DOT and EPA have established broad definitions of environmental justice impacts and have provided significant methodological support to project planners.

Broad Definitions of Impacts

There are many types of impacts that can occur, and that can disproportionately affect target populations. The DOT—and subsequent Highway Administration—order on environmental justice define key terms; definitions that demonstrate the broad nature of environmental justice concerns. Briefly, “adverse effect” is defined to mean the totality of significant individual or cumulative human health or environmental effects. Some of the potential effects listed include

- bodily impairment, infirmity, illness or death
- air, noise, and water pollution and soil contamination
- destruction or disruption of man-made or natural resources, aesthetic values
- destruction or disruption of community cohesion or a community’s economic vitality
- adverse employment effects
- displacement of persons, businesses, farms or nonprofit organizations
- isolation, exclusion or separation of target individuals from a given community

“Disproportionate adverse effect” is defined as one predominately borne by a target population or one that will be suffered by the target population and is appreciably more severe or greater in magnitude than the adverse effect suffered by the non-target population.

Similarly, EPA guidance specifies 42 specific factors to be considered in the environmental justice analysis, arrayed in four categories: demographic, geographic, economic, and human health. Each is defined as it relates specifically to EPA issues. For example, in EPA analyses “population age” needs to be considered in terms of the potential for increased sensitivity in younger or older populations to toxic effects; or “geomorphic features” need to be considered as they may affect pollutant dispersal.

Many of the impacts listed in EPA and DOT guidance, as well as in DOT-supported research, could relate to Corps projects, though some Corps-specific modification would be needed in descriptions. For example, EPA includes “life support resources,” which considers subsistence living situations of populations reliant on affected natural resources, or “public access” which

needs to be considered in terms of the extent to which community members have access to decision-making through representative commissions, boards, etc. (EPA Final Guidance, 1998, Exhibit 3) Similarly, research by the National Cooperative Highway Research Program (NCHRP)—part of TRB—defines impacts in 11 specific areas. They include, for example, visual quality, land prices and property values, and water quality and drainage. (Forkenbroc and Sheeley, 2004) Conversely, there are Corps-specific impacts, such as human safety in flood zones, not addressed in these other agencies' guidance.

Methodological Guidance

Both DOT and EPA websites offer extensive information on the background, purpose, and concept of environmental justice as well as guidance on how to ensure effective participation and sound analysis. Both agencies and the TRB have published extensive, flexible guidance on how to incorporate environmental justice issues into project planning. For example, DOT encourages use of “Community Impact Assessment” in carrying out NEPA analyses and achieving the goals of the executive order and related laws. The six iterative steps in Community Impact Assessment include:

- define the project study area
- develop a community profile
- analyze impacts
- identify solutions
- use public involvement
- document findings

Four key aspects of ensuring environmental justice concerns are (1) identifying the populations impacted, (2) ensuring meaningful participation in the process by those populations, (3) developing the data and analysis necessary to effectively predict probable impacts and then measure the impacts that actually occur, and (4) mitigating adverse impacts where they can not be avoided. Each agency's guidance, as well as research in the field, emphasizes that the impacts to be assessed—and the extent of the assessment— will vary with the specific project and specific populations impacted.

Some key points in CEQ, DOT and/or EPA guidance are summarized below.

Identifying populations impacted: All three agencies point planners toward Census data as a foundation for identifying locations of target populations. Communities of target populations can go unidentified in analyses based on large areas, such as states or counties. EPA and DOT provide maps and links to other Census information, as well as other sources of information to allow target populations to be identified within a project area as well as to overlay project activities on those maps. These analyses can be very detailed, down to the Census Block level, to meet the intent of identifying target population groups which might be interspersed with non-target groups, but could be differentially impacted.

Participation: Meaningful and effective participation by affected populations in decision-making is at the core of the environmental justice concept. It is critical to accurately identify all target

population groups and involve them in the process. They can be instrumental in both identifying possible impacts, defining the level of concern the community has about those impacts, and developing mitigation actions where needed. The guidance emphasizes the need to ensure meaningful and effective participation, including efforts to educate the target groups about the issues as well as the process of participation. Both agencies provide guidance in how to do this, including, for example, multi-lingual educational materials and meetings, collaboration with local community leaders, and surveys and focus groups.

Analysis to predict impact: As already noted, the extent and type of analysis will depend on the nature and potential severity of the disproportionate impact, as well as the level of concern demonstrated through the community participatory process. The 2004 report by NCHRP provides extensive guidance on the range of methods that can be used on 11 specific types of impact. Those methods range from basic interview and analysis of existing data to sophisticated primary data collection and multivariate analysis. (Forkenbrock and Sheeley, 2004)

Identifying mitigation activities: The ultimate environmental justice goal, as stated in the EPA guidelines, is not to redirect adverse impacts away from target populations and toward non-target groups. Instead it is to avoid negative impacts whenever possible and to mitigate them when they cannot be avoided. Each agency provides suggestions for mitigation actions relevant to specific kinds of negative impacts. Alternative project plans may mitigate negative outcomes in different ways and to different extents. The NCHRP report also notes, for example, that in some cases positive effects can overcome other negative effects, making mitigation unnecessary. One example provided in the report concerns construction of an expressway. The expressway may increase noise and reduce land value in adjacent areas; but, if property on the land is primarily rental, the renters may be willing to accept additional noise in return for lower rents.—The example demonstrates that the one key to determining what mitigation is needed is the reaction of the affected community itself. Experts familiar with DOT’s environmental justice efforts point to many project improvements resulting from this differential analysis, including for example, more equitable distribution of transit service, noise dampening measures that protect both poor and wealthy neighborhoods, and redirected highways that otherwise would spit communities in two.

Guidance on Assessing Success is Limited

As discussed above, extensive guidance is available for identifying and mitigating environmental justice concerns at the project planning level. However, guidance on how to assess success of environmental justice efforts at the project level and at higher levels (program, system, or watershed) is much more limited.

Transportation planning requirements address environmental justice issues above the project level, at least to some extent, through the certification process. Federal certification of Metropolitan Planning Organizations (in areas with populations of 200,000 or more) examines how federally funded plans and programs address environmental justice requirements—among many other factors.

But not all agencies address this issue beyond the project planning level. In 2001 and 2002, for example, the Academy issued several reports related to EPA and state efforts. Recommendations included developing performance measures that would allow EPA to assess how well it was meeting its mission, to avoid disproportionate negative impacts from its activities on the target populations. (Academy, 2001 and 2002) Recently, the EPA Inspector General also addressed the need to look more globally at environmental justice. The Inspector General reported that program and regional offices had not been given sufficient direction to conduct environmental justice reviews. The report indicated that without such reviews, “the Agency cannot determine whether its programs cause disproportionately high and adverse human health or environmental effects on minority and low-income populations.” (EPA Inspector General, 2006)

THE CORPS’ APPROACH TO IMPLEMENTING ENVIRONMENTAL JUSTICE REQUIREMENTS

The Issues for the Corps

Clearly, the possibility of disproportionate impact on protected populations is by no means limited to Corps programs and activities. But existing legal and policy requirements have raised concerns about the probability of such impacts resulting from implementation of Corps projects. Two factors are of most concern.

- Cost-share requirements: Local cost-share provisions, especially since implementation of WRDA 1986, might reduce the ability of low-income areas to successfully compete for projects because they may be unable to fund them, or if able to fund them, they may be forced to build to a lower level of protection than another area, again because of limited funding.³⁰
- Emphasis on economic benefit: The emphasis on national economic development and cost-effectiveness may reduce the likelihood that low-income (often minority dominant) areas can compete for projects against higher income areas, especially with regard to flood damage reduction projects. The concern is that because of lower property values, projects designed to protect these areas may not be determined to have as high a “benefit” (losses avoided from flooding, for example) than higher income areas. Thus, even if the

³⁰ WRDA 1986 mandated a study to determine if project selection was biased against rural and low-income areas. The resulting 1989 IWR study surveyed almost 500 studies and projects considered for budget inclusion in the mid-to late 1980s. Using income and housing values as metrics, IWR found no statistically significant bias against low-income populations between studies and projects with favorable versus unfavorable action. It did find, however, that there was a priority placed on flood control projects and that, in general, flood control projects serve urban, higher income areas more than other types of projects. It should be noted, however, that this study addressed the issue for the entire project area, and did not assess possible within-project distributional issues which are the focus of the 1994 environmental justice executive order. Also, it did not recognize the possibility that cost-share requirements could result in studies or projects not being proposed at all. Finally, it is possible that many of the decisions studied did not reflect the changes made in the 1986 WRDA. In an earlier study (Steinberg, 1984), again little bias was found. However, that study found that as the Administration sought to increase the local share for Corps projects, those proposed for funding (projects proposed for 1983 and 1984 were compared to earlier new starts) served wealthier communities; local sponsors had agreed to pay a higher percentage than previously required.

area could fund the project, it would not compete on an even basis with a like project in a more affluent area.

Beyond these policy concerns, individual Corps projects can affect the populations around them in a number of ways. The following examples illustrate the kinds of impacts that can occur.

- Flood control can protect some communities, but not others, and could even increase the flood potential for some communities.
- Creation of reservoirs, locks, and other projects can force some home owners and businesses to give up land and relocate, possibly at an economic, community, or emotional cost.
- Projects can ensure a stable water supply for some areas, while others go underserved.
- Improvements in navigation channels on one portion of a river can help some businesses or towns, but hurt others.
- Dumping of dredged material, sometimes with toxic substances, can have significant implications for health in the areas near the dumping location.
- Placement of particular structures can change the aesthetics of an area, alter transportation corridors, and change the nature of affected communities.

These types of negative impacts can fall disproportionately on the protected populations. Consider for example, building of a levee. When the Corps builds a levee, it is geo-technically constrained in terms of where the levee can be built. Some areas may not be protected by the new levee because of physical constraints or cost-effectiveness considerations. There are many types of impacts that planners should consider. For example:

- Homes frequently flooded tend to cost less or have lower rents, so they are more likely to be low-income homes. Homes that would be riverward of the levee (outside the protection of the levee) and homes in the levee construction area must be acquired. The homes closest to the river are more likely to be low-income homes, and more likely to be in front of the levee instead of behind it. This unavoidable disproportionate impact can be minimized by alternatives that include relocation of families from the flood zone, raising the elevations of the homes, or otherwise flood-proofing them.
- Older industrial areas are often located in low areas too. Initially, the impact may appear to be only on the business owners. However, it may be that a large portion of the protected populations would lose their jobs if the industry is moved or closed as a result of frequent flooding or levee construction.
- If a significant number of people's homes are relocated, the impact could be felt on many local stores and other businesses located near by, many of which could be owned or operated by members of the protected populations.

