

Pursuing Excellence in
Water Planning and Policy Analysis:
A History of the
Institute for Water Resources
U.S. Army Corps of Engineers

by

Gregory Graves

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FOREWORD

The U.S. Army Engineer Institute for Water Resources was formed to provide forward looking analysis and research in developing planning methodologies to aid the adaptation of the Civil Works Directorate to future Needs. Observers who know of the Institute's 25-year progress have witnessed the economists, engineers, political scientists, sociologists, and planners who participated during that period move from the uncertainty, the trials, and multiple expectations of a new organization to a present where contributions are widely recognized.

The 25 years of the Institute's history began at a time when the Corps was beginning to assess its programs in response to criticism of the role of the federal government and demand for changes in national policies toward management of water resources particularly with regard to the environment and public participation. The Corps leadership believed that a new look was needed which could be achieved through adoption of interdisciplinary planning. It required vision and hard work, but the results of the reports and recommendations of the Institute for Water Resources working with its Civil Works customers can be found in projects and programs throughout the Corps.

This role remains consistent with the founding vision stated in a letter dated February 4, 1969, from LTG William F. Cassidy to Senator Allen J. Ellender, in which he foresees the Institute as

“...an essential tool in enabling the Corps to carry out its public service mission in the field of water resources.”

The past contributions and continuing adaptation of the Institute’s program to meet current and future needs would not have been possible without the dedication of the people whose contributions have created the Institute’s record of accomplishment. Included among those whose teamwork this volume of history acknowledges, both those named and those who have not been identified, are permanent staff, consultants, visiting scholars and academia, Corps employees from headquarters and district and division offices, and student researchers. This history is a summary of the record they helped to create which I hope will be of use to students of the role of government in management of water resources.

Kyle E. Schilling
Director
Institute for Water Resources

PREFACE AND ACKNOWLEDGMENTS

Public policy is being formed as it is being executed, and it is being executed as it is being formed.

*Arthur Maass
"Muddy Waters" (1951)*

The U.S. Army Engineer Institute for Water Resources has a diverse and eventful history. Proponents in the Office of the Chief of Engineers believed the Corps needed a long-range planning organization to assist in improving the civil works planning process. They believed that the small group of economists, engineers, and planners should conduct their work in a place removed from headquarters. In April 1969, they prevailed in establishing the Institute. Twenty-five years later, the Institute for Water Resources continues to provide the civil works program with a variety of products to enhance the Corps of Engineers water resources development planning. The following pages chronicle the evolution of the Institute in the broader context of the history of federal water resource development.

A number of people contributed documents, agreed to be interviewed, and shared their experiences with the Institute. I am particularly indebted to George Antle, Thomas Ballentine, Mark Dunning, Michael Krouse, Kyle Schilling, and Eugene Stakhiv of the Institute for Water Resources, who gave graciously of their time, answered many questions, and reviewed short and long portions of

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Gregory Graves is a public historian who specializes in environmental and natural resources history. He has co-authored Saving California's Coast: Army Engineers at Oceanside and Humboldt Bay (1991) and From These Beginnings: A Biographical Approach to American History, 4th edition (1991), authored A History of the Las Virgenes Municipal Water District (1993), and written a history of the Corps Pacific Ocean Division (forthcoming). He received his doctoral degree from the University of California at Santa Barbara.

TABLE OF CONTENTS

FOREWORD	iii
PREFACE AND ACKNOWLEDGMENTS	v
TABLE OF CONTENTS	vii
GLOSSARY OF ACRONYMS AND ABBREVIATIONS	xi
CHAPTER ONE: THE EXPANDING ISSUES OF WATER RESOURCES DEVELOPMENT ...	1
Federal Water Resources Planning in the 20th Century	2
The Water Resources Academicians	8
The Seeds of Long-Range Planning	12
Economists and the Corps	15
Policy and Planning	19
Environmental Issues	22
The Office of Appalachian Studies	24
A Two-Centered Institute	28
IWR Takes Shape	32
CHAPTER TWO: THE CHANGE AGENTS OF THE CORPS	57
IWR Opens for Business	58
The Issues of Environmental Quality	59
Environmental Guidelines and the Environmental Advisory Board	65
The Emergence of Public Involvement	71
Urban Studies	77
Social Impact Assessment	79

Regional and National Navigation Analysis . . .	84
New Federal Water Resources Mandates	86
The Flood Control Challenge	88
Toward Reorganization	90
Matrix Management	94

CHAPTER THREE: REDEFINITION AND

POLICY ORIENTED STUDIES	123
Changes in Organization and Funding	124
The Corps Regulatory Program	129
The Regulatory Program and IWR	132
Environmental Initiatives and IWR	135
The Melding of Public Involvement and Social Impact Assessment	138
Post-construction Analysis	142
The Carter Hit List	144
Policy and Water Supply	148
An Expanding Workload	154
Wetlands and IWR	156
The National Studies	157
The National Hydroelectric Power Resources Study	161
The National Waterways Study	162
Incorporation into the Water Resources Support Center	165

CHAPTER FOUR: IWR AND WATER

RESOURCES DEVELOPMENT IN THE REAGAN YEARS	187
From Carter to Reagan	188
Incorporation of the Navigation Analysis Center into IWR	191
The Special Studies Division	193

Completing the National Studies	194
IWR in the Wake of the National Studies . . .	201
The Navigation Division	204
Policy and Research	205
The Research Division and Water Conservation	207
The Development of IWR-MAIN	210
Technology Transfer: Public Involvement and Noise Management on Military Installations	211
The Policy Division	213
The Emergence of Risk and Uncertainty Analysis	214
The Principles and Guidelines	218
IWR and Cost Sharing	225
The Issue of Navigation User Charges	228
Toward WRDA-86	229

CHAPTER FIVE: RESPONDING TO NEW

CHALLENGES, 1986-1993	247
Programmatic Changes in IWR	248
The Users Board and IWR	250
Issues of Wetlands and the Regulatory Program	254
Wetland Mitigation Banking	256
Drought Studies	263
Water Supply and Conservation-- IWR MAIN	266
Planning Methodologies: National Economic Development	268
NED and Recreation	269
NED: Agricultural and Urban Flood Damage Reduction	271

NED and Deep-Draft Navigation	274
An Overview of NED	275
Greater Integration of Risk Analysis	276
The Development of Alternative Dispute Resolution	282
Infrastructure and IWR	286
Changes in WRSC	291
The Program Analysis Division	293
The Corps of Engineers Recreation Study . . .	296
Environmental Valuation Research	298
The National Operation and Maintenance Program	299
IWR at a Glance: 1993	300
CHAPTER SIX: TOWARD TWENTY-FIVE YEARS: PROSPECTIVE AND RETROSPECTIVE	321
BIBLIOGRAPHY	331
INDEX	353

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ACIR	<i>Advisory Council on Intergovernmental Relations</i>
ADR	<i>Alternative Dispute Resolution</i>
ASA-CW	<i>Assistant Secretary of the Army for Civil Works</i>
BERH	<i>Board of Engineers for Rivers and Harbors</i>
EAB	<i>Environmental Advisory Board</i>
EAP	<i>Environmental Action Program</i>
EIS	<i>Environmental Impact Statement</i>
EPA	<i>Environmental Protection Agency</i>
EQ	<i>Environmental Quality</i>
FWPCA	<i>Federal Water Pollution Control Act Amendments of 1972</i>
GREAT	<i>Great River Environmental Action Team</i>
HEC	<i>Hydrologic Engineering Center</i>

HQUSACE	<i>Headquarters, U.S. Army Corps of Engineers</i>
ICUZ	<i>Installation Compatible Use Zone</i>
IPA	<i>Intergovernmental Personnel Act</i>
ISTEA	<i>Intermodal Surface Transportation Efficiency Act</i>
ITAP	<i>Information Transfer and Analysis Program</i>
IWR	<i>Institute for Water Resources</i>
MAIN	<i>Municipal and Industrial (Water) Needs</i>
MARDATA	<i>Maritime Data Network</i>
MOA	<i>Memorandum of Agreement</i>
MOU	<i>Memorandum of Understanding</i>
NAC	<i>Navigation Analysis Center</i>
NED	<i>National Economic Development</i>
NEPA	<i>National Environmental Policy Act</i>
NEWS	<i>Northeastern U.S. Water Supply Study</i>

NHS	<i>National Hydroelectric Power Resources Study</i>
NRDC	<i>Natural Resources Defense Council</i>
NWS	<i>National Waterways Study</i>
O&M	<i>Operation and Maintenance</i>
OAS	<i>Office of Appalachian Studies</i>
OASA-CW	<i>Office of the Assistant Secretary of the Army for Civil Works</i>
OCE	<i>Office of the Chief of Engineers</i>
OMB	<i>Office of Management and Budget</i>
ORWD	<i>Office of Regional Water Development</i>
OSE	<i>Other Social Effects</i>
P&G	<i>Economic Principles and Guidelines for Water and Related Land Resources Implementation Studies</i>
P&S	<i>Principles and Standards for Planning of Water and Related Land Resources</i>
PMS	<i>Lock Performance Monitoring System</i>

PPBS	<i>Planning-Programming-Budgeting System</i>
R&D	<i>Research and Development</i>
RED	<i>Regional Economic Development</i>
TAP	<i>Technical Assistance Program</i>
TRADOC	<i>U.S. Army Training and Doctrine Command</i>
USAREUR	<i>U.S. Army, Europe</i>
WES	<i>Waterways Experiment Station</i>
WRC	<i>U.S. Water Resources Council</i>
WRDA-86	<i>Water Resources Development Act of 1986</i>
WRSC	<i>Water Resources Support Center</i>



CHAPTER ONE: THE EXPANDING ISSUES OF WATER RESOURCES DEVELOPMENT

On 18 April 1969, the United States Army Corps of Engineers established the Institute for Water Resources (IWR) to help shape civil works policy. Housed in a small two-room office of a bank building at 206 North Washington Street in Alexandria, Virginia, the Institute had two primary components: the Center for Economic Studies and the Center for Advanced Planning. The new organization reported to the Civil Works Directorate of the Office of the Chief of Engineers (OCE) but was separate from the daily activities of the Corps in its Washington, DC, headquarters. Instead, the IWR staff, consisting primarily of nonengineers, was to devote its efforts to improving the Corps' long-range civil works planning techniques.

The establishment of IWR was controversial. While many Corps leaders believed their agency needed an entity that would assist in meeting the challenges to its civil works program, others questioned bringing nonengineers into a planning process long dominated by engineers. The 12 professionals who initially staffed the Institute included economists, sociologists, and political and environmental scientists. As the titles of its two centers indicated, economic

analysis and planning methodologies were to be the principal products of this intellectual laboratory of the Corps.

The Corps of Engineers established the Institute for Water Resources in response to sweeping changes in water development during recent decades. As public demands for water projects increased, so did the Corps' civil works program. As that program grew, critics of large public works and substantial government spending began to question the extent to which the federal government should provide navigation, flood control, and other water-related services. By the 1960s, criticism of federal water resources development was widespread. Critics included academicians, water resource specialists, elected officials, and environmentally motivated citizens. They decried federal water projects on the grounds of expense, poor economic justification, absence of public involvement in the planning process, and damage to the natural environment. Aware of such criticism and of the need to adhere to new laws, the Army engineers sought solutions. One response was the formation of the Institute for Water Resources. The original IWR mission statement, a full three single-spaced pages long, reflected the complexities in water resource management that had emerged by the late 1960s.