- The formerly low-lying land that is now protected by a new levee will go up in value. As property values rise, the low-income populations who traditionally had lived there may find themselves unable to afford rents and taxes in the improved area.

Corps Authorities Concerning Environmental Justice

Congress has, for many years, required social impacts of the Corps' efforts to be considered in planning. However, neither the overall federal guidance on water resources planning nor the Corps' own planning guidance focus very specifically on environmental justice. Recently, however, the Corps has begun to develop ways to more fully address these issues.

Congress has recognized the role of social factors in Corps efforts since at least the 1936 Flood Control Act, which stated that the government should help improve navigation and control floods if benefits outweigh costs and "if the lives and social security of people are otherwise adversely affected." The 1970 Flood Control Act set the objectives to be included in federal water resources projects as enhancing:

- regional economic development
- the quality of the total environment
- the well-being of the people of the U.S.
- national economic development

That act also specified that project development should include a full assessment of possible adverse economic, environmental and social impacts and decisions should weigh overall benefits and the cost of eliminating or minimizing any adverse impacts.

However, the 1973 *Federal Principles and Standards*—issued by the WRC as rules to be followed by federal water resources management agencies in planning projects—made national economic development and environmental quality co-equal objectives, and relegated regional economic development and social well-being to a category of "other beneficial and adverse effects," with information about these factors to be displayed "where appropriate." Subsequently, the 1983 P&G, which replaced the *Principles and Standards* (becoming guidance rather than rules), held only national economic development as the primary objective "consistent with protecting" the environment.³¹

It is, perhaps not surprising then, that until recently, Corps-specific guidance has mirrored this emphasis on economic development goals, leaving "other social effects" a distant consideration. The Corps' project planning guidance on "other social effects" is the most relevant concerning definitions of environmental justice impacts. The range of impacts described in that guidance (ER 1105-2-100, app. D, 2004) is fairly limited. For example, with regard to social considerations, it includes such aspects as (1) the evaluation of unemployed and underemployed labor, (2) evaluation of urban and community impacts such as life, health and safety factors, (3)

³¹ In addition to the four factors outlined, the P&G also specifies four standards for project plans: completeness, effectiveness, efficiency, and acceptability, including "acceptance" by state, local, and public stakeholders.

estimations of displacement, (4) changes in long-term productivity or real income, (5) changes in energy requirements and conservation, (6) evaluations of changes in educational, cultural or recreational opportunities, and (7) change in emergency preparedness.

But in May 2005, the Corps issued revised guidance, (*Planning in a Collaborative Environment*, EC 1105-2-409) that, among other things, requires that project planning reports include a full discussion and display of all of the elements identified in the 1970 Flood Control Act, and that the “preferred plan” no longer need be the plan that maximizes national economic development (NED plan).³²

The Corps is still working to develop more detailed guidance on what role these other factors, including “other social effects” should play in water resources planning. It is important to note, however, that the existing planning guidance, including the May 2005 EC, does not emphasize the need to focus on the distribution of these negative impacts among different communities or populations affected by the projects. A key intent of environmental justice efforts is to identify and mitigate negative impacts on targeted populations that may be “hidden” in overall project area analysis.

Corps’ Experience in Implementing Environmental Justice Requirements

Corps officials have indicated that there is little specific guidance available to Corps planners on this subject. Absent specific environmental justice guidance, Corps field offices sometimes use guidance from other agencies—such as the EPA, CEQ, or DOT guidance discussed above—as they consider environmental justice concerns in their project planning activities. But Corps officials knowledgeable about environmental justice issues indicated concerns about how well Corps field planners understand and focus on environmental justice.

One official noted, for example, that the many factors that identify the populations protected by environmental justice provisions—such as changes to local incomes, housing values, local revenues, or community cohesion—may be treated as resources in the NEPA context, but that the participation process that is critical to environmental justice might not be effectively carried out. Implementing environmental justice provisions requires full consideration of the concerns of the whole affected population(s) in project planning and the decision process.

He said he thought that most experienced project managers would agree that although the targeted groups may attend public meetings, they rarely get involved beyond attending these meetings. Yet at times planners assume there are no disparate impacts because they were not raised at the public meetings. Instead, the planners should be making deliberate efforts to learn and consider their concerns in development of a project; this should be a specialized part of the public involvement program. He pointed to the experience of the Jacksonville, Florida, district office in work they did related to the Everglades restoration. They held meetings in local neighborhoods and found that those that attended these meetings were much more likely to voice

³² Existing guidance in the P&G mandates that the NED plan—the plan that maximizes national economic development—be the recommended plan, absent exceptions approved by the Secretary. The new guidance maintains the requirement from the P&G that any recommended plan that is not the NED plan be specifically justified in terms of other priorities to support an exception by the Secretary. The 2005 guidance expires in September of 2007.

concerns and opinions in this environment than they were in the larger, more general public participation meetings. The planners also made efforts to publicize meetings in local papers, those the targeted populations might be more likely to read than the mainline newspapers.

The official also said that sometimes the headquarters review of planning studies (conducted at several phases of the studies) identifies a need for planners to look a lot more deeply and more specifically at data, going beyond comparing city/county data to state/national data. A substantial low income or minority neighborhood can be lost in whole-city or whole-county statistics, but they can rarely be missed at the Census Block or Tract level.

However, he emphasized that in the last four or five years the planning study review process has come to a point where he thinks most people in the field are “getting the message” and more willingly including the increased focus on environmental justice in planning efforts. He believes that, generally, by the time the feasibility study is complete, these concerns are properly identified and either addressed or the reasons they could not be addressed are documented. But much of that success appears to have been the result of reactions by field planners to review comments and persuasion from headquarters.

In one case, however, the Everglades Restoration Project discussed below, the Corps has initiated an extensive, proactive environmental justice effort.

Environmental Justice in Everglades Restoration

In at least one case—Everglades restoration—the Corps has devoted significant attention specifically to environmental justice issues. In fact, WRDA 2000, which authorized federal funding for the Everglades restoration, specifies that the “...impacts on socially and economically disadvantaged individuals, including individuals with limited English proficiency, and communities are considered during implementation..., and that such individuals have opportunities to review and comment on” implementation. One key characteristic of the effort is that it seeks to address these issues at both a systems and project level.

The Everglades restoration program is one of the largest ecosystem restoration efforts ever undertaken. The Corps, along with state and regional partners, is working to overcome the negative impacts of generations of water resource activities in the Everglades and to restore major portions to their original natural functions. Environmental justice issues have been given much thought in the context of this project, which could, for example, have significant economic impact on agricultural communities in south Florida. Appendix E provides a brief case description of the Everglades restoration effort.

As part of the Comprehensive Everglades Restoration Plan (CERP) the Corps, along with the prime state sponsor, the South Florida Water Management District (SFWMD), has developed an Environmental and Economic Equity (EEE) Program Management Plan (August 2001). According to the CERP website (<http://www.evergladesplan.org>) the EEE Plan “...deals with the social, cultural, behavioral, historical and/or economic subjects involved with CERP. The Plan’s purpose is to maximize the potential benefits, both system-wide, and project-specific, resulting from CERP activities and to minimize any adverse social or economic impacts that may arise.”

The restoration effort will take decades. The initial EEE Plan is a five-year plan, with an estimated cost of \$6 million. The EEE plan is also closely linked to the outreach program plan.

CERP itself has two sets of objectives: (1) enhance ecological values and (2) enhance economic values and social well being. The EEE Plan specifies six objectives:

- promote economic equity through use of socially and economically disadvantaged small businesses and individuals
- provide solid baseline data for system-wide and project-specific assessments, including, for example, demographic, economic, water use, and conservation and land use data
- institute the sensitivity for and the provision of environmental justice assessment procedures, according to NEPA guidelines, for all project planning and decision-making
- provide guidance, support, and coordination to project-level activities on matters related to environmental justice
- through literature review and/or research, incorporate and use appropriate models, improved methods, and research in the subjects of demography, economics, land use, water use, water conservation, environmental justice, public involvement, and community-based planning to enhance decision making system-wide and at the project level
- evaluate and assess socio-economic parameters of the CERP through development of indicators and performance measures, periodic monitoring, and use of quantitative and qualitative feedback mechanisms from within the CERP process and from the general public

The EEE Plan describes a lengthy list of specific planned activities designed to achieve the above objectives, to ensure that restoration efforts overall meet environmental justice goals, and to support the individual project directors (there are over 60 projects in the CERP) who are responsible for environmental justice issues associated with their specific projects. Among other things, the Plan calls for providing training; developing data, such as data on growth trends and land use; developing methodologies and models; and supporting a demonstration project to pilot data collection methods, socio-economic methodologies, and community involvement in a CERP-related community.

In December of 2002, the SFWMD and the Corps issued a joint memorandum setting forth guidelines for incorporating environmental justice issues in planning specific restoration projects (USACE, SFWMD, No. 024.00. 2002). The guidance helps link the Corps' six-step planning process (included in overall Corps project planning guidance) and the steps of the NEPA process as they specifically apply to environmental justice. Among other things, it specifies that:

- In describing the “affected environment” the socio-economic environment will be described, including minority or low-income communities and their issues and concerns. Projections should be made into the future of the project (usually 50 years).
- Normally, performance measures or criteria will be developed by an interdisciplinary team in the early stages, as goals and objectives are established for the project.
- In formulating and assessing alternative plans, most projects will use multiple criteria. There will, for example, be one or more for: biological measures (habitat, wetlands function); water hydrology, cost; system-wide restoration; project-specific restoration; as well as one or more for environmental justice and socio-economic criteria.

Progress to Date

As required by WRDA 2000, in an October 2005 report to Congress, the Assistant Secretary of the Army/Civil Works reported progress on CERP implementation.³³ Also as required by WRDA 2000, the report includes a specific discussion of public outreach and environmental and economic equity.

The report points to four specific environmental justice accomplishments since 2001.

First, extensive efforts were undertaken to ensure the process is open to all audiences. A broad set of stakeholders has been identified.³⁴ Examples of efforts undertaken include, town hall meetings to inform and engage the community in program decisions, one-on-one sessions to educate various communities about the importance of CERP, meetings in minority and “front porch”³⁵ communities, multilingual newsletters and meetings, and discussions with business and commerce groups at which environmental justice was a highlighted issue.