Federal Water Resources Planning in the 20th Century

Although the need to change Corps planning methods was acute by the 1960s, a series of events beginning decades earlier shaped that immediacy. Federal water resources development had evolved slowly but steadily as the nation industrialized and urbanized in the 1800s. Several federal agencies became involved in water resources development,

but the Corps of Engineers, with its early responsibility for federal navigation improvements, emerged as the primary developer of the nation's rivers and harbors.¹ In the General Survey Act of 1824, Congress gave the Corps its first water resources work when it authorized the U.S. Army Engineers to survey road and canal routes of national importance. Federal responsibilities continued to grow. By the time of the Civil War, federal spending on river, harbor, and canal improvements totaled about \$17 million; by 1882, that amount had risen to more than \$111 million; and by 1907 expenditures exceeded \$400 million.²

Because of its civil engineering capabilities, the Corps of Engineers became the government's--more specifically, Congress's--primary construction agent for much of this work, which was often politically driven. Navigation and harbor improvements were the Corps' principal projects, but the agency was indirectly involved with flood control through participation in the Mississippi River Commission established in 1879 and the California Debris Commission established in 1893. The Corps retained its primary interest in navigation, however, and its water resources development generally responded to the need for waterways, harbors, and flood protection.³

By the early 20th century, federal water projects were a large enough part of the budget to draw criticism from fiscal conservatives. Ohio Representative Theodore Burton, chairman of the House Rivers and Harbors Committee, called attention to the "pork-barrel" legislation that often surrounded water projects and questioned the turn-of-the-century rush to develop inland waterways throughout the nation. As people struggled to overcome the perceived transportation monopoly of the railroads,

waterway proponents envisioned a vast system of inland and intercoastal routes.⁴ Burton and other congressional critics, however, doubted that most inland waterways would affect railroad rates, and their opposition to economically questionable waterways contributed to the establishment of the Board of Engineers for Rivers and Harbors (BERH) in 1902. The board's function was to review Corps projects for cost effectiveness. Burton hoped that the board would put an end to poorly justified and highly promoted projects and at the same time keep the power of authorizing water projects in Congress.⁵

Even stronger criticism of pork-barrel water projects came from an emerging group of scientifically trained individuals who made up an important component of the reform movement known as Progressivism. Progressives complained about the lack of comprehensive planning in water resources development. The idea of planning was nascent at the turn of the century, but there were early expressions coming from disciplines other than engineering. National planning of water resources had several champions, including proponents of irrigation, hydropower, and urban landscaping. The most vocal was Gifford Pinchot, the first chief forester of the United States. As the head of President Theodore Roosevelt's Inland Waterways Commission, Pinchot envisioned a single federal agency to manage the nation's natural resources, including water, on a comprehensive basis. Pinchot called the idea "conservation"--a comprehensive land, water, and resource plan that would ensure America's future prosperity by conserving such resources for future generations.⁶ Conservation fell out of favor as the Progressive Era waned during the century's second decade. Congress never

supported Pinchot's conservation plan and neither did the Corps because of the threat it posed to the agency's navigation work. Such opposition also left the Corps unreceptive to the logic of comprehensive resource planning, regardless of what agency did the work.

Despite its opposition to comprehensive resource allocation, the Corps had a planning organization of sorts in BERH. Each year, the board advised against economically or engineeringly unsound water projects and forced local participation through limited cost sharing in questionable projects.⁷ By considering projects with regard to their comparative value throughout the United States, BERH was conducting economic evaluation of navigation projects, although such consideration was slight compared with the comprehensive water planning--including navigation, flood control, hydropower, irrigation, and water supply--that Progressive scientists advocated.

Gradually, the Corps expanded its planning considerations. With passage of the Flood Control Act of 1917, the first official federal flood control legislation, the Corps began to build levees and remove debris from the Mississippi and Sacramento rivers.⁸ Increasing the Corps' multiple-purpose water development considerations, Congress in 1925 directed the Corps and the Federal Power Commission to submit a list of navigable streams that might have hydropower, irrigation, and flood control potential and to give cost estimates for surveying those streams. In 1926, the Corps submitted House Document 308, containing the list and cost estimates for surveys, which totaled \$7.3 million. In early 1927, Congress authorized the surveys, and the Corps produced the "308 Reports," the agency's first

comprehensive, multiple-purpose planning documents for water resources development.⁹

With each new decade of the 20th century the issues of water resources development became more complex. During the Great Depression and New Deal, major public works projects became part of an overall plan to put Americans back to work and inject capital into the economy. The large-scale multiple-purpose dam and river improvement projects envisioned in the 308 Reports appeared to be a good tonic for the ailing economy. Another response was the 1933 creation of the Tennessee Valley Authority (TVA), a regional multiple-purpose water resources program. When floods devastated parts of New England and the Ohio River Valley in 1935 and 1936, President Franklin Roosevelt declared such disasters a menace to the economic recovery. Congress, although wary of Roosevelt's strong Executive initiatives, agreed, authorizing the Corps to supplement the 308 Reports and passing the Flood Control Act of 1936. The 1936 act acknowledged flood control as "a proper activity of the Federal Government in cooperation with States, their political subdivisions, and localities thereof."¹⁰ It called for three structural solutions to flood control: levees and dikes, channel modifications or improvements, and dams and reservoirs.¹¹ It placed the Corps, which became the primary federal flood control agency, in a situation of developing primarily single-purpose flood control projects. True comprehensive planning of river systems was not a part of this legislation. Instead, it established the framework for many large reservoir projects.¹²

The large-scale developments authorized by the Flood Control Act of 1936 and New Deal public works

spending led to an even stronger relationship between the Corps of Engineers and Congress. With passage of the Flood Control Acts of 1938, 1941, and 1944, Congress reasserted its prerogatives in water resources development in response to the Roosevelt Executive challenge.¹³ The action had far-reaching impact for the Corps. The benefits of a large Corps project could be significant for a locality, not only in flood protection, but also in short-term employment and business during construction of the project. Members of Congress who succeeded in bringing a major water resource project to their jurisdictions greatly enhanced their chances for reelection. Therefore, congressional authorization committees exercised increasing control over the Corps' civil works functions. This situation prevailed through World War II and beyond. Often, Corps civil works projects satisfied primarily local interests. The beneficiaries of such projects, including construction companies, real estate developers, agribusiness, state and local commerce promoters, and bankers, supported and defended the system.¹⁴

As appropriations for civil works soared in the late 1940s in response to a backlog of projects deferred during World War II, many issues evolved from certain provisions of the Flood Control Act of 1944. Criticism of the Corps increased beyond the issues of real estate acquisition that had arisen in the 1930s. Some critics--including senators and representatives--questioned the Corps' planning process, especially the adequacy of its cost estimates. Others criticized the Corps' close working relationship with Congress. The 1944 act broadened federal water resources responsibilities greatly and coordinated some Corps functions with the Bureau of Reclamation and state

governments. The act was also an endorsement of the Pick-Sloan Plan for the Missouri River Basin. In 1943, Colonel Lewis A. Pick, Missouri River Division Engineer and Chief of Engineers from 1949 to 1953, devised a \$1 billion plan for navigation and flood control on the Missouri and its tributaries. Meanwhile, W. Glenn Sloan of the Bureau of Reclamation drew up a plan for his agency's development of the Missouri River Valley. The Roosevelt administration devised a third plan, calling for a regional organization like the TVA for the area. The compromise worked out became known as the Pick-Sloan Plan, a major portion of the 1944 Flood Control Act. Implementing the plan, however, was controversial, pitting rural people who opposed huge reservoirs flooding agricultural land against urban interests who wanted the reservoirs as protection from floods. Soon the arguments became framed in the context of an intruding federal government imposing its will on the people.¹⁵ The Corps and the Bureau of Reclamation represented big government--agencies hell-bent on building large, expensive dams throughout the Midwest.

The Water Resources Academicians

Perhaps even more challenging to the Corps' traditional way of doing business were water resources specialists trained in natural resources economics, political science, and geography. They harshly criticized the Corps' lack of comprehensive planning and its reliance on engineering feasibility to produce benefits and costs. Among these individuals was Harvard University political scientist Arthur Maass. In 1951, Maass published Muddy Waters: The Army Engineers and the Nation's Rivers. Maass took the Corps to

task for its lack of accountability to the executive branch and criticized its close relationship with Congress, suggesting that top officials in the Corps considered themselves "engineer consultants to the Congress of the United States"¹⁶ instead of the White House. The unfortunate results of this situation, according to Maass, were projects that often benefited only local interests. Maass also criticized the "conservative . . . professional standards . . . used to plan and design water resources systems."¹⁷ In short, Maass said that the Corps was failing to include considerations other than engineering in its planning. Projects were mostly single-purpose, or at best, dual-purpose, and the Corps lagged far behind TVA in multipurpose development.¹⁸ Maass advocated transferring the civil works functions of the Corps to the Department of the Interior.¹⁹ Meanwhile, several Executive committees in the Truman and Eisenhower administrations argued that the current water resources development system was in need of major change. The general conclusion favored centralized water development on a national scale, and planned by a single agency.²⁰

Such scathing criticism gradually influenced the way the Corps did business. While Chief of Engineers Pick lambasted the critics as conspirators, subsequent chiefs realized the public relations damage of such outbursts. When Chief of Engineers Samuel Sturgis, Jr., assumed command in 1953, he found a Corps of Engineers that had lost much of its national prestige and was bewildered by the broad range of criticism. Sturgis recognized that much of the criticism stemmed from public demands for tight fiscal control during the 1950s. In 1952, during the final days of the Truman administration, the Bureau of the Budget presented Circular A-47, establishing new criteria for

justifying federal water resource development projects. Not only must project benefits exceed costs, but each project purpose must also have benefits exceeding costs. The circular also set new standards for local cost sharing for flood control projects that made it more difficult to fund smaller projects. When the Eisenhower administration endorsed Circular A-47 and attempted to establish more rigid guidelines, some members of Congress complained about an invasion of Legislative Branch prerogatives. However, the momentum for reform was well under way, and both Congress and the Presidency moved toward directing federal resource agencies to more comprehensive planning of water resources development.²¹

During the 1950s, social scientists continued to advocate new approaches to planning water projects. College graduates in public administration, political science, and sociology made their way into federal agencies such as the Bureau of the Budget and the Department of Agriculture and began to question the Corps of Engineers' civil works justifications with increasing vigor. One individual who spoke out against the Corps' flood control practices was Gilbert White. The University of Chicago-trained geographer, who had studied under human ecology pioneer Harlan Barrows, had written a doctoral dissertation during the 1940s called "Human Adjustment to Floods." White's dissertation, republished after Maass's Muddy Waters, challenged the idea that structures could always protect settlements built in flood-prone areas. White argued that such notions had led to piecemeal attempts to protect floodplains, and those attempts had led to dramatic development in flood-prone areas. According to White, no federal agency was more responsible for this situation than

the Corps of Engineers. White also questioned the traditional benefit-cost calculations that resulted in projects planned primarily on the basis of cost efficiency and engineering design. Instead, planners should assess each major variable encompassed in the potential development area. White called for "flood plain management," including relocation of buildings, flood expansion zones, or other "non-structural solutions," rather than flood walls, dams, or channelization.²²