Although these early efforts at the program level appear to be focused largely on educating and informing interested parties about the goals of and approach to the restoration efforts, the report indicates that activities also allowed input and involvement in decision-making. For example, the report indicates that public involvement efforts in developing program regulations took longer and were more complex than expected. This slowed progress but, the report concludes, resulted in better-designed regulations that are more accepted by the wide variety of stakeholders impacted by the restoration effort.

³³ Section 601(1) of WRDA 2000 requires that the Secretary of the Army and the Secretary of the Interior, in consultation with the EPA, Department of Commerce, and the State of Florida, jointly submit to the Congress a report on the implementation of the CERP every five years. The report: *Central and Southern Florida Project: Comprehensive Everglades Restoration Plan: 2005 Report to Congress*.

³⁴ They range, for example, from school children to retirees; from those who require detailed technical information to those who need very basic information; those who need information in languages other than English; elected officials at all levels; those with a variety of interest, including agricultural, recreational, environmental, business and property owners; utilities, and others.

³⁵ “Front Porch Florida” is a Governor’s initiative designed as a grassroots community revitalization effort promoting economic self sufficiency and social empowerment. (<http://www.dca.state.fl.us/News/2006/041706.pdf>)

Second, the Corps and SFWMD worked with EPA to develop an Environmental Justice Collaborative Training Program. They partnered with EPA to provide “sensitivity and knowledge” training jointly to project managers and involved community members. An official involved in the training cited this as the Everglades’ environmental justice work’s greatest success thus far. Corps staff and representatives of stakeholder groups were trained together. The official said that both groups walked away with a good understanding of what is, as well as what is not, required by the environmental justice executive order. However, there were some problems, which resulted in changing the format for the follow up training, discussed below. The official also indicated that there was benefit to partnering with EPA, including increased “credibility” in the eyes of both Corps and stakeholders.

Third, the “sensitivity and knowledge” training discussed above was augmented by development of a “how to” training module.³⁶ Information was provided to help staff understand how to incorporate environmental justice issues into each of the six Corps planning steps. This training was provided to Corps staff without stakeholders being present, however. An official explained that the Corps staffers had been somewhat uncomfortable in the joint sensitivity training, in part because stakeholders raised issues about specific projects that the staff could not answer in that forum.

Fourth, custom-made maps were developed using Census information and applying EPA’s thresholds for interpreting the 2000 Census data. The maps show the locations of low-income and minority communities. They are available on the web and, according to the report, have helped project managers, team members, and the public “see where projects and populations of concern intersect.” Project officials are proud of these maps, which, they report, have been praised in the map-making community. The CERP website describes these baseline data acquisition and analysis maps as follows:

The Environmental and Economic Equity Program Management Plan states six objectives. The second objective is to provide relevant, timely, valid and reliable socio-economic and environmental justice baseline data for system wide and project specific assessments. Baseline data will include, but not be limited to, demographic, economic, water use, conservation and land use data.

The EPA Region 4 maps were designed to be a tool to help begin to disseminate this type of data to the Project Managers.

The maps rely on the Census 2000 data that is currently available, focusing on Minority populations throughout the Counties. These maps will be updated with associated income data, as it is made available from the Census Bureau. This is considered "baseline data." The map's intent is to aid the Project Managers with their Outreach projects and also to assist in Environmental Justice aspect of CERP.

³⁶ CERP staff indicated that at least one Corps district—not involved in the Everglades project—has asked to be given this training.

Figure G-1, below, shows an excerpt of one of these maps. It illustrates the level of detail and extent of information made available. Because of the detail, a full county map could not be presented in this report. The maps are available on the CERP website:

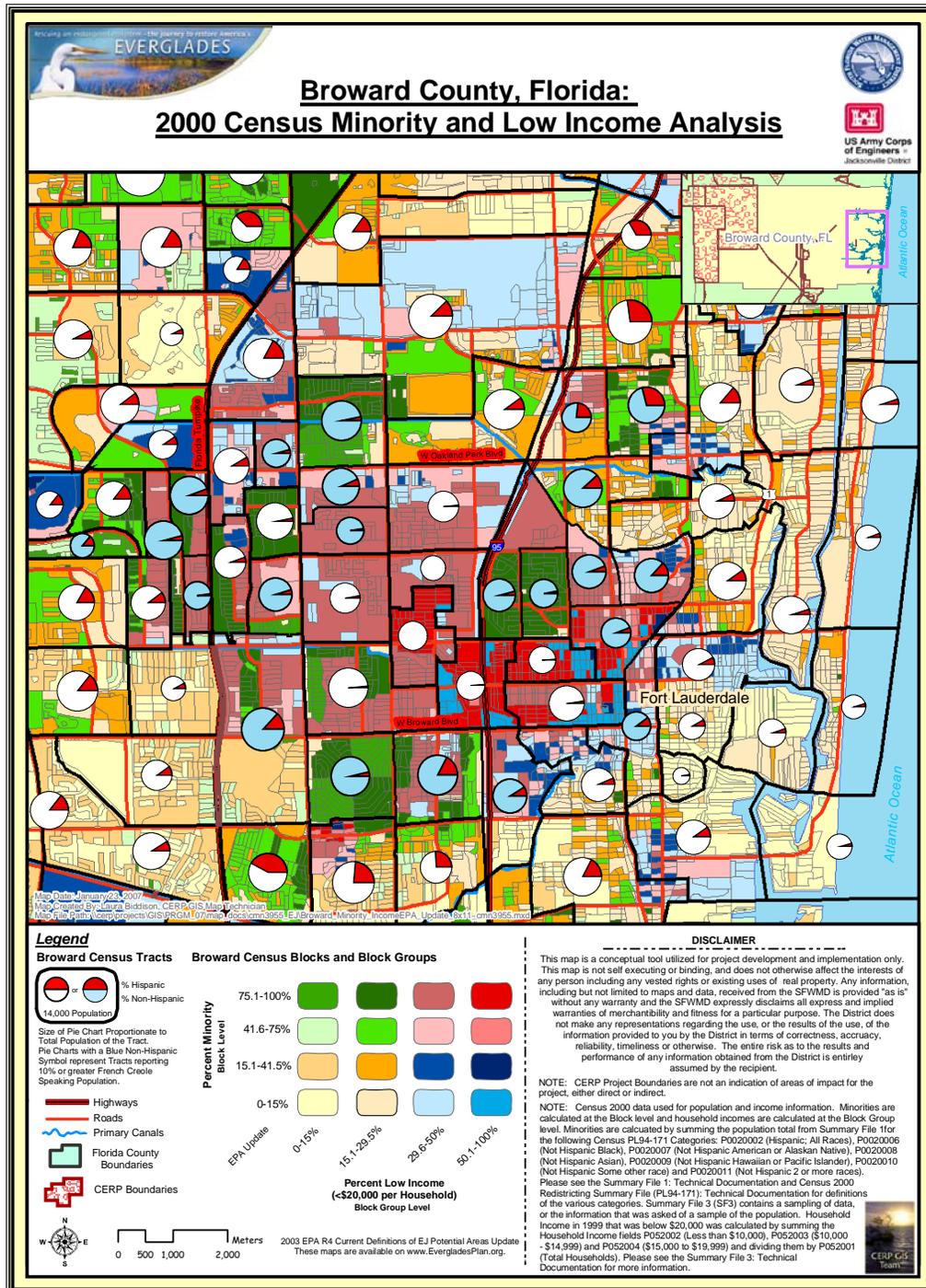
http://www.evergladesplan.org/pm/progr_eee.aspx#epa

The 2005 progress report to Congress notes that “...project managers utilize the training and standard census analysis to consider potential inequity of impacts and environmental justice responsibilities. Early involvement of the community...” helps ensure problems are identified early and considered in project development.³⁷ One official placed great emphasis on this point. He said that, in general, if environmental justice concerns are identified early in the planning process, they can be addressed with relatively little cost and time. On the other hand, significant time (delays) and costs can be incurred to address these issues if they are discovered after plans are completed.

The progress report also indicates that draft system-wide performance measures have been developed, but the separate report on those measures does not include measures specifically related to environmental justice. CERP officials knowledgeable about the environmental justice efforts said efforts are still on outreach and studies to identify potential impacts. Performance metrics have not yet been developed.

³⁷ Additionally, the report outlines actions to ensure that businesses that are socially and economically disadvantaged are identified and given the opportunity to work on restoration projects.

Figure G-1: Illustrative Map Excerpt—Everglades Baseline Data Acquisition and Analysis Maps
(Segment of one county; analysis at the Census Block level)



http://www.evergladesplan.org/pm/progr_eee.aspx#epa

Incorporating Environmental Justice Into the Corps' Project Planning and Prioritization

The following sections discuss possible changes in the Corps prioritization process to more directly consider environmental justice issues. First, however, the guidance for project planning is discussed briefly. Some of the key environmental justice concerns raised by Corps policies and legislative requirements cannot be fully addressed by changes in the budgeting process. Prioritization at that point is limited to the projects that have made it through the planning process. It is in the pre-authorization planning that environmental justice concerns are identified and mitigation actions decided.

Project Planning:

The Panel did not review Corps practices with regard to incorporating environmental justice into project planning. However, it seems apparent, given the limited emphasis placed on these issues in the guidance and information provided by knowledgeable Corps officials, that the Corps can do more to vigorously assess and consider environmental justice issues in project planning as well as in prioritization.

The Corps' guidance on incorporating environmental justice concerns into project planning is minimal, compared to the guidance some other agencies make available. Concerns have been raised that district planners do not fully understand the intent of the environmental justice mission, or the scope of analysis and participation efforts needed to fully accomplish it.

The examples of guidance provided by DOT and EPA indicate that more extensive explanation of impacts as they might apply specifically to the Corps' projects, and what kind of mitigation activities can be undertaken, would be useful. Additionally, expanding the guidance to include both focused analysis of the distributional impacts and focused efforts to identify and encourage participation by targeted populations could help planners better address the equity issue. Efforts to date as part of the Everglades restoration project might serve as a pilot in successfully undertaking this expanded emphasis, though results of that effort are not yet clear.

The following discussion addresses possible steps to better incorporate environmental justice into the Corps' prioritization process. The discussion focuses on the three stages of the strategy presented in this report, which are designed to move the Corps to a budgeting process based on sound watershed planning and management practices.