Gilbert White's work paralleled that of several others who advocated better water resource planning. One was James E. Goddard, an engineer working for the Tennessee Valley Authority who added substantially to the policy of regulating development in floodplains. During the mid-1950s, Arthur Maass helped organize the Harvard Water Program and initiated a general study that examined national water resources problems without considering existing government responsibilities. The study concluded that most water projects were too narrowly focused. Instead, a number of disciplines should participate in the planning process, with close coordination among various federal agencies. Only through "multiobjective planning analysis," Maass and others argued, would genuinely national goals for water resources development be met. The initial guidelines of multiobjective planning analysis appeared in a 1962 publication called Design of Water Resource Systems: New Techniques for Relating Economic Objectives, Engineering Analysis, and Governmental Planning. The study called for increased use of computer technology to examine economic and physical projections and identified the criteria for multiobjective analysis, including economic growth, regional income, and environmental quality.²³

The Seeds of Long-Range Planning

While many in the Corps of Engineers agreed with the critics, incorporating more disciplines into the planning process of the agency was a difficult task. Civil engineers concerned with building a technically sound project often doubted the value of social science in the planning process. While some military leaders may have recognized the need, or the growing demand, for interdisciplinary planning, many civilian engineers were less enthusiastic about change.²⁴ They felt that social scientists would obstruct and greatly increase the cost of needed water projects. With their emphasis on values and alternatives to traditional engineering solutions, social scientists could even scuttle water projects if allowed into the planning process. At the same time, social scientists--particularly geographers, political scientists, and economists--skillfully pointed out the need for their participation in the planning process in water resources development and identified deficiencies in the current system.²⁵

During General Sturgis's tenure as chief, the idea of establishing a long-range planning organization first developed in the Corps. The principal architect was B. Joseph Tofani, then chief of the program branch of the planning division of OCE. Tofani had begun his career in government as a civil engineer in the Bureau of Reclamation, the Soil Conservation Service, and then the Pennsylvania state resources agency. In 1942, he came to work in OCE, and by the 1950s he was one of the principal civilian advisers in civil works. Tofani wanted to establish an organization to reach out to the new disciplines whose practitioners were often so critical of the Corps. However, when he proposed that such an organization might elicit the

expertise of people like Arthur Maass and Gilbert White, he was strongly rebuked for attempting to bring "enemies into camp."²⁶ The engineering bias in the Corps remained strong and suspicious of multidisciplinary planning.²⁷

Federal momentum for reform of water resources planning continued to grow into the early 1960s. The Eisenhower administration's view of reform focused on reducing the federal budget. Eisenhower generally opposed funding for major water projects and proposed a "no new starts" policy to Congress for 1959 and 1960. Congress rejected the proposal, and, in turn, Eisenhower vetoed the public works appropriation bill for fiscal year 1960.²⁸ The Senate Select Committee on National Water Resources, chaired by Senator Robert S. Kerr of Oklahoma, was created partly in response to the President's dim view of federal water resources development procedures. The committee, composed of members of the Senate subcommittees concerned with water, began to draw on more interdisciplinary expertise in the preparation of a report on national water problems. Several water resources professionals joined agency personnel in developing the Report of the Senate Select Committee released in January 1961. Primarily concerned with water quality, water shortages, and floods, the report viewed such problems on a comprehensive basis and provided a blueprint for federal, state, and local cooperation in dealing with water problems.²⁹

The Kennedy administration proved more receptive to federal water resources development than its predecessor. President Kennedy viewed public works as a way to stimulate economic growth in poor areas of the nation. Following the views of one his advisers, Harvard professor Richard Neustadt, who argued that competition among

federal water resource agencies increased Presidential leverage, Kennedy opposed consolidating water resource agencies into a single agency, thereby helping to stabilize the Corps.³⁰ Kennedy concurred with the Senate report and recommended that Congress work on an overall water resources planning law in 1961. Kennedy also requested that the four secretaries who headed water resource agencies form an ad hoc Water Resources Council to review current policies and make recommendations for standard practices. The result was Senate Document 97, accepted by Kennedy on 29 May 1962, the same day the Bureau of the Budget rescinded the "too restrictive" (according to Congress) Circular A-47.³¹ Titled "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources," Senate Document 97 established three main objectives: national economic development, natural resources preservation, and the "well-being of all the people." The document acknowledged that federal leadership was necessary for comprehensive water development and that multidisciplinary planning must be a part of all considerations. It increased the useful life standards of 50 years in Circular A-47 to 100 years and indexed the discount rate on the project to long-term government securities.³² Senate Document 97 both encouraged federal project development and provided the justification for interdisciplinary planning.

The drive for social science expertise in water resources planning gained momentum with passage of the Water Resources Research Act of 1964 and the Water Resources Planning Act of 1965. The former authorized funding for water resources research institutions at various

land grant universities.³³ Congress had debated the latter bill for 4 years before it received the added support of President Lyndon Johnson, also a proponent of federal public works. Among many provisions, the act created an official Water Resources Council consisting of the secretaries of the Army; Agriculture; Interior; and Health, Education, and Welfare; and the chairman of the Federal Power Commission. The council was charged with developing "principles, standards, and procedures for Federal participants in the preparation of comprehensive regional or river basin plans and for the formulation and evaluation of Federal water and related land resources projects."³⁴ The act also authorized the President to establish river basin commissions for each major national watershed. The members of these commissions would be from state and federal governments as well as from interstate agencies concerned with water.³⁵

Economists and the Corps

Planning was the key word in the 1965 act, and its authors intended that interdisciplinary planning would guide all future federal water projects. The emphasis on regional river basin studies increased pressure on the Corps to bring more nonengineers, especially economists, into the planning process. The discipline of economics had made steady inroads into other government agencies such as the departments of Agriculture and Commerce, but with few exceptions, the Corps was reluctant to bring economists into civil works planning. Economists, however, had established themselves at the forefront of measuring the benefits and costs of public works projects. A federal interagency group composed primarily of economists had published a report

entitled Proposed Practices for Economic Analysis of River Basin Projects (better known as the Green Book) in 1950. Furthering the study of benefit-cost analysis was the nonprofit corporation Resources for the Future, founded in 1952 to assess present and future resource needs.³⁶

Modern economic theory generally supported federal investment in water resources. However, it urged the inclusion of more data in benefit-cost calculations, including the social and political factors of projects. In other agencies, economists persuasively demonstrated that such multivariate analyses gave more realistic benefit-cost ratios, but the Corps' response to the new criteria varied widely. In 1955, OCE responded by establishing a Committee on Economic Policies. Composed of most of the economists in the Corps at that time, the committee produced a revised Engineering Manual for Civil Works containing new economic evaluation criteria in 1956.³⁷

Corps field offices were also slow to incorporate economists. Although the Corps increased the number of economists in its field offices from 51 in 1963 to 77 in 1965, these individuals had minimal impact. About half of them, according to Nathaniel A. Back, the first economist in OCE's civil works directorate, were not well trained.³⁸ Recruiting good economists was made more difficult by the Corps' organizational hierarchy. Throughout the agency, engineering divisions usually handled planning, and they did not consider it on a par with engineering and construction. Lamenting the status of the Corps' civil works planning, a 1965 Bureau of the Budget memorandum stated, "[I]t will not improve greatly unless a major effort is made to diversify and strengthen the planning staff and pull it out of the engineering (construction dominated) organization."³⁹

During the mid-1960s, the Corps responded to two more highly critical analyses of its planning. One was a report issued by the Civil Works Study Board. Secretary of the Army Cyrus Vance had created the board, which consisted of two engineer officers and one Corps civilian, in 1964. Board members consulted several water experts for comments on the agency's work, including Maass and White, and the report, released in 1966, roundly criticized the Corps for its inability to implement Army directives in civil works planning and for its failure to consider nonconstruction alternatives in water development. The report stressed the need to strengthen the civil works review capabilities in the Office of the Secretary of the Army.⁴⁰ Meanwhile, a number of academic and professional water resource experts continued to criticize the Corps for slowness in adopting multiple-objective planning.⁴¹ While changes were occurring in the Secretary's office and the chief's office, public perceptions and outside evaluations suggested that the Corps of Engineers had changed little in regard to its civil works planning.

B. Joseph Tofani, who in 1961 became chief of the programs division of the Civil Works Directorate, led the fight to bring new disciplines into the Corps of Engineers. By the mid-1960s, Tofani had become the principal civilian civil works adviser to the director of civil works. Long before that, Tofani acknowledged that the Corps needed to "broaden its planning capabilities" to meet the new challenges of water resources development. His experiences in dealing with Bureau of the Budget and congressional staff people indicated that inadequate economic analysis conducted by "retread engineers" was a glaring liability of the Corps. To redress this deficiency, Tofani had persuaded

the Chief of Engineers to hire the first economists in OCE in 1953.⁴²

As chief of the programs division of OCE from 1961 to 1967, Tofani was instrumental in creating the economics branch of OCE's planning division in 1963 and in securing the appointment of Nathaniel (Nat) Back as its chief economist. Since coming to the Corps from the Department of Agriculture's Bureau of Agricultural Economics and the Office of the Secretary, Back had worked to bring modern applied economic analysis into Corps planning. He had represented the Department of Agriculture in preparing the Green Book in 1950, and he represented the Corps in preparing a 1958 revised edition of the guidelines for analyzing river basin projects.⁴³ The revised Green Book was more acceptable to the Corps, primarily because of the work of Corps economists involved in its production. As economic analysis became more valued by the Bureau of the Budget, economists were becoming more valued by the OCE.

During the mid- and late 1960s, the Corps made substantive additions to its economic analysis capabilities in divisions and districts. By 1965, there were 77 economists in Corps field offices. After passage of the Water Resources Planning Act, the Corps increased its number of economists to 119 by 1967, and its nonengineering specialists grew from 361 in 1964 to 516 in 1967. This direction was opposed by many in OCE and the field, who still viewed economics as an inexact science and social scientists as impediments to progress. But an increasing number of other civilian and military personnel strongly believed that the Corps must become more socially sensitive, environmentally conscious, and cost effective. With the Bureau of the Budget

nearing negotiation of an increase in the discount rate for federal water projects--and with the introduction in 1965 of yet another congressional bill to incorporate the Corps' civil works functions into a Department of Natural Resources--the reform message gained more urgency during the mid-1960s.⁴⁴

Policy and Planning

Economic analysis was only one of a broadening range of water resources planning considerations. Senate Document 97, for example, had gone well beyond the procedures of the 1958 Green Book in planning. "National prosperity and regional growth," while certainly economic goals, also encompassed social and even political considerations that would endure for the life of water resource projects. Evaluation of these concerns required interdisciplinary planning.⁴⁵ Partly in response to this need, the Chief of Engineers created the policy and analysis division with Tofani as its chief in 1967. Tofani had also been named the Corps representative on the Water Resources Council. With the support of incoming Chief of Engineers Lieutenant General William F. Cassidy, Tofani and his staff in the Policy and Analysis Division found themselves in a powerful position. Tofani had succeeded in making the division the main link for policy issues between OCE and the rest of the Corps, a clear break with the past when the Engineering Division served in that position. In attempting to secure "a new look for the Corps," Tofani staffed the new division with energetic young professionals trained in social science disciplines.⁴⁶ When questioned about hiring nonengineers for several positions, Tofani retorted that he did not care if

they were "music majors." What they had was "brain power," and, in Tofani's view, that was what the Corps needed.⁴⁷ Moreover, Tofani kept the idea of establishing a long-range planning organization alive through periodic memorandums.⁴⁸