Stage One: Existing Budgeting and Prioritization Process

Concerns about whether and how well planners considered and dealt with environmental justice issues in determining which alternative plans to propose cannot be directly addressed during the budgeting process. At this stage the pool of projects being considered is a given. But selection criteria can help to ensure environmental justice is achieved.

One goal of the process should be to address concerns—related to cost-share requirements and a focus on economic benefits—that projects that protect or serve poorer populations are not given

sufficient consideration in budget decisions. It is, for example, clearly unacceptable to consistently delay construction of protective structures in poorer areas while proceeding with construction of similar structures in more affluent areas. The current heavy reliance on remaining-benefits/remaining-costs (RBRC) may work against projects in poorer areas. Since the Corps' calculation of flood control benefits is heavily dependent on the value of property being protected, it is possible that protection of poor communities may not be able to "make the cut" of a RBRC ratio greater than the budget standard.

The use of RBRC can be complemented by attention to social equity in two ways. First, a separate assessment of risk to human safety may be undertaken. As discussed in Chapter 4, the Corps undertakes such assessments which are explicitly factored into budgeting decisions. This assumes that some projects that do not meet the RBRC threshold will be included in the budget if a significant risk to human safety is determined to exist. This decision rule trumps any advantage based on relative property values that might bias a judgment based solely on RBRC. The less affluent receive equal protection from similar risks to human safety.

Social equity also could be addressed by modifying the RBRC ratio test. In the case of flood damage reduction projects, this would involve:

- obtaining per capita income data for all Census Tracts in the area of primary flooding
- calculating the mean and standard deviation for per capita income for the full sample of flood control projects
- calculating an adjustment factor ("poverty index") for projects where per capita income is below the sample mean³⁸
- creating a revised ranking of projects using the adjusted RBRC ratios, using it to set budget priorities³⁹

This proposal assumes that for the existing pool of projects, lower poverty indices are statistically correlated with lower RBRC ratios. This is an empirical issue that could easily be addressed, but is beyond the scope of this study.

Broader Environmental Justice Criteria

The criteria discussed above directly support the agency's environmental justice goal: to avoid disproportionate negative impact of Corps projects on minority and low-income populations. However, as discussed in Chapter 2, environmental justice concerns go far beyond whether these target populations receive equal protection from floods. The types of negative impacts that could fall disproportionately on various populations can include, for example, disruption of communities and businesses, negative health effects, and reduction of aesthetic values. The

³⁸ There are numerous mathematical formulas that could be used; as a general rule, the further from the mean (measured in standard deviation units) the higher the adjustment factor.

³⁹ This has the effect of reducing the threshold for projects in low-income areas.

definition of negative impact should also include unequal distribution of services, such as recreational benefits, water supply, relocation assistance, and small business participation.⁴⁰

In developing alternative project plans, each one is likely to mitigate disproportionate impacts in different ways and to different degrees. This also is true of the projects that are considered during the annual budgeting process. Thus alternative metrics, beyond those discussed above, would be needed to allow headquarters to consider the extent of success in addressing environmental justice issues when making decisions. And, given that the specifics of impacts to be avoided and actions to mitigate them are project-unique, some generally applicable metric would be needed. Although significantly more work would be needed to design and implement such criteria, some possible approaches include:

- Project planners could be required to obtain opinions of affected low-income and minority groups on how well each project addressed community concerns. This could be done through surveys, focus groups, or some other means more compatible with extant language, educational, and cultural norms in the affected area. A standard set of questions and scale of satisfaction could be used.
- A “scorecard” for environmental equity could be developed, focused on the specified categories of impacts most likely to apply to Corps projects. For example, each project could be rated on the extent to which the project successfully avoided or had remaining unmitigated disproportionate impacts related to: income, aesthetics, community cohesion, risk to public health and safety, and water supply. A summary rating could be developed to feed into the overall scorecard, or dashboard, described in Chapter 4.
- Projects could be ranked on the extent to which negative impacts are totally avoided or mitigated, or conversely, the extent to which unmitigated disproportionate negative impacts remain. Given that impacts vary in severity, it may be appropriate to include an adjustment so that avoiding essentially small impacts does not provide as much priority as avoiding a severe one. A scale could be developed that recognizes both the severity of the adverse disproportionate impact and the extent to which it is avoided or mitigated. In the example below, the decision criterion would focus on the extent of unmitigated impacts. The goal would be to give lower priority to projects that had less successfully mitigated disproportionate negative impacts. In this example, the higher the rating (level of impact X extent of mitigation) the lower the priority.

⁴⁰ Also, as discussed earlier, identification of negative impacts that are disproportionately distributed does not necessarily, or even often, result in cancellation of the project. Instead, reasonable efforts must be made to consider alternatives, and mitigate negative impacts. For example, if a disproportion number of members of targeted populations are left with homes outside levee protection, efforts to mitigate could include actions such as buying their houses or modifying them to better withstand flooding.

Table G-1: Example Project Rating Matrix: Extent of Unmitigated Disproportional Negative Impacts

Level of Impact			
• Severe impact (3)	9	6	3
• Moderate impact (2)	6	4	2
• Mild impact (1)	3	2	1
• <i>No impact</i>	0	0	0
Extent of Mitigation	Not mitigated (3)	Partially mitigated (2)	Fully Mitigated (1)

- Projects could be ranked solely on the overall extent of unmitigated, disproportionate impact. In contrast to the above option, the extent of mitigation efforts would not be considered. Projects would be ranked, with highest priority being where no disproportionate impact exists:
 - Priority 1: No impact or fully mitigated impact
 - Priority 2: Mild unmitigated impact
 - Priority 3: Moderate unmitigated impact
 - Priority 4: Severe unmitigated impact

Any of these criteria could be built into program performance measures and used to link success in meeting the environmental justice mission to budget prioritization. More study is necessary to develop meaningful, practical metrics to do so.

One possible problem with the last three alternatives is that these numbers would be fairly subjective and may be easily, if unintentionally, manipulated by project planners anxious to “score high” to ensure inclusion of the project in the budget. A more transparent process—increased transparency is a goal for each of the Panel’s proposed alternatives—would help to ensure supportable ratings for these criteria. Another potential implementation issue is that, in each of the possible approaches suggested above, a consistent metric would be needed to allow Corps-wide priorities to be set. However, the definitions and guidance for using those metrics may be different for different kinds of projects. The extent of mitigation possible for locating levees may be significantly different than for deepening a channel.

Stage Two: Functional Systems Planning

With functional systems planning and a division-wide budgeting focus, the Corps could begin to consider the overall impact of Corps projects on targeted populations. Within a given function in a given watershed/river basin, assessments could be made to determine whether the system plan and projects evenly distribute benefits. This recognizes that although any given project may not have disproportionate impacts, a “program of projects” might. For example: Are delayed segments of projects more often in target population areas? Is overall flood protection “equitable” along the river, for different population centers? Are navigation improvements consistently benefiting large businesses to the detriment of small, minority-owned businesses?

Do contractors for construction and O&M include small and minority-owned businesses? Where necessary, the functional plan could be altered to better ensure equity in distribution of program benefits.

It's also important to note that the need for meaningful participation by affected communities in identifying and addressing environmental justice concerns mirrors the strong emphasis on stakeholder participation in decision-making critical to systems-based planning.

Prioritization criteria similar to those suggested above for stage one of the strategy recommended in this report (improvements to the current process) could be developed on a "systems" basis. Planners could, in fact, use them in developing systems plans, and headquarters could further consider them in making budgeting decisions.

Stage Three: Integrated Systems Planning

A fully integrated systems-based plan will allow a much more proactive approach to addressing environmental justice issues. The foundation watershed assessment could include overall consideration of location and benefit levels of target populations. As indicated by the studies, program goals could include overcoming any inequities that are found. Plans and programs would seek from the start to address environmental justice issues. Stakeholder participation by targeted groups would be integral to the overall planning process.

As with functional systems planning, the kinds of criteria discussed for stage one would be used at the watershed program level as well as headquarters to make budgeting decisions. And, again as with stage two, performance measures could be developed at the watershed and agency level to more clearly assess success in addressing these issues and link that success to budget priorities.

SUMMARY OF PART RESULTS FOR U.S. ARMY CORPS OF ENGINEERS CONSTRUCTION PROGRAMS

While OMB ranks and budgets construction projects on an individual basis, it has, at the same time, attempted to focus the Corps more broadly on developing holistic programmatic goals, as opposed to fragmented planning on a project-by-project basis. It has done so through a program assessment process adopted during the current administration.

Here we review the results of these assessments. Special attention is given to OMB's assessment of strategic planning and program results.

OMB PROGRAM ASSESSMENT RATING TOOL

To assess programs, OMB employs the Program Assessment Rating Tool (PART). PART is a standardized questionnaire (attached) that OMB uses to evaluate the management and performance of federal programs and to integrate program performance into the annual budget process. PART assessments are generally conducted on a rotating basis every three years.

Responses to the questionnaire are rated with "assessment action scores." Established weights are used for the four main rating factors: program purpose and design (20 percent), strategic planning (10 percent), program management (20 percent), and program results/accountability (50 percent). Assessment scores are categorized into five ratings: effective, moderately effective, adequate, in-effective, and results not demonstrated. These ratings focus OMB efforts to stimulate improvements in agency program design and management, strategic planning, and budgetary decisions.

The following sections:

- summarize patterns in the PART assessments of Corps construction programs
- compare PART assessments of Corps programs to those of similar programs administered by other federal water resources agencies
- discuss findings and conclusions

PART ASSESSMENTS OF CORPS CONSTRUCTION PROGRAMS

All but one of the assessments reviewed were completed from 2002 to 2004; the PART for ecosystem restoration was completed in 2006. There is a process whereby agencies can have their programs reassessed, but the Corps has not chosen to do so, because of disagreement with OMB on appropriate program performance measures. The Corps continues to work with OMB on developing mutually acceptable performance measures.

At the time of the 2002-2004 reviews, Corps construction projects were managed through six individual programs. The Corps's construction efforts are now organized around four "business lines,"⁴¹ flood/storm damage reduction, navigation, hydropower, and aquatic ecosystem restoration. The objectives of the six Corps "PARTed" programs are as follows.