One of the first initiatives of the new division was to begin a biannual series of policy planning conferences wherein OCE officials met with district and division personnel throughout the nation.⁴⁹ Another was to arrange seminars in conjunction with universities like Stanford, Pennsylvania State, and Colorado State, at which leading water resources academics would confer with Corps planners and, in the words of one Corps economist, "find out what the eggheads were thinking."⁵⁰

Corps planning and analytical capabilities were improving by the early 1960s, but many influential members of Congress and the Bureau of the Budget still regarded Corps project justifications as "economic fairy tales" with unrealistic benefits, optimistic discount rates, and submerged costs.⁵¹ Various reports supported such contentions. The Civil Works Study Board report found that because of unimplemented policy directives, change was not yet evident in Corps' project planning documents, nonengineering positions were still relegated to lower grades, and turnover rates for economists were higher than elsewhere in government. Bureau of the Budget reports continued to criticize the engineering dominance of the Corps' planning process. Meanwhile, the National Academy of Sciences Committee on Water, appointed by President Kennedy, issued another report highly critical of federal water resources planning.⁵²

During General Cassidy's tenure as Chief of Engineers (1966-1969), the pace of change quickened in the Corps. Cassidy's response to the problem of OCE directives not making their way to the field was implementation of the Planning-Programming-Budgeting System (PPBS) that the Bureau of the Budget imposed on most federal agencies in August 1965. The new rules were developed by the Robert S. McNamara-directed Department of Defense, endorsed by President Johnson, and codified by the Bureau of the Budget. The system required government agencies to identify national goals, prioritize them, search for alternatives to reach the goals at the least cost, calculate the total cost of programs, and measure the performance of programs.⁵³ For the Corps, implementation of PPBS included development of improved program memorandums. Partly in response to the new system, the Corps upgraded planning by establishing a planning division in each district and giving equal government grades to chiefs of planning and engineering throughout the agency. The system also supported the principles of multiobjective planning analysis by requiring that attention be given to the broadest range of planning options.⁵⁴

Changes in evaluation procedures, work on the Water Resources Council, and implementation of PPBS posed serious challenges to the economists in OCE. General Cassidy's civilian advisers rather easily persuaded him to hire more economists and to establish an organization for them. In March 1968, Cassidy and Director of Civil Works Brigadier General H.G. Woodbury requested approval for creation of an Economic Research Center in OCE before the House Public Works Appropriations Committee. Cassidy asked for three positions to staff the center, which initially

would be housed in the OCE planning division. "Perhaps our greatest deficiency in the past," declared Cassidy, "has been our inability to identify and measure the impacts water resources developments have on social and environmental values, and on local and regional economies."⁵⁵ The Economic Research Center would focus on such issues, provide the Water Resources Council with accurate information, and monitor economic research taking place in other federal organizations. Cassidy and Woodbury added that while the center would initially be part of the civil works directorate, the plan for subsequent years was to make it "a separate entity divorced from the day-to-day routine" of headquarters.⁵⁶ The basic tenets and guidelines for the economic element of a long-range planning organization were thus established in this concept of an Economic Research Center.

Environmental Issues

Another challenge facing the Corps during the mid-1960s came from a growing number of Americans concerned about environmental quality. Among many complaints about contemporary industrial society, environmentalists decried air and water pollution and the increasing control of nature that Corps water projects usually represented. Their numbers grew as the 1960s progressed. General Cassidy, who listened carefully to criticism of the Corps, responded with increased public relations to get the message out that the Corps was indeed changing. Shortly after becoming Chief, Cassidy permitted U.S. News and World Report to do a lengthy interview with him regarding many water resources issues.⁵⁷ In speeches like the one delivered in February

1967 to the American Society of Civil Engineers, Cassidy spoke of the need for "environmental engineering" as an integral component of water resources development. "Environmental considerations," he declared, "should be a primary objective from the very start of the water resource planning process. . . We should not wait for legislators or policy makers to require us to incorporate environmental considerations into our work. These things should be part of the orientation of all engineers whose tasks affect water and related land resources."⁵⁸ Cassidy was sincere in his concern for environmental protection. When the Wild and Scenic Rivers Act of 1968 created a national system of undeveloped rivers, he directed field offices to comply fully with the law and more generally consider environmental protection on an "equal basis with economic development." Cassidy, along with Deputy Chief of Engineers Brigadier General Frederick J. Clarke and top OCE policy civilians, even attended retreats in Aspen, Colorado, with outspoken environmental critics of the Corps to exchange views on issues.⁵⁹

Despite the support of top Corps executives, the problem of disseminating "environmental engineering" and "interdisciplinary planning" from OCE to the divisions and districts remained. Many in the agency predicted that even more sweeping changes regarding environmental quality were on the way and noted that OCE was already overloaded with new civil works planning issues. The policy and analysis division, responsible for developing new civil works policy directives, was particularly overburdened. Under the direction of Tofani and staffed by John Hadd, a former economic analyst and water resources specialist for the Bureau of the Budget, and David Aggerholm, trained in forestry, the division attempted to address multidisciplinary

challenges through innovative methods. Division staff held conferences where academic and water resources professionals spoke about issues such as public involvement, social impact, and environmental quality. Through enlisting outside experts to train Corps planners, the staff hoped to learn new planning techniques and develop policies accordingly. But as the 1960s progressed, the division's workload increased dramatically, and its ability to withdraw from the day-to-day responsibilities of OCE decreased.⁶⁰

Given these circumstances, interdisciplinary proponents in OCE believed the time had come to create a new organization within the agency. Members of such an organization would study evolving water resources scholarship and develop new planning methodologies for the Corps. The organization should not be burdened with the day-to-day operations in OCE as the current policy and analysis division was. The idea of creating a long-range planning organization was not new; Tofani and others had advocated establishing some kind of Corps of Engineers civil works "think tank" since the 1950s. Although the concept generated some interest then, it did not gain enough acceptance to progress beyond the discussion stage.⁶¹ By the late 1960s, the prospects seemed better. Interdisciplinary planning increased with each new law and guideline, and the military leadership of the civil works directorate appeared to be receptive to change.

The Office of Appalachian Studies

While the policy and analysis workload expanded, so did economic analysis throughout the agency. The economics branch in OCE was conducting several large research

projects, and its workload had become too great for its staff to undertake in addition to other regular functions. At about the same time, another group of economists in the Corps was nearing completion of a major field study. Under the provisions of the Appalachian Regional Development Act of 1962, the Corps had been the lead agency in developing a multiobjective water plan. Since it was the agency's first study that explicitly justified water projects based on their ability to enhance regional economic development, the task attracted a number of talented economists. The study involved 10 districts and 4 divisions of the Corps as well as the Soil Conservation Service, the Tennessee Valley Authority, state and local resource agencies from New York to Mississippi, and an intergovernmental umbrella agency called the Appalachian Regional Commission.⁶²

Congress passed a second Appalachian Regional Development Act in 1965, further refining and broadening the scope of the study. "The Appalachian region," section 2 of the act declared, "lags behind the rest of the Nation in its economic growth and . . . its people have not shared properly in the Nation's prosperity." Section 206 of the act authorized a general water resources survey "to increase the real output of goods and services" as an integral part of the overall development of the region. The study was to examine the likelihood that water resources development--including flood control, navigation, hydropower, and mine drainage--could stimulate economic prosperity. The Corps established the Office of Appalachian Studies in the Ohio River Division in Cincinnati under the command of Colonel John C.H. Lee, Jr. The Corps attempted to use new planning tools to accomplish its work, including analytical techniques to assess the value of regional water resources

projects, plan formulation to maximize benefits over costs, cost allocation procedures to assess traditional and regional development, and new methods to estimate user benefits and expansion benefits and costs.⁶³

The Appalachian survey, along with the concurrent North Atlantic Regional Study, broadened the Corps' planning abilities significantly. Planning evaluated regional economic development benefits to the national economy. This "new yardstick," as General Clarke termed it, would allow the Corps to judge the real impact of its projects more accurately.⁶⁴ The multiobjective approach considered three broad effects: regional economic development, national income gains through the use of underused resources, and environmental quality.⁶⁵ By considering regional and national benefits, researchers identified the effect of projects and the benefits to both direct users and "expansion beneficiaries." These expansion benefits helped determine regional economic impact.⁶⁶ Although the study did not consider several alternatives to water development, including improving educational facilities and constructing overland transportation, and viewed environmental quality primarily with regard to recreation projects and cleaning up polluted mine sites, the effort broke new ground in Corps planning.⁶⁷

As the Office of Appalachian Studies neared completion of its 26-volume report during the late 1960s, many in the Corps recognized that the economists and water resource specialists involved had gained valuable expertise in regional planning. Appalachian studies proponents included General H.G. Woodbury, director of civil works, and Robert E. Jordan, III, acting special assistant for civil functions to the Secretary of the Army. In a January 1968 meeting with Carl H. Schwartz, Jr., director of natural resources programs

for the Bureau of the Budget, Jordan discussed the future of the Office of Appalachian Studies and urged "retention of the unique skills and capabilities of the present staff."⁶⁸ Jordan wanted to integrate the 18-person professional staff into the planning division of the Ohio River Division, where it would be renamed the Regional Development Group. In this capacity, Jordan believed, the group could continue to coordinate with the Appalachian Regional Commission, assist the Corps in undertaking other regional economic studies, and help refine the evaluation procedures for water projects. Schwartz agreed that the Corps should retain the group to coordinate "planning activities for regional development."⁶⁹

Because of regional studies and innovative work in headquarters, the economic analysis capabilities of the Corps became more visible in the late 1960s. The increased exposure translated into funding for additional studies in a variety of civil works projects under consideration. Several states encompassed by the Appalachian regional study passed a resolution in November 1967 to continue the Office of Appalachian Studies. With Presidential support for regional planning from the Johnson administration, and with Senate Document 97 and the Water Resources Planning Act of 1965 favoring federal water development, the Corps received additional funding for detailed studies. Because of these studies, pressure for an economics-based organization such as the Regional Development Group increased. Each Corps division involved with Appalachian studies needed continuing economic analyses for a variety of projects. The economics branch of OCE's policy and analysis division oversaw most of this work, but the surveillance studies alone for the Appalachian region were overwhelming the

capabilities of headquarters. The proposed Regional Development Group would produce surveillance surveys for the Appalachian region, make final modifications to the 26-volume Appalachian report, and undertake other developmental studies.⁷⁰

A Two-Centered Institute

For the first few months of 1968, the location for the Regional Development Group remained an issue. In March, the Corps had proposed creation of an independent Economic Research Center. The Regional Development Group, along with a small group of economists from OCE, might form the nucleus of such a center.⁷¹ For most of the time, however, it appeared that the staff of the Office of Appalachian Studies would be incorporated into the planning division of the Ohio River Division, since that was the least expensive way to retain the group. The name of the organization underwent several changes, but by April, OCE and Colonel Lee had agreed on Office of Regional Water Development (ORWD). Lee had been a strong advocate of the work done by the organization he had directed since 1965 and had promoted its continuation to OCE and the Appalachian Regional Commission. "The current Appalachian planning effort," Lee announced to the commission in March 1968, "has developed techniques for planning and evaluating water resources improvements which should prove to be extremely useful in planning for economic development in other regions of the country."⁷² However, he opposed ORWD's incorporation into the Ohio River Division under the direct supervision of the division engineer. Lee believed this would be incompatible with

ORWD's broader mission and advocated that ORWD, like the earlier proposed Economics Research Center, be housed in an independent location away from the day-to-day operations of a division or headquarters.⁷³

By June 1968, placement of the organization in the Ohio River Division posed additional problems. Bureau of the Budget officials would approve ORWD only if it became part of the Ohio River Division. However, influential people in OCE, including new Director of Civil Works Brigadier General Charles C. Noble, and Chief of Planning Irving Reisler, now agreed with Colonel Lee that ORWD should be independent of division control.⁷⁴ Meanwhile, Tofani and others had recently gained General Noble's approval for the long-term planning organization outside of OCE.⁷⁵ The tentative title for the new organization was the Water Resources Institute.⁷⁶

On June 25, General Cassidy wrote Robert Jordan reviewing the events of the past months regarding ORWD and the proposed planning organization. Cassidy spoke of the need for ORWD to be independent of any division:

As a result of planning now underway in this office, there appears to be a better position for ORWD than as part of the division of ORD. Presently under development within my Directorate of Civil Works is a field agency tentatively titled the Water Resources Institute. This Institute will be involved in all phases of water resources development that are beyond the capabilities of the Divisions and Districts and are best carried out away from the day to day staff activity of Civil Works. . . . The Office of Regional Water

*Development will be one of the major planning agencies under the Institute "umbrella."*⁷⁷

Among the tasks Cassidy mentioned for the Institute were training for Corps personnel, career development, coordination of research, establishment of training centers and laboratories, long-range planning, and problem solving. Cassidy called on Jordan to secure the Secretary of the Army's approval.⁷⁸

The concept of a water resources Institute had been long discussed within the Corps of Engineers, but it began to coalesce about a year before Cassidy's letter to Jordan. During the summer of 1967, Nathaniel Back secured funding for an investigation into the possibility of the Corps establishing a center for water resources studies. The results appeared in a study entitled "An Exploratory Investigation of a Center for Socioeconomic Studies in Water Resources," prepared by Wilbert Fritz, an Alexandria researcher. Fritz and his assistants visited 18 universities to investigate their potential as sites for the center. They evaluated the type of organization that might best serve Corps needs and explored other operational issues, including funding, staffing, and internal organization.⁷⁹

The Fritz report left more questions than answers. Most perplexing was the nature of the organization. Was it to be devoted to pure research--a true think tank? Should it be located on a university campus and operated by the government? Should it be operated by the university, and, if so, what relationship would the government staff have with the university? Should it be a nonprofit corporation, like Resources for the Future? Or should it be a semiprivate nonprofit corporation along the lines of the RAND

Corporation? The universities Fritz investigated included Stanford, the University of California at Berkeley, Chicago, Colorado, Colorado State, Harvard, Cornell, Johns Hopkins, Maryland, Michigan State, Duke, North Carolina, North Carolina State, Georgia, and several others. With the exception of Harvard and Johns Hopkins, which balked at the idea of sponsoring research for one specific government agency, university officials were enthusiastic about having the center on their campuses. The Fritz report also expressed a preference for establishing a "RAND-type of operation" that would do research only for the Corps and other Government agencies.⁸⁰

As a result of the Fritz report, OCE officials began to evaluate seriously what kind of organization would be best for the Corps. There was little support for an organization devoted to pure research. Tofani, Hadd, and Back were among those who argued that the organization should have several missions, but that its main purpose would be long-range planning to help OCE in its civil works operations. As they reviewed the possibilities, it became evident that placing the center on a college campus might result in a lack of responsiveness and accountability to Corps needs. A RAND-style institution might also become too autonomous to assist OCE and would create a host of staffing difficulties. What the Corps needed, they believed, was an organization physically outside, but close to, headquarters. While maintaining close ties with academe, the organization should be staffed and operated by government employees and housed in government facilities.⁸¹

As the Fritz report circulated through OCE, the idea for combining the economics and planning elements coalesced. General Cassidy's 25 June letter to Jordan

followed a 21 June meeting with the chief, General Noble, and civilian leaders including Tofani and Back. The attendees agreed that ORWD should be incorporated into the proposed water resources Institute, and that the Institute should have four broadly based missions: planning, training, planning research, and problem solving in the planning fields.⁸²

During the next few months, proponents developed the integral elements of the proposed Institute. Some favored making the ORWD the planning division of the organization, and naming it the Center for Complex Planning.⁸³ Others believed that the planning division should be composed of people from the policy and analysis division of headquarters who were already working on planning issues. ORWD should instead be devoted to economic analysis, particularly region-wide studies. Staffing was also an issue. Should the technical director be military or civilian? What disciplines would be the most desirable for the Institute, from the division chiefs to the other professional positions? And where should the Institute be housed? Funding and congressional approval also had to be secured.⁸⁴

IWR Takes Shape

During the remainder of 1968, the OCE staff worked the details of the Institute into a justification statement for Congress. Early in 1969, General Cassidy submitted letters requesting creation of the Institute to Representative Michael J. Kirwan and Senator Allen J. Ellender, chairmen of the Subcommittees on Public Works of the House and Senate Appropriations Committees. "In recent years," wrote

Cassidy, "the complexity of the water resources management field has been growing at a rapid pace, with new concepts and interests appearing in a continuing stream. We are facing new problems, as well as new opportunities." Cassidy believed that changing social and environmental values needed to be more carefully considered in project justifications. Additionally, he thought the Institute could help prepare the Corps to respond to future water resources development challenges. "Accordingly," he concluded, "I propose to move ahead with the establishment of an Institute for Water Resources as an essential tool in enabling the Corps to carry out its public service mission in the field of water resources."⁸⁵ Cassidy expressed his desire that the Institute be established as a "field activity physically and functionally separate from [OCE]."⁸⁶ He also outlined the organizational structure of the Institute. There would be a small executive office and two operating units: a Center for Economic Studies and a Center for Advanced Planning. The Center for Economic Studies would consist of the Economic Research Center staff and members of the former Office of Appalachian Studies. Cassidy anticipated that staffing for the Institute would increase to about 30 in 2 years. The Institute would be temporarily housed in Alexandria, Virginia, and would move to Fort Belvoir when the Kingman Building was completed in 1971.⁸⁷

In that same month, incoming Chief of Engineers General Frederick J. Clarke, Director of Civil Works Brigadier General Frank Koisch, and Deputy Director of Civil Works Brigadier General Richard H. Groves each appeared before the House and Senate Appropriations Committees to forcefully request an Institute for Water Resources.⁸⁸ Koisch declared to the House committee, "It is

to be the vehicle which would allow the Corps of Engineers to determine how we will do the project formulation in the future, and to assist the Water Resources Council in its work."⁸⁹

The issue of staffing arose during the hearings. When Clarke, Koisch, and Groves requested a staff of 30 or more people for the Institute, several committee members expressed concerns. Member U.S. House of Representatives, Michael Kirwan, for example, questioned the staffing request and observed that such organizations tend "to expand greatly once they are established."⁹⁰ Others questioned whether the Secretary of Defense would approve of such a request. Still others wondered how such an organization would produce information that was not already being developed by other agencies "in the water business in this country." As Representative John Boland posed the question bluntly, "With respect to the Institute for Water Resources, what are you going to do that some other agencies are not going to do in this field?"⁹¹

General Koisch's response reached the heart of the Corps' civil works dilemma. Aside from the increasing complexities of water issues, he explained, the Water Resources Council was requiring the services of two Corps employees: Joseph Tofani and Nat Back, who was chairman of the Economics Committee. Other economists in OCE were also providing services to the council.⁹² Koisch anticipated similar demands on Corps' personnel from the National Water Commission. In September 1968, Congress had passed the National Water Commission Act (Public Law 90-515). The seven-member group appointed by the President was to "review present and anticipated national water resource problems, . . . [and] consider economic and

social consequences of water resources development on regional economic growth, on institutional arrangements, and on esthetic values affecting the quality of life of the American people.⁹³ Finally, the commission was to report its findings to the President.⁹⁴ Koisch told the committee that such demands were making it impossible for economists and planners in OCE to do any long-range planning.

Such demands were only a part of Koisch's argument for an Institute. In his previous assignment as North Atlantic division engineer, Koisch had taken part in the North Atlantic Regional Study and the Northeastern U.S. Water Supply Study. Because of the interdisciplinary methodologies and regional approaches that defined these studies, he learned how "the think-tank approach" could help the Corps improve such studies and "break new ground" in water resources planning.⁹⁵

Koisch then justified the need for better economic analysis by reviewing recent events. He informed the committee that the Economics Research Center proposed by General Cassidy in March 1968 had been placed into operation late that year. The four economists in the Center were from the economics branch of the planning and analysis division. Top officials in OCE believed that immediate needs required them to reduce the staff of the economics branch to create the center. For a time the center remained at headquarters, but in February 1969 it moved to an office in a bank building at 206 North Washington Street, Alexandria, Virginia. By this time, the Economic Research Center was already working on two high-priority studies surrounding the social impact of Corps' projects and the influence of flood control works on land values.⁹⁶ Now Clarke and Koisch proposed that the Economic Research

Center, along with the economists from the Office of Appalachian Studies, become the nucleus of the Center for Economic Studies in the Institute for Water Resources.⁹⁷

General Koisch argued just as forcefully for establishment of the Center for Advanced Planning, citing the immediate need for people trained to evaluate "intangible, non-monetary costs and benefits." Other issues, such as the changing status of the federal system of government, public participation, and current planning methods, also concerned the civil works directorate. In addition, Koisch listed tasks to help the Corps plan "20, or 50 years ahead," including harbor improvements, interregional problems, and international issues regarding water resources.⁹⁸

For all these reasons, Koisch and Clarke argued forcefully for the establishment of the Institute for Water Resources. When Congress asked more information regarding the Institute, General Clarke answered the request. "We need the Institute," wrote Clarke, "to provide us with the means for making essential improvements in the Corps of Engineers planning . . . and to be responsive to the changing concerns of our society." The Institute would bring together experts in "engineering, economics, social sciences and related disciplines so that, working in concert, they can develop methods for fully coordinating these specialties into all phases of our planning."⁹⁹ Clarke stated that the primary purpose of the Institute would be to "generate applications and develop techniques to extend national policy into the area of the Corps of Engineers specific responsibilities."¹⁰⁰ He enclosed the proposed mission statement of the Institute, which began as follows:

*To enhance the capability of the Corps of Engineers to develop and manage the Nation's water resources . . . by developing essential improvements in planning to be responsive to the changing concerns of our society. This mission may be categorized into three functional areas-- development and application of methodology, training, and interagency liaison.*¹⁰¹

The mission statement emphasized improving methods for considering environmental quality and regional development and for conducting interregional and international planning. Training and interagency liaison functions would help spread new methods to Corps field offices and other government agencies while preventing duplication of research and planning. The primary mission of the Center for Advanced Planning was "long-range water resources planning" in support of the overall Institute mission, while that of the Center for Economic Studies was "developing analytical techniques to be applied by the Corps of Engineers in identifying and evaluating the economic and social effects of water resources programs."¹⁰²

Four days after receiving Clarke's letter, Representative Kirwan advised the general that the Committee on Appropriations had approved the establishment of the Institute for Water Resources, including the staffing requests, with the understanding that the initial staff of 20 (15 professionals and 5 clericals) would increase after the move to the Kingman Building. Kirwan, however, did express a continuing concern shared by other members of Congress. "The Committee," Kirwan wrote, "expects that the work to be undertaken by the Institute will in no way duplicate that of the Water Resources Council, the National

Water Commission, and related agencies concerned with water resources planning."¹⁰³ Instead, the mission of the Institute was to improve the Corps civil works planning and concentrate on "quality rather than quantity" in its work.¹⁰⁴