- The Coastal Storm Damage Reduction Program works to minimize the destructive coastal impacts of hurricanes and storms by maintaining and developing jetties, seawalls, and beach nourishment.
- The Flood Damage Reduction Program mitigates flood damage by constructing levees, floodwalls and other structural and non-structural projects. It also assists states in floodplain management and maintains large federally owned dams and levees.
- The Inland Waterways Navigation Program maintains and rehabilitates infrastructure of the Inland Waterway Navigation System.
- The Coastal Ports and Harbors Program develops and maintains key portions of the nation's marine infrastructure (such as navigation channels, jetties and breakwaters) at the nation's coastal ports and harbors.
- The Hydropower Program produces hydroelectric power and sells it *at cost* to augment the U.S. Department of Energy's Power Marketing Administrations. It also supplements the hydropower produced by private entities.
- The Aquatic Ecosystem Restoration Program focuses on restoring degraded ecosystem processes to a more natural condition. Projects restore aquatic resources such as wetlands, rivers and estuaries. The primary focus is on large hydrologically complex projects.

The scores on the four PART assessment factors across the six construction programs are provided in Table H-1 below.

⁴¹ Two business lines each encompass two previously separate programs. Flood/storm damage reduction includes the Coastal Storm Damage Reduction and Flood Damage Reduction programs. Navigation includes the Inland Waterways Navigation and Coastal Ports and Harbors programs.

Table H-1. PART Ratings for Six Corps Construction Programs

Program Title	Program Purpose & Design	Strategic Planning	Program Management	Program Results	Rating*
Coastal Storm Damage Reduction	80%	44%	63%	28%	RND
Flood Damage Reduction	60%	67%	82%	66%	RND
Inland Waterways Navigation	80%	78%	73%	33%	RND
Coastal Ports and Harbors	80%	100%	88%	56%	ME
Hydropower	80%	100%	100%	33%	A
Aquatic Ecosystem Restoration	80%	44%	75%	17%	RND
Average Score	76.7%	72.2%	80.2%	38.8%	--

*Ratings: E = effective; ME = moderately effective; A = adequate; I = ineffective; RND = results not demonstrated

The average score on the program results factor is dramatically lower than for strategic planning, program purpose and design, and program management factors. Four of the six programs reviewed were rated “Results Not Demonstrated.” While the average score for strategic planning is relatively high, the coastal storm damage reduction and aquatic ecosystem restoration programs both scored well below the average. (The attachment to this appendix describes the weaknesses reflected in the ratings of the “PARTed” Corps construction programs.)

ANALYSIS OF CORPS PART ASSESSMENTS

Our analysis of PART assessments of Corps construction programs focuses on two rating factors: program results and accountability and strategic planning.

Program Results and Accountability

In the area of program results and accountability, general weaknesses of Corps construction programs included insufficient data collection methods, lack of baseline and target data, and lack of long-term performance measures. Efforts to collect baseline data to support specific performance targets in budget requests were just beginning. OMB determined that many programs had purpose-driven, as opposed to outcome-oriented, measures. Although long-term goals had been established in some cases, maintenance backlogs prevented their attainment. Many programs had not demonstrated progress in achieving long-term goals due to funding constraints. Also, aggregate measures of overall return on investment (based on established

benefit-cost ratios) had not yet been developed. Annual performance measures had only recently been developed, making long-term program evaluation difficult.

Program results were demonstrated most effectively in the Flood Damage Reduction Program, which scored 66 percent, based on projects implemented between 1991 and 2000. The results included an estimated \$20.8 billion worth of flood damage prevented by completed projects and another \$1.8 billion worth from projects still under construction. The OMB review of flood damage projects between 2000 and 2001 also found that, on average, they were completed within the planned costs and schedules.

Strategic Planning

In the area of strategic planning, OMB found the Corps needed to increase collaboration among agencies with similar goals, including FEMA, and to overcome limitations on its ability to plan and select needed projects when willing sponsors do not provide outside monetary backing. Additionally, NRC studies recommended “more independent review of individual projects and studies.” In response, the Corps established an Office of Water Project Review. Reviews were typically conducted on projects with special circumstances. However, there was no established mechanism for the regular independent review of projects.

The Coastal Ports and Harbors and the Hydropower programs received scores of 100 percent in strategic planning, due in part to their development of specific, outcome-oriented, long-term measures that incorporated set targets and timeframes. Additionally, the OMB noted that both programs conducted independent evaluations. The Coastal Ports and Harbors program conducted evaluations on an as-needed basis, and Hydropower contracted with Haddon-Jackson and Associates, an independent consulting firm, to evaluate agency operations.

COMPARISONS TO OTHER AGENCIES’ PART RATINGS

Although deficiencies in strategic planning and results were also identified in the PART evaluations of some other federal programs with similar goals, the responsible agencies overcame the project-by-project planning focus that seems to dominate the Corps programs. They also incorporated internal mechanisms to support broader program planning, more adequate data collection, and productive stakeholder collaboration. Table H-2 below presents a summary of PART ratings of four programs administered by the Bureau of Reclamation, the Tennessee Valley Authority, and the National Resources Conservation Service.

Table H-2. PART Ratings for Construction Programs of Other Federal Water Resources Agencies

Program Title	Program Purpose & Design (20%)	Strategic Planning (10%)	Program Management (20%)	Program Results (50%)	Rating*
Bureau of Reclamation - Hydropower (2003)	100%	100%	100%	84%	A
Bureau of Reclamation - Safety of Dams (2005)	100%	75%	100%	80%	E
Tennessee Valley Authority (2002)	80%	89%	91%	84%	E
Natural Resources Conservation Service -Watershed Protection and Flood Prevention (2004)	80%	86%	100%	40%	A

*Ratings: E=Effective, ME=Moderately Effective, A=Adequate, I=Ineffective, RND=Results Not Demonstrated

OMB noted that the Bureau of Reclamation was working in collaboration with HydroQuebec and the Corps to create risk analysis methods for prioritizing capital expenditures. The Bureau's Hydropower and Safety of Dams programs both received final assessment scores of "effective" and scored 80 percent and 84 percent, respectively, on program results. OMB attributed the success of the Safety of Dams program to key factors including comprehensive project performance data provided in an annual "Databook" report. In the area of strategic planning, the PART assessment noted that the Safety of Dams program had an Independent Review Panel made up of consulting engineers, and an internal Dam Safety Officer that conducted annual reviews.

In the area of strategic planning, OMB found that the Bureau's Hydropower program developed new long-term goals that measure power plants' ability to meet energy demands during peak demand periods, as well as long-term goals for improving the capabilities of power facilities. In addition, the Hydropower program established ambitious program goals to increase power availability during peak demand periods from 92 to 94 percent. The hydroelectric industry average is 88 percent. Since 1996, Haddon-Jackson, has conducted Hydropower's independent reviews. OMB's PART review also found that the Bureau's hydroelectric power costs are

consistently among the lowest in the nation, comparing favorably to the Corps' Hydropower program.

The Tennessee Valley Authority Resource Stewardship Program received a final assessment score of "effective" with a program results score of 84 percent. This score was due in part to their established GPRA Performance Plan and TVA Balanced Scorecard program, implementation of collaborative benchmarking studies, and regular assessments conducted by GAO, the agency's Inspector General, and Congress. In the area of planning, TVA was also in the process of developing a new strategic plan spearheaded by a Senior Vice President for Strategic Planning and Analysis, hired in 2002.

The Natural Resources Conservation Service Watershed Protection and Flood Prevention Program assists local sponsors through three program components: (1) Watershed Surveys and Planning, (2) Watershed Protection and Flood Prevention Operations, and (3) Watershed Rehabilitation. The OMB review found that the Service's typical flood damage reduction project provided 50 to 70 percent less net benefits than a typical FEMA or Corps project, respectively. However, resources are distributed among several programs. In the area of program results, project information is collected in a national web-based Program Operations Information Tracking System. In the area of strategic planning, the program has developed new long-term goals that began implementation in FY 2005 with developed targets and timeframes. Although independent evaluations are not conducted, there are internal review mechanisms, such as federally funded quality control reviews conducted by the National Watershed Management Center.

CONCLUSION

From this quick review of other federal programs having goals similar to the Corps, it appears that other agencies have shown the ability to collect baseline and target data, and to establish long-term performance goals. They also appear to make more regular use of outside expertise for independent evaluations. This comparison shows that the highest assessment score for program results among the Corps programs was 18 percent lower than the highest score for similar federal programs administered by other agencies. The Corps' scores in the areas of program management and design are generally higher than its scores on strategic planning and program results.

ATTACHMENT
Weaknesses of Corps Construction Programs Identified in PART Assessments⁴²

Program Title	Program Purpose & Design (20%)	Planning (10%)	Management (20%)	Results (50%)	Rating	Weaknesses
Coastal Storm Damage Reduction	80%	44%	63%	28%	RND	<p><u>Lack of Cost Effective Strategies</u> Cost effective strategies are needed to mitigate the financial commitment posed by long-term shoreline erosion management (i.e. 50 year beach re-nourishment projects). Additionally, comparisons of estimated versus actual results for completed projects are recommended.</p> <p><u>Lack of Collaboration</u> The Federal Emergency Management Agency (FEMA) and the Corps of Engineers both work to minimize natural and man-made coastal damage. However, levels of collaboration are not commensurate with existing mission overlap.</p> <p><u>Lack of Long-term Performance Measures</u> Need for baseline data in the development of long-term performance measures. Improvements also need to be made in the linkages between program performance goals and related funding requests.</p>

⁴² The questions used to assess programs on each of the factors scored above are provided in the PART questionnaire at the end of this attachment.