In a letter similar to Kirwan's, Senator Ellender expressed his committee's approval of the Institute but added that the organization would be required to make an annual budget presentation to the Committee on Appropriations. In this manner, Congress could keep close tabs on the Institute's accomplishments and ensure that its work was valuable to the Corps. Ellender also recommended that the director of the Center for Advanced Planning should serve as the technical director of the Institute, while the director of the Center for Economic Studies should serve as deputy director.¹⁰⁵ The committee reasoned that if a military officer became the director, as the Corps proposed, the civilian positions would be downgraded. The Corps leadership, however, saw things differently and persevered in the plan to have the deputy director of civil works serve as director of IWR.¹⁰⁶

On 11 April 1969, the Chief of Engineers authorized the establishment of the Institute for Water Resources with Engineering Regulation (ER) 10-1-23. The specific task list for the Center for Advanced Planning included examining environmental and social values in Corps water resources projects, community impacts (economic and social) of Corps projects, urban needs, interregional problems, harbor facilities and future fleet sizes, changing intergovernmental responsibilities, methods and objectives research, and public participation.¹⁰⁷ The Center for Advanced Planning would also host planning seminars with academicians and water resource specialists

that were currently being held in the policy and analysis division of OCE.¹⁰⁸

The task list for the Center for Economic Studies was equally challenging, even though some of the work was already under way in the economics branch of OCE. The list included improvement of floodplain management, economic evaluation of navigation improvements, economic evaluation of completed projects, economic analysis of deep-draft harbor improvements, water resource development and economic growth, examination of the impact of flood protection on land values, analysis of carrier mode transportation, and analysis of the economic impact of water shortages.¹⁰⁹ The Institute was to be under the "general staff supervision of the Director of Civil Works." Funding for IWR would come from "planning research funds for the accomplishment of specific studies, and by levying the field." Research funding for IWR would come from the General Investigations budget. Until IWR moved into larger quarters at Fort Belvoir, its administrative and logistic needs would be served by the Baltimore District.¹¹⁰

One week after the issuance of ER 10-1-23, the Institute for Water Resources officially opened on Washington Street in Alexandria. The nucleus of the Center for Economic Studies, the Economic Research Center, was already onsite. It consisted of four economists: Director Nathaniel Back and James Tang, Richard Howes, and Gary Hershendorfer, all of whom came from OCE. By June 1969, they were joined by economists Robert Harrison and George Antle of the Office of Appalachian Studies. The Center for Advanced Planning consisted of former policy and analysis specialist David Aggerholm, trained as a forester, and planners Forrest Swiggart, Norman Wengert, and Patrick

Johnson. James Evans, an economist who came from the Office of Appalachian Studies, also joined the Center for Advanced Planning. The selection of a director for advanced planning posed some problems, but eventually Burnham Dodge, former chief of planning in the North Atlantic division, assumed the position. Dodge had been involved in the North Atlantic Regional Study and the Northeastern U.S. Water Supply Study. Brigadier General Richard Groves, deputy director of civil works, became the Institute's first director.¹¹¹

The broad range of tasks promised a full workload for the Institute. As indicated in justification statements, testimony, and internal discussions, the top echelons of the Corps of Engineers had high expectations for IWR. A legion of objectives and immediate and long-term planning needs had accompanied most discussions about its formation. In many ways, the Corps was placing its faith in the handful of interdisciplinary planners who staffed the Institute to solve problems ranging from developing the criteria for considering intangible costs and benefits to improving public involvement in the planning process.

The Institute's members viewed themselves as agents of change in the Corps and believed this was their main function. Whether producing better economic analyses, authoring guidelines for environmental planning, bringing academic expertise into the Corps, or forecasting future water resource needs, the IWR staff accepted these tasks as basic to their mission in the Corps' civil works program. After settling into the Alexandria office, however, the 15 members of the Institute got their first long look at the challenges and vexing problems for which they were

expected to provide definitive solutions. Much had been promised, and much was expected from IWR.

¹ See Beatrice Hort Holmes, A History of Federal Water Resources Programs, 1800-1960 (U.S. Department of Agriculture, Economic Research Service, 1972), for general treatment of water resources development in the 1800s. See also Martin Reuss, Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986 (IWR Policy Study 91-PS-1, 1991), pp. 1-39, for an overview of water resources history leading to cost sharing.

² Reuss, Reshaping National Water Politics, pp.-5-7.

³ Ibid.; Holmes, A History of Federal Water Resources Programs, 1800-1960, pp. 3-5.

⁴ Samuel P. Hays, Conservation and the Gospel of Efficiency: The Progressive Conservation Movement, 1890-1920 (Cambridge, MA: Harvard University Press, 1959), pp. 92-94.

⁵ Reuss, Reshaping National Water Politics, pp. 6-7, 9; Jeffrey K. Stine, "Environmental Politics and Water Resources Development: The Case of the Army Corps of Engineers during the 1970s," (Ph.D. dissertation, University of California, Santa Barbara, 1984), pp. 4-5.

⁶ See Holmes, A History of Federal Water Resources Programs, 1800-1960, pp. 5-7, for a discussion of the Inland Waterways Commission.

⁷ Hays, Conservation and the Gospel of Efficiency, p. 94; Reuss, Reshaping National Water Politics, p. 7.

⁸ Jamie W. Moore and Dorothy P. Moore, The Army Corps of Engineers and the Evolution of Federal Flood Plain Management Policy (Boulder, CO: University of Colorado Institute of Behavioral Science, 1987), p. 4; Stine, "Environmental Politics and Water Resources Development," p. 5.

⁹ Moore and Moore, The Army Corps of Engineers and the Evolution of Federal Flood Plain Management Policy, pp. 4-6.

¹⁰ Quoted in Reuss, Reshaping National Water Politics, p. 15.

¹¹ See Joseph L. Arnold, The Evolution of the 1936 Flood Control Act (Fort Belvoir, VA: U.S. Army Corps of Engineers Office of History, 1988), passim, for an analysis of this legislation.

¹² Moore and Moore, Federal Flood Plain Management Policy, pp. 12-15; Holmes, A History of Federal Water Resource Programs, 1800-1960, pp. 15-17.

¹³ Reuss, Reshaping National Water Politics, pp. 18-19.

¹⁴ Stine, "Environmental Politics and Water Resources Development," p. 7.

¹⁵ Ibid., pp. 25-26; Moore and Moore, Federal Flood Plain Management Policy, pp. 23-25; See also John R. Ferrell, Big Dam Era: A Legislative and Institutional History of the Pick-Sloan Missouri Basin Program (Omaha, NB: U.S. Army Corps of Engineers, Missouri River Division, 1993) chapters 1-3 for the evolution of the Pick-Sloan Plan.

¹⁶ Quote by Maass in regard to Muddy Waters in Martin Reuss, Water Resources, People, and Issues: Interview with Professor Arthur Maass, (Fort Belvoir, VA: U.S. Army Corps of Engineers Office of History, 1989), p. 4.

¹⁷ Ibid, p. 4.

¹⁸ Ibid, p. 4.

¹⁹ Arthur Maass, Muddy Waters: The Army Engineers and the Nation's Waters (Cambridge, MA: Harvard University Press, 1951), passim.

²⁰ Reuss, Reshaping National Water Politics, pp. 21-23; Moore and Moore, Federal Flood Plain Management Policy, pp. 26-27.

²¹ Moore and Moore, Federal Flood Plain Management Policy, pp. 28-30; Holmes, A History of Federal Water Resources Programs, 1800-1960, pp. 37-43.

²² Moore and Moore, Federal Flood Plain Management Policy, pp. 36-37; Martin Reuss, Water Resources, People, and Issues: Interview with Professor Gilbert F. White (Fort Belvoir, VA: U.S. Army Corps of Engineers Office of History, 1988), passim.

²³ Reuss, Interview with Professor Arthur Maass, pp. 6-8; Moore and Moore, Federal Flood Plain Management Policy, pp. 42-47.

²⁴ Interview, Martin Reuss with B. Joseph Tofani, 10 Feb. 1988, OHA. Hereafter cited as Reuss, Tofani interview.

²⁵ Martin Reuss, "Coping With Uncertainty: Social Scientists, Engineers, and Federal Water Resource Planning," Natural Resources Journal Vol. 32, No. 1 (Winter 1992), pp. 101-103; Beatrice Hort Holmes, History of Federal Water Resources Programs and Policies, 1961-70 (Washington, DC: USDA Economics, Statistics, and Cooperatives Service, 1979) Misc. Pub. No. 1379, pp. 6-9.

²⁶ Telephone interview, author with B. Joseph Tofani, 26 Dec. 1993. Hereafter cited as Tofani interview, 26 Dec. 1993.

²⁷ Ibid.; "Biographical Sketch of B. Joseph Tofani," undated typescript, Tofani interview files, CW/P files, OHA.

²⁸ Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 1, 37-39; Moore and Moore, Federal Flood Plain Management Policy, pp. 50-51; Reuss, Reshaping National Water Politics, pp. 23-24.

²⁹ Ibid, Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 37-41.

³⁰ Reuss, Reshaping National Water Politics, p. 27.

³¹ Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 37-41; Reuss, "Coping With Uncertainty," pp. 112-115.

³² Ibid, U.S. Congress, Senate, Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources, S. Doc. 97, 87th Cong., 3d sess., 1962, p. iv.

³³ Reuss, Reshaping National Water Politics, p. 26; Interview, Martin Reuss with Henry Caulfield, Dec. 1986, transcript in OHA. Hereafter cited as Caulfield interview.

³⁴ U.S. Congress, House, House Report 169 (15 March 1965), p. 1924.

³⁵ Ibid.; 79 Stat. 244, Water Resources Planning Act, p. 262; Reuss, "Coping With Uncertainty," p. 115.

³⁶ Reuss, "Coping With Uncertainty," pp. 124-127.

³⁷ Ibid, pp. 127-128.

³⁸ Moore and Moore, Federal Flood Plain Management Policy, p. 82.

³⁹ Quoted in Ibid.

⁴⁰ See Anna Kasten Nelson, "The Office of the Assistant Secretary of the Army for Civil Works," (draft manuscript, U.S. Army Corps of Engineers Office of History), pp. 32-35, for more details on the Civil Works Study Board.

⁴¹ Moore and Moore, Federal Flood Plain Management Policy, pp. 82-83; Reuss, Interview with Professor Arthur Maass, p. 10; "Policy Forecasting and Dissemination," unsigned and undated typescript located in Tofani interview file, CW/E OHA; Holmes, History of Federal Water Resources Programs and Policies, 1961-70, p. 119.

⁴² "Summary of Major Achievements, Nathaniel A. Back." ca. 1970, typescript sent to author by Mr. Back; Telephone interview, author with B. Joseph Tofani, 20 Feb. 1994. Hereafter cited as Tofani interview, 20 Feb. 1994.

⁴³ "Summary of Major Achievements, Nathaniel A. Back"; Moore and Moore, Federal Flood Plain Management Policy, p. 22.

⁴⁴ Moore and Moore, Federal Flood Plain Management Policy, pp. 82-85; Congressional Record, 3 July 1974, p. E4500; Telephone interview, author with B. Joseph Tofani, 26 Dec. 1993, Hereafter cited as Tofani interview; "Summary of Major Achievements, Nathaniel A. Back"; Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 117-118. The bill was introduced by Sen. Frank Moss of Utah in August 1965. See Martin Reuss, Shaping Environmental Awareness: The United States Army Corps of Engineers Environmental Advisory Board, 1970-1980 (Fort Belvoir, VA: U.S. Army Corps of Engineers Office of History, 1983), p. 5.

⁴⁵ Col. John Lee, Jr., "Planning Water Resource Investments to Support Regional and National Objectives," 6 June 1968, typescript located in Director's Office, Institute for Water Resources. Hereafter referred to as IWR DO Files.

⁴⁶ Tofani interview; "Biographical Sketch, B. Joseph Tofani, Unsigned and undated typescript, Tofani file, CW/E OHA; Telephone interview, author with David Aggerholm, 11 Jan. 1994. Hereafter cited as Aggerholm interview.

⁴⁷ Interview, B. Joseph Tofani with John Greenwood, 1979, OHA.

⁴⁸ Ibid.

⁴⁹ "Policy Forecasting and Dissemination," undated and unsigned typescript located in Tofani interview file, OHA.

⁵⁰ Interview, author with Robert Harrison, 12 Jan. 1994. Hereafter cited as Harrison interview.

⁵¹ Ibid.

⁵² "Policy Forecasting and Dissemination"; Moore and Moore, Federal Flood Plain Management Policy, pp. 81-83.

⁵³ Remarks by B. Joseph Tofani, acting deputy director of civil works, to Council of State Planning Agencies, 1 Apr. 1967, Civil Works/General files. Hereafter referred to as CW/G OHA, Box 65; Nelson, "The Office of the Assistant Secretary of the Army for Civil Works," pp. 40-48; "Civil Works PPB Fact Sheet," undated typescript, CW/G, OHA, Box 58; Letter, Jim J. Tozzi, Systems Analysis Group, to Prof. A. Allen Schmid, Michigan State University, subj: PPBS, 19 March 1970, CW/G, OHA, Box 58.

⁵⁴ Interview, author with Lt. Gen. John F. Wall, 10 Jan. 1994. Hereafter cited as Wall interview; Harrison interview; Interview, author with James R. Hanchey, 7 Jan. 1994. Hereafter cited as Hanchey interview.; Moore and Moore, Federal Flood Plain Management Policy, pp. 82-83; Reuss, "Coping with Uncertainty," p.130; Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 118-119.

⁵⁵ Hearings before the House Public Works Appropriations Committee, FY 69, 5 Mar. 1968, Copy in historical files, U.S. Army Corps of Engineers, Institute for Water Resources. Hereafter cited as IWR files.

⁵⁶ Ibid.

⁵⁷ U.S. News and World Report (25 Oct. 1965), passim. See also "Management of Water Resources," 27 Oct. 1966, speech for Industrial College of the Armed Forces, CW/G OHA, Box 65, for Gen. Cassidy's views on comprehensive planning.

⁵⁸ Aggerholm interview; "Remarks by Lt. Gen. William F. Cassidy, Chief of Engineers, to the Environmental Engineering Conference of the American Society of Civil Engineers," 8 Feb. 1967. CW/E OHA.

⁵⁹ Moore and Moore, Federal Flood Plain Management Policy, pp. 83, 92-93; Aggerholm interview.

⁶⁰ Ibid.; Moore and Moore, Federal Flood Plain Management Policy, pp. 65-67.

⁶¹ Tofani interview.

⁶² Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 118-120; Interview, author with George Antle, 14 Jan. 1994. Hereafter cited as Antle interview, 14 Jan.; Harrison interview.

⁶³ Harrison interview; PL 89-4, 89th Cong. 1st sess.; "Planning Water Resource Investments to Support Regional and National Objectives," 6 June 1968, IWR files; Holmes, History of Federal Water Resources Programs and Policies, 1961-70, pp. 118-121; Interview, author with George Antle, 22 Feb. 1994. Hereafter cited as Antle interview, 22 Feb. 1994; Nelson, "The Office of the Assistant Secretary of the Army for Civil Works," p. 81.

⁶⁴ "Remarks by Maj. Gen. F.J. Clarke, Dep. Chief of Engrs., to American Society of Civil Engineers," 10 Dec. 1968, CW/E OHA; See also "Water Resources Management," 6 Feb. 1967, Remarks to International Turfgrass Conference, CW/G, OHA, Box 65, for Clarke's views on the need for balanced water resources development.

⁶⁵ Holmes, History of Federal Water Resources Programs and Policies, 1961-70, p. 120.

⁶⁶ *Ibid.*, pp. 120-121.

⁶⁷ *Ibid.*

⁶⁸ Letter, Robert E. Jordan, III, Spec. Asst. to Sec. of the Army, to Carl H. Schwartz, Jr., Dir. of Natural Resources Programs, Bureau of the Budget, 11 Jan. 1968, subj: Creation of Regional Development Group, IWR files; Memorandum, Brig. Gen. H.G. Woodbury, Dir. of Civil Works, to Acting Div. Engr., Ohio River, 8 Feb. 1968, subj: Regional Development Group, IWR files.

⁶⁹ Ibid, Letter, Schwartz to Jordan, 18 Jan. 1968, subj: IWR files; "Evaluation Statement for GS-15 and GS-14 Positions in the Regional Development Group, USAED, Ohio River," undated, by C.H. Wilholt, Div. Analyst, ORD, IWR files.

⁷⁰ Memorandum, Lt. Col. Fred Anderson, Jr., Asst. Dir. of Civil Works, Central Divisions, to Div. Engr., Ohio River Div., 20 Dec. 1994, subj: Regional Development Group, IWR files; "Presentation made by Col. Lee to the Appalachian Regional Commission," 19 March 1968, IWR files.

⁷¹ Letter, Brig. Gen. H.G. Woodbury, Dir. of Civil Works, to Acting Div. Engr., Ohio River, subj: Regional Development Group, 8 Feb. 1968, IWR files.

⁷² Ibid.

⁷³ Ibid.; "Proposal of Col. Lee for ORWD," draft copy, 1 April 1968, IWR files.

⁷⁴ Memorandums for the Record from Lt. Col. Thomas W. Nelson, subj: ORWD, 12, 19 June 1968, IWR files.

⁷⁵ Tofani interview; Aggerholm interview.

⁷⁶ Letter, Lt. Gen. William F. Cassidy, Chief of Engrs., to Jordan, subj: Incorporation of ORWD into WRI, 19 June 1968, IWR files.

⁷⁷ Ibid.

⁷⁸ Ibid.

⁷⁹ Letter, Wilbert G. Fritz, consultant, to Nathaniel Back, OCE Economics Branch, subj: Submission of Report, 24 Aug. 1967, IWR files; Wilbert G. Fritz, "An Exploratory Investigation of a Center for Socioeconomic Studies in Water Resources," Part 1, p. 1.

⁸⁰ Ibid, pp. 1, 12, 15-16; Harrison interview.

⁸¹ Tofani interview; Harrison interview; Aggerholm interview.

⁸² Memorandum for the Record from Lt. Col. Thomas W. Nelson, subj: Call from Col. Lee, 25 June 1968, IWR files; Memorandum from Nelson, subj: Water Resources Institute, 25 June 1968, IWR files.

⁸³ Memorandum for the Record from Col. Nelson, subj: ORWD and WRI, 2 July 1968, IWR files.

⁸⁴ Memorandum, Nelson to Cassidy, subj: Staffing WRI, 12 July 1968, IWR files; Memorandum, Noble to Ohio River Div. Engr., subj: WRI, 13 July 1968, IWR files. General Noble actually wanted Colonel Lee to direct the institute. Lee, however, retired from Government service. See Interview, Martin Reuss, with Maj. Gen. Charles C. Noble, 22, 23 Sept. 1981, OHA.

⁸⁵ Letter, Lt. Gen. Cassidy to Rep. Michael J. Kirwan, Chairman, House Subcommittee on Public Works, subj: Establishment of the Institute for Water Resources (IWR), 4 Feb. 1969, IWR files.

⁸⁶ Ibid.

⁸⁷ Ibid.

⁸⁸ Interview, author with Maj. Gen. R.H. Groves, 16 June 1994. Hereafter cited as Groves interview.

⁸⁹ Hearings before the House Public Works Appropriations Committee, FY70, March 1969, IWR files.

⁹⁰ Ibid.

⁹¹ Ibid.

⁹² Ibid.; Letter, Reuben J. Johnson, Acting Exec. Dir., Water Resources Council, to Nat Back, 4 Dec. 1969, subj: Back's resignation from Water Resources Council, IWR files.

⁹³ "The National Water Commission Act," PL 90-515, 90th Cong., S. 20 (82 Stat. 868) 26 Sept. 1968, p. 539.

⁹⁴ Ibid.; Holmes, History of Federal Water Resources Programs and Policies, 1961-70, p. 272; Interview, Martin Reuss with Theodore Schad, 27 Feb. 1989, transcript in OHA. Hereafter cited as Schad interview.

⁹⁵ Hearings before the House Public Works Appropriations Committee, FY70, March 1969, IWR files.

⁹⁶ Ibid.

⁹⁷ Ibid.

⁹⁸ Ibid.

⁹⁹ Letter, Major General Clarke to Kirwan, subj: Establishment of IWR, 25 March 1969, IWR files.

¹⁰⁰ Ibid.

¹⁰¹ "U.S. Army Engineer Institute for Water Resources Mission," unsigned and undated typescript, IWR files.

¹⁰² Ibid.

¹⁰³ Letter, Rep. Kirwan to Lieutenant General Clarke, subj: Approval of IWR, 29 March 1969, CW/E OHA.

¹⁰⁴ Ibid.

¹⁰⁵ Letter, Sen. Elender to Lt. Gen. Clarke, subj: Approval of IWR, 31 March 1969. CW/E OHA.

¹⁰⁶ Tofani interview, 20 Feb. 1994; Groves interview.

¹⁰⁷ ER 10-1-23; "Task List for Institute for Water Resources," enclosure in letter, Lt. Gen. Clarke to Sen. Ellender, 25 March 1969, IWR files.

¹⁰⁸ "Policy Forecasting and Dissemination."

¹⁰⁹ Ibid.

¹¹⁰ Letter of Instructions from Brig. Gen. F.P. Koisch, Director of Civil Works, 29 April 1969, IWR Files.

¹¹¹ Interview, author with George Antle, 18 Feb. 1994. Hereafter cited as Antle interview, 18 Feb. 1994; Aggerholm interview; Tofani interview, 20 Feb. 1994.



CHAPTER TWO: THE CHANGE AGENTS OF THE CORPS

During the years 1969 through 1975, the staff of the Institute for Water Resources looked for ways to prove its value to the Corps of Engineers civil works program. Since there was no real precedent for such an organization in a federal water resources agency, no map existed to suggest a proper direction. The Institute's personnel attempted to address present needs, such as compliance with new environmental laws and water resources mandates, improvement of the Corps' public relations, assessments of existing programs, and economic evaluations of navigation and flood control. They also attempted to anticipate future water resource issues for the nation and assess how those needs would affect the Corps. The broad range of tasks was beyond the capability of the small in-house staff, and therefore IWR used a portion of its resources to enlist the services of water resources professionals and academicians. Such academic and professional outreach produced many well-researched reports widely used outside the Corps. While these reports gained the Institute recognition in the water resources community, critics within the agency questioned their value-- and the overall value of IWR to the civil works program. The controversy led to a major reorganization in 1975

aimed at making the Institute more responsive to the needs of the civil works directorate.