APPENDIX H

Program Title	Program Purpose & Design (20%)	Planning (10%)	Management (20%)	Results (50%)	Rating	Weaknesses
Flood Damage Reduction	60%	67%	82%	66%	RND	<p><u>Inadequate Economic Justification of Projects</u> Economic justification for 100-year protection projects is recommended.</p> <p><u>Lack of Collaboration agencies with similar mission</u> Increased collaboration is recommended with agencies that work to reduce flood damage nation-wide, such as FEMA, the National Resources Conservation Service and the Tennessee Valley Authority. Coordination will assist efforts to diminish instances of program duplication and allow for best practices and knowledge sharing.</p> <p><u>Funding Limitations</u> Cost and schedule goals must take into account existing limitations of funding and should support assessments of the quality of cost estimates.</p> <p><u>Lack of Established Risk Sharing Strategies</u> Increased implementation of performance based contracts versus fixed contracts would allow for greater opportunities for risk-sharing.</p>
Inland Waterways Navigation	80%	78%	73%	33%	RND	<p><u>Lack of Long-Term Goal Development</u> The Corps long-term goal is to provide sufficient movement of waterway commerce to meet transport demand. The Corps is working with OMB to develop specific long-term goals that focus on outcomes (e.g., keeping barge waiting times down).</p> <p><u>Lack of Cost Containment Goals</u> Increased efforts are recommended to lower the ratio of breakdown maintenance to preventative maintenance.</p>

APPENDIX H

Program Title	Program Purpose & Design (20%)	Planning (10%)	Management (20%)	Results (50%)	Rating	Weaknesses
						<p><u>Underutilization of Management Options</u> The Corps has not embraced many recommended management options that would alleviate traffic congestion due to aging locks that are not equipped to handle modern flows of commerce. These management options include lock scheduling, lockage fees, and decreasing operation. At present, the Corps is collaborating with the tow-boat industry to enhance crew training and potential investments in lock modernization.</p> <p><u>Lack of Independent Evaluations</u> The Corps underutilizes independent evaluations in its planning process.</p>
Coastal Ports and Harbors	80%	100%	88%	56%	ME	<p><u>Inability to Accomplish Long-Term Performance Goals</u> Agency-wide limitations on program funding and construction backlog have diminished the ability of long-term goal accomplishment.</p>
Hydropower	80%	100%	100%	33%	A	<p><u>Lack of Cost-Containment Strategies</u> Direct customer funding will enable bulk purchasing of power generation components vs. individual projects competing for limited funds. An earned value management system is recommended to indicate costs and benefits.</p>

APPENDIX H

Program Title	Program Purpose & Design (20%)	Planning (10%)	Management (20%)	Results (50%)	Rating	Weaknesses
Aquatic Ecosystem Restoration	80%	44%	75%	17%	RND	<p>The Corps has recently identified a limited number of <u>annual and long-term performance measures</u>. These include the number of acres restored, the percentage of the total that is nationally significant, and the cost per acre to restore nationally significant acres. The Corps has not yet established baselines to allow evaluation of program effectiveness.</p> <p><u>Individual projects receive extensive review but the program as a whole has not been subject to regular independent evaluation.</u> Such evaluation may contribute to identification of enhanced methods for performing comparative analysis of projects with dissimilar ecological outputs, refinement of the definition of nationally significant, and improved or alternative performance metrics.</p>

PART Questionnaire

The PART questionnaire is divided into four sections shown below.

PROGRAM PURPOSE & DESIGN

- 1.1 Is the program purpose clear?
- 1.2 Does the program address a specific and existing problem, interest or need?
- 1.3 Is the program designed so that it is not redundant or duplicative of any other Federal, state, local or private effort?
- 1.4 Is the program design free of major flaws that would limit the program's effectiveness or efficiency?
- 1.5 Is the program effectively targeted, so that resources will reach intended beneficiaries and/or otherwise address the program's purpose directly?

STRATEGIC PLANNING

- 2.1 Does the program have a limited number of specific long-term performance measures that focus on outcomes and meaningfully reflect the purpose of the program?
- 2.2 Does the program have ambitious targets and timeframes for its long-term measures?
- 2.3 Does the program have a limited number of specific annual performance measures that can demonstrate progress toward achieving the program's long-term goals?
- 2.4 Does the program have baselines and ambitious targets for its annual measures?
- 2.5 Do all partners (including grantees, sub-grantees, contractors, cost-sharing partners, and other government partners) commit to and work toward the annual and/or long-term goals of the program?
- 2.6 Are independent evaluations of sufficient scope and quality conducted on a regular basis or as needed to support program improvements and evaluate effectiveness and relevance to the problem, interest, or need?
- 2.7 Are budget requests explicitly tied to accomplishment of the annual and long-term performance goals, and are the resource needs presented in a complete and transparent manner in the program's budget?
- 2.8 Has the program taken meaningful steps to correct its strategic planning deficiencies?
- 2.9 Has the agency/program conducted a recent, meaningful, credible analysis of alternatives that includes trade-offs between cost, schedule, risk, and performance goals and used the results to guide the resulting activity?

PROGRAM MANAGEMENT

- 3.1 Does the agency regularly collect timely and credible performance information, including information from key program partners, and use it to manage the program and improve performance?
- 3.2 Are Federal managers and program partners (including grantees, sub-grantees, contractors, cost-sharing partners, and other government partners) held accountable for cost, schedule and performance results?
- 3.3 Are funds (Federal and partners') obligated in a timely manner and spent for the intended purpose?
- 3.4 Does the program have procedures (e.g. competitive sourcing/cost comparisons, IT improvements, appropriate incentives) to measure and achieve efficiencies and cost effectiveness in program execution?
- 3.5 Does the program collaborate and coordinate effectively with related programs?
- 3.6 Does the program use strong financial management practices?
- 3.7 Has the program taken meaningful steps to address its management deficiencies?
- 3.8 Is the program managed by maintaining clearly defined deliverables, capability/performance characteristics, and appropriate, credible cost and schedule goals?

RESULTS AND ACCOUNTABILITY

- 4.1 Has the program demonstrated adequate progress in achieving its long-term performance goals?
- 4.2 Does the program (including program partners) achieve its annual performance goals?
- 4.3 Does the program demonstrate improved efficiencies or cost effectiveness in achieving program goals each year?
- 4.4 Does the performance of this program compare favorably to other programs, including government, private, etc., with similar purpose and goals?
- 4.5 Do independent evaluations of sufficient scope and quality indicate that the program is effective and achieving results?
- 4.6 Were program goals achieved within budgeted costs and established schedules?

APPLICATION OF REMAINING-BENEFIT/REMAINING COST CALCULATIONS

This appendix provides a detailed discussion of the remaining-benefit/remaining-cost (RBRC) ratio as it is used in the Corps' budget prioritization process. The sections of this appendix correspond to, and expand on, the discussion in Chapter 4.

HOW IS THE RBRC RATIO APPLIED TO INCREMENTAL UNITS?

A simple example can be used to illustrate the mathematical derivation of the RBRC ratio. Assume that there are two port facilities on the Purple River, Facility A at milepost 3.0 and Facility B at milepost 5.0. If the channel is deepened, there will be reductions in shipping costs to and from these facilities. The benefit-cost ratio of the selected plan is 3.2 to 1. (Before construction starts, the total benefit-cost ratio equals the RBRC ratio, since all costs and benefits are remaining.)

Assume that each facility will receive 50 percent of the benefits and that the cost of dredging, and subsequently maintaining, the first three miles will be 60 percent of the total costs. In the first year, the river is dredged up to milepost 3.0. After the first year, Facility A will have obtained all its benefits. For the remaining project, 50 percent of the benefits and only 40 percent of the original project costs remain. The recalculated RBRC ratio for work to Facility B is now 4.0.⁴³

Since this example will be used to illustrate multiple RBRC topics, the assumed "facts" of this hypothetical project are presented here in greater detail. The tables below quantify costs and benefits as determined in the hypothetical feasibility study for this project.

Initial Calculation

During the feasibility phase, two alternatives were considered: (1) deepen the channel up to Facility B (full five miles) or (2) deepen the channel only to Facility A (three miles).⁴⁴ Table I-2, below, shows the traditional way the Corps displays the results of its economic analysis. The first alternative—dredging the entire five miles—is found to be the preferred alternative⁴⁵ because it generates a larger net benefit than only dredging to Facility A.

⁴³ Real world projects are highly complex and calculation of the RBRC ratio requires significant judgment. Analysts must decide what benefits have been achieved and what remain. They must also measure benefits from multiple project objectives. For example, flood control projects may be nearly finished, but certain recreation benefits remain to be developed (jogging paths, etc.).

⁴⁴ It is not possible to dredge to Facility B without dredging past Facility A, therefore, there are only two project alternatives.

⁴⁵ In the parlance of the federal water policy, the project alternative featuring the highest net benefits is referred to as the National Economic Development (NED) plan.

Table I-1: Initial Calculation of Benefit-Cost for Illustrative Purple River Project

Work Covered	Average Annual Benefits	Average Annual Costs	Project Alternatives at Time of Authorization:	
			Net Average Annual Benefits ⁴⁶	Initial Benefit Cost Ratio
Alternative One: Deepen channel up to Facility A	\$1.6 million	\$0.6 million	\$1.0 million	2.7
Alternative Two: Deepen channel up to Facility B	\$3.2 million	\$1.0 million	\$2.2 million	3.2

“Average annual costs” shown in the table represent total construction costs and O&M costs averaged over the life of the asset (50 years for most projects). Assume that the five mile project requires \$150,000 each year in maintenance dredging; \$60,000 of that for the channel from Facility A to Facility B.⁴⁷ Using present value formulas with this assumed O&M requirement, it can be shown that the total costs are \$11.73 million; the costs from Facility A to Facility B (40 percent) are \$4.69 million.⁴⁸

Once the project has been authorized, the initial (“new start”) RBRC ratio equals the full project benefit-cost ratio, in this case, 3.2. Since this ratio exceeds 3.0, it is assumed that construction is funded and work completed up to Facility A in the first year.

Second Year Calculation

Budget decisions in the second year are based on a revised RBRC ratio. Table I-2 compares the initial calculation for the entire project to the calculation for the second year effort, extending the project from A to B.

The costs incurred in the first year are considered “sunk costs.” Although operation and maintenance dredging will occur in future years, the Corps has already committed to O&M for the first three miles. Therefore, all future O&M costs for the first segment are also considered sunk. This may seem counter-intuitive, but it is equivalent to the way benefits are treated. That

⁴⁶ The Corps uses average annual net benefits to determine the recommended (NED) project.

⁴⁷ These costs include both the federal and non-federal share. For ease of exposition, it is assumed that this project is fully funded at the federal level.

⁴⁸ At 7 percent, the construction costs (\$11.73 million) + \$150,000 annually in maintenance have the same present discounted value as \$1 million in average annual costs. The timing of construction affects this calculation slightly. The calculated value is based on the assumption that all of the construction payments are made the day the project is finished.

is, benefits—in this case transportation cost savings at Facility A—in all future years have already been considered in RBRC for the initial work to Facility A.

Table I-2: Comparison of RBRC Ratio Calculation for First and Second Phase of Illustrative Purple River Project

Work Covered	Remaining Average Annual Benefits	Remaining Construction Costs	Remaining O&M	Total remaining costs	RBRC ratio
Before Year One	\$3.2 million	\$11.7 million	150,000	\$1.0 million	3.2
Before Year Two ⁴⁹	\$1.6 million	\$4.7 million	60,000 ⁵⁰	\$1.6 million	4.0

Assume that in putting together its budget proposal, the district has divided the possible work in the second year on the Purple River into five equally costly increments of spending (miles 1-3 have already been deepened). At this time, the RBRC ratio is 4.0.

Table I-3: Example: Project Increments for the Purple River Project

Priority Ranking ⁵¹	Description of Spending Increment	Construction Cost
5	Purchase land needed to dispose of dredged material.	\$940,000
14	Dredge between miles 3 and 4 to new project depth	\$940,000
27	Construct revetments; implement other bank stabilization measures.	\$940,000
29	Dredge between miles 4 and 5 to new project depth.	\$940,000
41	Purchase additional land and convert to wetlands (mitigation)	\$940,000
	Total for Purple River, year two	\$4,700,000

What are the RBRC ratios for each increment? One perspective is that increments 1-3 should have an RBRC ratio of zero. There is a cost to the activities, but they do not by themselves produce any benefits. Under this interpretation, if RBRC was the only factor in developing the budget, this project might not receive additional funding. This is not the intent of the RBRC test. So instead, each increment gets assigned the same RBRC ratio (in this example, 4.0) and all amounts meet the budget test for funding.

In this example, the RBRC ratio increased in the second year. This may happen for many projects; after each year of construction, the remaining costs will fall, the remaining benefits

⁴⁹ Assumes channel is deepened to Facility A in year one.

⁵⁰ \$90,000 of O&M costs required to keep channel depth to Facility A are considered part of sunk costs.

⁵¹ The district’s proposed budget includes the increments for all projects from studies to construction to O&M; hence the numbers for the Purple River are not consecutive.

often do not fall proportionately, and the RBRC increases. However, there are numerous exceptions. For example, suppose that in its second year the Purple River Project was funded at the 80 percent capability level. This would allow the Corps to complete increments 1-4 and get to Port Facility B. In this case, the mitigation increment remains for a third year, and the RBRC ratio falls to zero. With RBRC as the sole determinant, this project would never get completed and there would be no compensation for the loss of wetlands caused by the project.

CAN THE METHODS OF CALCULATING THE RBRC RATIO BE IMPROVED?

Calculating a project's current RBRC ratio can be a significant analytical challenge. The greatest challenge may be to determine the extent of estimated benefits that apply to the remaining increments of a project that is already partially constructed. Feasibility studies or subsequent documents used to justify projects generally do not provide this information. Additionally, some of the economic studies are old; Corps headquarters does not ask a district to update the economic analyses used to justify projects before presenting its yearly RBRC data. RBRC ratios should reflect the changing economic circumstances of the project area which will require a historical perspective not available at the time the report was written.

There may also be differences in analytical procedures from one district to another and, even within a district, from one project to the next. There are also differences among different sizes of projects. Often, less rigor is applied to less costly projects. This is not an unreasonable response to the need to balance the cost of studies against the robustness and accuracy of the data that they generate, but it makes it more difficult to compare one project to another for budget purposes.

The Corps has recognized these problems and has instituted a review process within headquarters. Each RBRC ratio must be "certified" as reasonable. While ratios for most projects included in the budget request have been certified, some have not yet met this standard. As long as RBRC is an important variable in the budget process, this certification will have significant policy implications.

Improvements are possible. For example, as part of its move towards greater transparency, the results of the headquarters certification process could be made available.

IS THERE A BETTER MEASURE OF ECONOMIC MERIT?

Net economic benefit is one alternative measure of economic merit. This measure is used in the selection of project alternatives and their justification for authorization. With some exceptions, the Corps recommends the project alternative that promises the highest net economic benefits.⁵²

While offering the highest net economic benefit, the recommended project alternative might not have the highest benefit-cost ratio, as illustrated in the Purple River Project example presented in Table I-4 below.

⁵² A project alternative with lower net economic benefits may be selected at the request of the local sponsor with the approval of the Secretary of the Army.

Table I-4: Impact of Change in Net Benefits for Illustrative Purple River Project

Work Covered	Average Annual Benefits	Average Annual Costs	Project Alternatives at Time of Authorization	
			Net Average Annual Benefits	Initial Benefit Cost Ratio
Alternative One: Deepen channel up to Facility A	\$1.6 million	\$0.4 million	\$1.2 million	4.0
Alternative Two: Deepen channel up to Facility B	\$3.2 million	\$1.0 million	\$2.2 million	3.2

Alternative Two, the recommended project alternative—deepening the channel to Facility B—has the highest net benefit (\$2.2 million), but Alternative One—deepening only up to Facility A—has a higher benefit-cost ratio. This circumstance applies to many actual projects.

Given that the RBRC ratio rather than net economic benefit is used in budgeting projects, one might conclude that the two measures could work at cross purposes. (See subsequent section for further discussion of this issue.) However, this does not suggest a choice of one measure over the other. Each measure is good at doing different things. Net economic benefit provides a measure for ranking and selecting project alternatives in absolute terms for authorization, but it does not lend itself to prioritizing multiple projects for budgeting. In budgeting decisions, the question is what additional investment provides the proportionately greatest return. This issue is most effectively addressed by comparing benefit-cost ratios. Moreover, by excluding sunk benefits and costs from the calculation, the RBRC ratio appropriately focuses on the impact of future budget decisions.

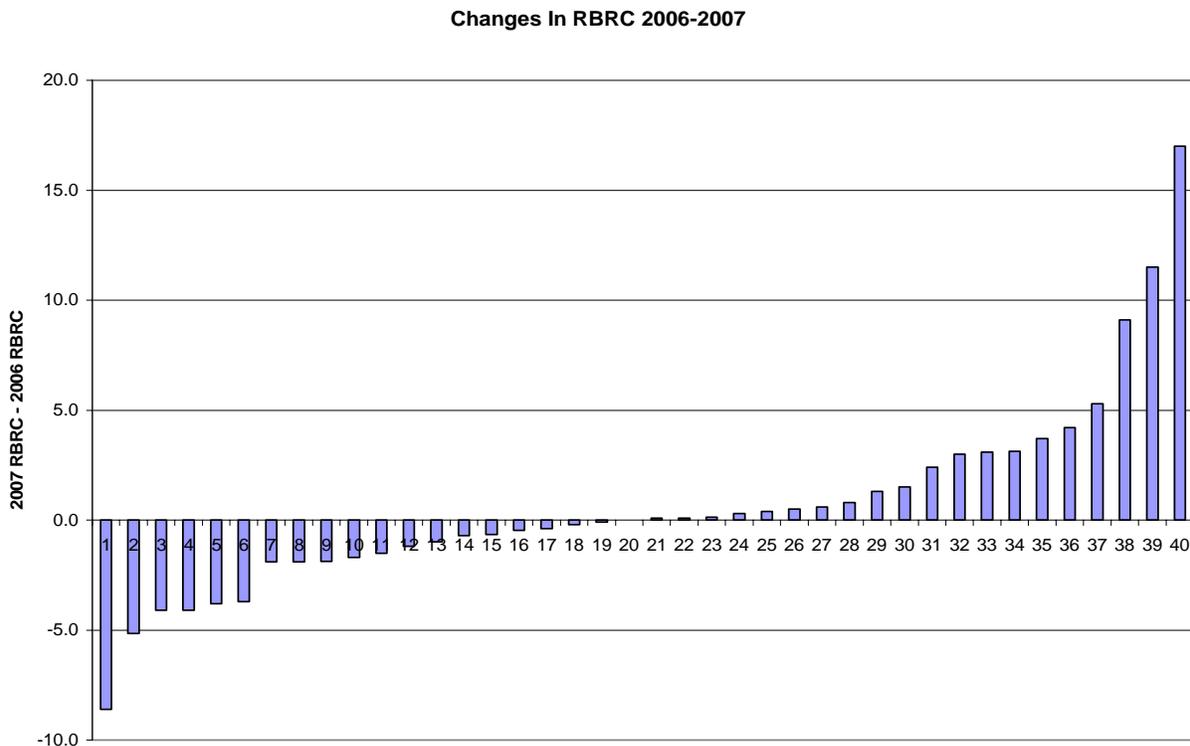
DOES THE USE OF THE RBRC RATIO CREATE AN UNSTABLE YEAR-TO-YEAR BUDGET REQUEST?

As demonstrated earlier in this appendix, RBRC ratios for projects (or increments of projects) can change from year to year. If the project requires completion before benefits can be obtained, the RBRC ratio will go up over time (benefits constant, costs falling). If some benefits are provided when a project is partially completed (e.g. levees built but not to the full height of the final project) both benefits and costs go down. In these cases, it is possible, but not inevitable, that the RBRC will fall. Under current guidance, these changes can cause projects (or increments) to migrate in and out of the budget from year to year.

Chapter 4 presents the empirical evidence from the Corps' FY 2006 and 2007 budget requests. There are three groups of projects where comparisons between 2006 and 2007 are possible:

- There are 40 projects included in both the 2006 and 2007 budgets with a reported RBRC ratio; 19 of the 40 projects had lower ratios in 2007, 20 had higher ratios (see Figure I-1 below). The extent of change varied significantly.
- The Corps identified 7 projects as candidates for suspension⁵³ in 2007. In 6 of these cases, ratios fell from above 3.0 to below 3.0. The remaining project had also been identified as a potential suspension project in 2006, with no RBRC calculated. This project is not included in the analysis below.
- There are 18 projects added to the 2007 budget with a RBRC ratio ≥ 3.0 ; presumably these ratios were less than 3.0 in 2006.

Figure I-1: Change in RBRC Ratio for Projects Included in Both FY 2006 and 2007 Budget Requests



This data provides information on two important issues. First, as projects are built, do their RBRC ratios go down or up? The evidence is mixed, but in this analysis more went up than down. There were 26 projects with a lower RBRC ratio and 38 with an increased ratio. There was one project with the same RBRC ratio for the two years.

⁵³ Current OMB guidance requires that projects with an RBRC ratio of less than 3.0 that do not involve significant human risk should be listed as “potential construction suspension projects.”

Second, have fluctuations in ratios caused projects to drop out or be added to the budget? Of the 64 projects in this analysis, 40 were included in both the FY 2006 and 2007 budgets. Of the remaining 24, 6 fell out of the budget when their ratio fell below 3.0 in the second year, and 18 were included in the budget the second year, apparently because their ratio increased.⁵⁴ In light of these numbers, it is not surprising that stakeholders are concerned with RBRC driven fluctuations in budgeted projects from one year to the next.⁵⁵

DOES USE OF THE RBRC RATIO INFLUENCE INITIAL PROJECT DESIGN OR THE WORK SCHEDULE OF EXISTING PROJECTS?

As long as the RBRC ratio continues to play a major role in budgeting, the Corps and non-federal sponsors might have incentive to design projects that can pass this test. A second revision to the Purple River example demonstrates this problem.

Table I-5: Alternative Calculations of RBRC Ratios for Alternative Plans in Illustrative Purple River Project

			Project Alternatives at Time of Authorization	
Work Covered	Average Annual Benefits	Average Annual Costs	Net Average Annual Benefits	Initial Benefit Cost Ratio
Alternative One: Deepen channel up to Facility A	\$1.4 million	\$0.4 million	\$1.0 million	3.5
Alternative Two: Deepen channel up to Facility B	\$2.8 million	\$1.0 million	\$1.8 million	2.8

The NED plan—with maximum net economic benefits—remains deepening the channel to Facility B, but now, with a threshold of 3.0, a project deepened all the way to Facility B would not be included in the budget request (because its ratio is only 2.8). Given the budget realities, deepening to Facility A only might be the “locally preferred plan” since without B, the RBRC ratio for A moves to 3.5—above the threshold.

As discussed above concerning project increments in the Purple River Project, the choice of work schedule can make a difference as to how much work is completed under the RBRC rule.

⁵⁴ Why was the Corps able to add so many projects in comparison to the number dropped without increasing the size of the budget? A major contributor to this outcome was the transfer of 13 projects from construction in 2006 to O&M in 2007. Without the transfer, it might have been necessary to increase the threshold value of RBRC for including project in the budget, and more projects might have fallen out.

⁵⁵ The 2006 potential suspension list included 36 projects (five from the MR&T account). This large number was not caused by fluctuations in the RBRC ratio, but by the fact that the ratio test was applied for the first time in 2006. Data from the 2005 budget request makes it possible to compare year to year ratios for 17 of the 36 projects. In only one case did the ratio fall from above 3.0 to below 3.0.

In that example, scheduling mitigation last meant that the RBRC ratio fell below 3.0 before the project was finished. However, if mitigation were scheduled earlier, it could be included while the project still passed the RBRC test.

The ratio test will not affect project selection for those projects already authorized. While changes in work schedules may occur, there is currently no data that can be used to determine the extent of such changes. If, as recommended in this report, the number of factors used to prioritize projects is increased, the relative importance of the RBRC ratio would be reduced thereby reducing the incentive acting on both the choice of project designs and the scheduling of project work. Nonetheless, the possibility of gaming remains and these decision processes should be monitored.

OPERATION AND MAINTENANCE: CORPS' IMPLEMENTATION OF FEDERAL ASSET MANAGEMENT REQUIREMENTS

This appendix provides a summary of the Corps' responsibilities under Executive Order 13327, Federal Real Property Asset Management, and opportunities for these responsibilities to contribute to the prioritization of projects and activities within the Civil Works program.

THE EXECUTIVE ORDER

On February 4th, 2004, the President issued Executive Order 13327 to "...promote the efficient and economical use of Federal real property resources in accordance with their value as national assets and in the best interests of the Nation." The order includes a statement of policy, which encompasses the following aims: to promote efficient and economical use of America's real property assets; to improve management accountability for these assets; to increase management attention to them; to establish clear goals and objectives for managers overseeing them; to improve policies; and to take other appropriate actions with respect to such assets.

The order covers only real property that is both federally owned and operated. The Corps owns and operates approximately 1,000 coastal structures, 2,500 recreation areas, 75 hydropower facilities, over 200 locks, 600 dams, and 7 laboratories. The order does not encompass the substantial portfolio of non-federally owned assets that the Corps is responsible for operating and maintaining. This includes 25,000 miles of navigable federal channels and over 300 commercial harbors.

The Order established the Federal Real Property Council (Council) to develop guidance and facilitate the success of asset management plans developed by the major agencies. The Council issued guidance that included the following components.

- A summary of the executive order requirements for all major agencies, including mandates to:
 - establish the position of a Senior Real Property Officer, who will be held accountable for the effective management of agency real property
 - determine what it owns, what it needs, and how and what it costs to manage its real properties
 - develop and implement asset management plans
 - develop and monitor real property performance measures
 - dispose of property that is not needed

- Guiding principles for carrying out these tasks, stating that agency real property activities shall:
 - support agency missions and strategic goals
 - use public and commercial benchmarks and best practices
 - employ life-cycle cost-benefit analysis
 - promote full and appropriate utilization
 - dispose of unneeded assets
 - provide appropriate levels of investment
 - accurately inventory and describe all assets
 - employ balanced performance measures
 - advance customer satisfaction
 - provide for safe, secure and healthy workplaces

- Required components for the agency’s asset management plan:
 - Integrated Guiding Principles (listed above)
 - Agency-Specific Owner’s Objectives
 - Periodic Evaluation of All Assets
 - Prioritized Operations and Maintenance and Capital Plans
 - Identified Resource Requirements to Support Plans
 - “Building Block” Asset Business Plans in Agency Portfolio Context
 - Continuous Monitoring and Feedback Mechanism
 - Consideration of Socio-Economic-Environmental Responsibilities
 - Adequate Human Capital Support of Asset Management Organization
 - Common Government-wide Terminology

- Twenty-three data elements to be developed and submitted for inclusion in a national database of all inventoried property. Four of the elements were established as performance measures:
 - utilization
 - condition index
 - mission dependency
 - annual operating and maintenance costs

CORPS ACTIVITIES IN RESPONSE TO THE EXECUTIVE ORDER

Two of the main requirements of the executive order related to operation and maintenance costs and effective prioritization of projects and activities within the Civil Works construction budget are: 1) the development of an asset management plan, and 2) the development and monitoring of performance measures.

Corps Asset Management Plan

The Corps submitted its asset management plan to OMB and received approval in the third quarter of 2006. Although the plan was initiated in response to an executive order, the agency intends to build on the approach outlined in its plan and develop the data measures needed to make, support, and develop out-year budgets. New processes, tools, policies and procedures will be put into place as a result of the order that will allow the Corps to make more informed strategic decisions and to contribute to funding prioritization decisions. At this point, much remains to be done to make the plan a reality. Currently, the Corps lacks sufficient information on repairs and alterations and maintenance backlog to establish strategic goals.

Prioritization of O&M investments

The Corps is moving towards individual constructed-asset management plans that will be integrated with its strategic plan and with its five-year development plan. The plans will contain risk-based assessments, best practices, and customer input to determine impacts. New automated systems are being implemented to help improve facility maintenance processes and techniques, and equipment assessment.

District offices will develop a prioritized O&M Plan based on maintenance work packages. The projects will be prioritized based on a risk analysis and an overall view of the district facility portfolio. The risk analysis takes into consideration the engineering, loss of life, mission and economic aspects if the structure fails.

Performance Measures

Four of the Corps' business lines involve constructed assets: Flood and Coastal Storm Damage Reduction, Hydropower, Recreation, and Navigation. The asset management plan contains the program objectives and performance measures for each of the four. As mentioned earlier, four of the twenty-three data elements established by the Council were also established as performance measures. They were: utilization, condition index, mission dependency, and annual operating and maintenance costs. The plan contained (in Appendix G) a Real Property Inventory Data Validation Report. The report outlined next steps and schedules for completion of the data base information. Each of the four performance measures required information that the Corps did not have, or had special situations that did not fit the Council definitions/requirements.

Condition index

One of the four established performance measures could be especially useful in prioritizing funding decisions. The condition index (CI) is a general measure of the constructed asset's condition at a specific point in time. CI is calculated as the ratio of "repair needs" to "plant replacement value."

The CI is reported as a "percent condition" on a scale of 0 to 100 percent. The higher the CI, the better the condition of the constructed asset. The repair needed is the amount necessary to

ensure that a constructed asset is restored to a condition substantially equivalent to the originally intended and designed capacity, efficiency or capability.

Initially, the CI will be employed to identify and rank investments in those assets with the greatest maintenance needs and that pose the highest risk. However, once immediate maintenance issues are addressed, the CI can be used for planning purposes as well. It can provide a guide to prioritizing the maintenance of assets with the aim of preventing deterioration that will make urgent, major, unplanned repairs necessary.

The hydropower business line is taking the lead on condition assessment and will probably be the model for implementation in other Corps business lines. A team consisting of the Corps, Bureau of Reclamation, Hydro-Quebec, and Bonneville Power Administration is developing assessment guides for hydroelectric components. The Corps has found that its funding requests for hydropower projects may be understated in light of replacement values and rehabilitation costs. The asset management plan outlines an agency-specific measure called HydroAmp. The measure will establish a facility CI for the hydropower program.

Condition assessments as well as realistic plant replacement values are required in order to calculate the facility CI required by the Council. The Corps has developed plant replacement values for real property assets in excess of \$25,000. The Corps is in the process of collecting the data necessary to develop them for a range of expensed real property assets under \$25,000.

The asset management plan does not identify goals for the functional replacement values for reinvestment.

RISK

The Corps has established a goal to “improve the reliability of water resources infrastructure using a risk-based asset management strategy.” The agency intends that the implementation of this goal will be a continuing effort that is flexible and responsive to any mandated authorities, with the sole purpose of ensuring that potential risks and loss of life and property are protected by maintaining projects and systems at optimum condition levels.

The Corps is developing several risk analysis tools, some of which are discussed in Appendix F. Risk-based condition assessment tools are being developed and implemented that identify major project or system components, predict deterioration and probability of failure, and propose a maintenance or major rehabilitation cycle that will minimize consequences and extend the life of the asset. The Dam Safety Portfolio Risk Assessment program has already established its process for screening high risk dams and evaluating needed rehabilitation and has been effective in establishing national budget priorities for ensuring the safety and reliability of those major infrastructure assets. Regional initiatives, such as one developed for the Ohio River Main Stem called the Ohio River Navigation Investment Model, incorporate risk and reliability tools into the decision process for scheduling major maintenance and rehabilitation.