IWR Opens for Business

The ten professional and five administrative staff members of the Institute for Water Resources who settled into offices in Alexandria, Virginia, during the spring of 1969 quickly discovered that influencing the Corps of Engineers civil works program would not be easy. While the economists, civil engineers, and planners envisioned their work in IWR as a unique opportunity to redirect the civil works program of the Corps, they represented a small organization in an agency with 40,000 employees scattered across the nation. The events of the prior three decades indicated that the Corps civil works program was adaptable but that change did not occur quickly or uniformly throughout the agency. In the realm of civil works planning, social scientists had made inroads, yet their complete integration into the process had remained elusive. Since they perceived themselves as agents of change, the IWR staff members were determined to help broaden the planning process--as well as to contribute to an overall redirection of the civil works program.

When the Institute opened in 1969, the manner in which the staff would accomplish its goals remained uncertain. Retiring Chief of Engineers Lieutenant General William F. Cassidy commented to the special assistant to the Secretary of the Army for Civil Functions in June 1969 that he expected the Institute to "concentrate full-time on improving both planning procedures and results."¹ The Institute was also to be a consultant for regional surveys and metropolitan area water planning.² Principal officials in

OCE anticipated that IWR would enlist academic expertise in conducting interdisciplinary water resources planning seminars. Moreover, they expected IWR to refine multiobjective planning analysis, conduct and expand on regional economic studies, assist in implementing the Planning-Programming-Budgeting System, participate in a new program initiative for urban wastewater treatment, and supply information to Corps representatives on the Water Resources Council.³ By the end of 1969, the Institute had five research studies under way and three more planned. The studies were investigations of national commodity transportation methods, urban floodplain management, and agricultural flood control benefits; economic analyses of completed projects; and evaluations of deep-draft harbors. The planned studies were evaluation of water supply shortages, evaluations of recreational benefits, and the creation of a data bank of commercial waterway statistics since the 1950s.⁴

The Issues of Environmental Quality

In addition to the challenges already at hand, new federal legislation greatly increased the complexity of civil works planning. The most sweeping of these laws concerned environmental quality. The emphasis on clean air, clean water, and a healthy environment reflected rapid changes in public values. On 1 January 1970, an event took place that epitomized the growing pressure on federal resource agencies to respond to environmental quality issues. President Richard M. Nixon signed the National Environmental Policy Act (NEPA) and announced that the "1970s absolutely must be the years when America pays its

debt to the past by reclaiming the purity of its air, waters, and our living environment."⁵

Nixon's words foretold significant changes for federal construction agencies like the Corps of Engineers and a greatly expanded role for the Institute for Water Resources. NEPA was the most comprehensive environmental law affecting federal agencies, but other laws also had impact. In 1964, Congress had passed the National Wilderness Preservation System Act, creating wilderness areas on public lands, and in 1968, it passed the Wild and Scenic Rivers Act, creating a system for protecting free-flowing rivers from development. Clean air and clean water acts came in 1970 and 1972. Nonetheless, NEPA was the capstone legislation to more than two decades of changing views regarding the environment.

As the nation industrialized after World War II, Americans embraced growth and prosperity and thought little about the environmental consequences. Federal agencies like the Corps played a major role in national economic development through navigation, flood control, and hydropower projects. The result was an unprecedented economic expansion, but it was not without cost to the nation's environment. Scientists like Rachel Carson pointed out the toxic problems wrought by chemical pesticides in Silent Spring (1962), while consumer activist Ralph Nader sought to expose corporate environmental abuses. Many Americans took the messages to heart and supported passage of NEPA. The law required all federal agencies to prepare a detailed environmental impact statements (EIS) for any development project having "significant impact on the natural environment."⁶ The EIS would be reviewed not only by other agencies but also by the public. The analysis in the

EIS had to include the environmental impact of a project, an assessment of unavoidable adverse impacts, and a list of alternatives to the proposed action. NEPA made it a federal responsibility to guarantee a quality environment for future generations; to assure Americans of safe and healthful surroundings; to preserve important historical, cultural, and natural aspects of the national heritage; and to achieve a balance between population and resources use to permit the highest possible living standards.⁷

Although it had undergone significant changes since the 1940s, the Corps civil works program required more alteration to be responsive to public demands for environmental quality. The agency officially acknowledged its environmental responsibilities in the 1969 Annual Report of the Chief of Engineers on Civil Works Activities, which began with these words:

As man continues to expand his requirement for limited natural resources, environmental quality must be balanced with matching requirements for clean water and the capability to meet these requirements. Only through wise planning and efficient management can water of high quality and sufficient quantity be provided to meet the accelerating needs of the present and the future.⁸

Such words had little effect on people who opposed large federal water resources development on environmental grounds. At the time of NEPA's passage, environmental critics were besieging the Corps' civil works program. Some journalists and politicians, fortified by the activist atmosphere of the 1960s, attacked the Corps and other

federal construction agencies, as well as private corporations identified with development and pollution. However, the attack on the Corps was particularly fierce. In July 1969, U.S. Supreme Court Justice William O. Douglas published "The Public Be Dammed" in Playboy magazine. A few months later, Elizabeth Drew took aim at the Corps' civil works program in "Dam Outrage: The Story of the Army Engineers," published in Atlantic Monthly. These were the most visible of a number of highly critical articles published in periodicals ranging from Sports Illustrated to the Wall Street Journal between 1968 and 1971.⁹ In 1971, Arthur E. Morgan, the first chairman of the Tennessee Valley Authority, published Dams and Other Disasters: A Century of the Army Corps of Engineers in Civil Works, a chronicle of alleged ill-conceived planning by the agency since the late 1800s.¹⁰

Like the other critics, though, Morgan was attacking an agency in rapid transformation. Arthur Maass, a harsh critic of the Corps in the 1950s, wrote a rebuttal to Drew's article that the Atlantic Monthly refused to publish. In response, Maass had the rebuttal published in the Congressional Record. Maass carefully pointed out the deficiencies in Drew's analysis and argued that she was criticizing the way the agency operated in the past--not the present. Similarly, Secretary of the Army Stanley R. Resor announced in 1970 that "to a considerable extent, many of the criticisms being leveled at the Corps, to the degree they were ever valid, related to an organization that no longer exists."¹¹

Resor's comment reflected the steps being taken by the Corps of Engineers as the 1970s began. Despite public perceptions to the contrary, Chief of Engineers Lieutenant

General Frederick Clarke remembered that many in the agency "actually welcomed the environmental policy act."¹² Environmental quality was now the law and a national policy objective; the Corps' planning would necessarily change accordingly. As the 1970 Annual Report on Civil Works phrased it, the requirements of NEPA included "using an interdisciplinary approach in making decisions which may have an impact on the environment; developing quantitative methods to insure that environmental values will be given appropriate consideration in decision making; describing appropriate alternatives to recommended courses of action regarding resource use; utilizing ecological information in the planning and development of resource-oriented projects; and providing statements of the expected environmental impact of proposed Federal actions."¹³

Federal agencies generally had difficulty responding to NEPA. Measuring tangible regional and national economic benefits had proven difficult for federal agencies involved in natural resources or urban development. Now NEPA required federal agencies to make efforts to "prevent or eliminate damage to the environment and biosphere." The mandates of NEPA were as complex as definitions of what constituted environmental quality. If any alteration resulted in environmental degradation, then could any development project be environmentally sound? By involving the people affected by developments, NEPA also promised to bring a full spectrum of viewpoints into the planning process, including those categorically opposing water resources projects. No longer would federal agencies proceed with projects with the support only of influential politicians or local elites.¹⁴

The Corps responded to NEPA in several ways. One was to reassign the assistant director of civil works for comprehensive planning as the assistant director of civil works for environmental programs, to oversee the compliance of the civil works program with NEPA.¹⁵ In another response, the Chief of Engineers directed the Institute for Water Resources to provide assistance in interpreting the law.¹⁶ The Institute staff attempted to ascertain the noneconomic considerations of projects and how they could become part of the Corps' planning. In pursuing such objectives, IWR attempted to develop a policy statement that would apply throughout the agency and facilitate incorporation of environmental concerns into the planning process.¹⁷ IWR also assisted in the Corps response to section 103 of NEPA, which required all federal agencies to review their "statutory authority, administrative regulations, and current policies and procedures" to identify any deficiencies that might inhibit full compliance with the law. All agencies were required to submit proposals to bring about compliance to the President by 1 July 1971.¹⁸ Finally, IWR formulated strategies for implementing President Nixon's Executive Order 11514, requiring federal agencies to hold at least three well-publicized public meetings during the planning process of projects.¹⁹

Although the planners at IWR took the new law seriously, their counterparts throughout the agency had mixed feelings. Some believed NEPA was a fad, and people would soon lose interest in environmental issues. Others believed the Corps was in for difficult times if it failed to make at least a public relations response to NEPA, but they favored only minimal commitment to environmental quality. Still others argued that environmentalism had captured the

American mind, that environmental quality should be an integral objective of water resources development, and that the Corps should make a genuine effort to uphold the new law.²⁰

Environmental Guidelines and the Environmental Advisory Board

The position of the Chief of Engineers on environmental quality was crucial at this time. In General Clarke the Corps had a leader committed to compliance with NEPA.

Commenting later on the Corps' response to NEPA, Clarke stated, "It may sound a little strange, but I think we actually welcomed the environmental policy act. . . . It forced us to put [environmental concerns] down clearly, so that everyone could see what the aspects were that we were considering."²¹

Early in 1970, Clarke directed IWR to prepare a statement of policy for the field. In June, he sent a letter reflecting those policies to all district and division engineers and clarified his intention to make environmental quality an integral aspect of the Corps' civil works mission. Clarke also informed the engineers that OCE was preparing a more detailed policy statement.²²

Shortly after passage of NEPA, General Clarke directed the Institute for Water Resources to sponsor a special task force to study methods for "redirection of the Corps' environmental policy," with particular emphasis on section 103 of the law.²³ The Institute's director, General Richard Groves, who was also deputy director of civil works, assigned the work to the center for advanced planning and its director, Burnham Dodge. Dodge assigned the study to David Aggerholm, who had come to the Institute from the

OCE policy and analysis division. Aggerholm enlisted the support of experts in environmental quality, including Lynton Caldwell, a nationally known political scientist at Indiana University who had been a principal author of NEPA.²⁴

In November 1970, the task force presented its findings to General Clarke. Entitled Environmental Guidelines for the Civil Works Program of the Corps of Engineers, IWR Report 70-5 had immediate and long-term impact. The twelve-page, double-spaced document was succinct, contained broad guidelines for interpreting NEPA, and identified new environmental objectives for the Corps civil works program. The message of the report was as clear as General Clarke's had been: Corps projects must be "in full consonance" with NEPA, and economic justifications and engineering feasibility alone were no longer sufficient for a project to go forward. Questions about a project's impact on the environment needed to be resolved first. The Corps needed to expand its dialogue with the public, and planning should proceed only with the maximum possible public and interagency involvement and with full consideration for environmental concerns. The report concluded,

In essence, we seek to introduce an environmental viewpoint when our projects first come under consideration and to receive and accommodate it at every subsequent stage of their development and utilization. In achieving this end, we require the full cooperation of every employee of the Corps of Engineers, and we invite the participation of all other concerned Americans.²⁵

As the environmental guidelines were produced, the Corps also created a new organization to assist the Chief of Engineers: the Environmental Advisory Board. As early as 1967, Tofani and Aggerholm had proposed the establishment of such a board. With passage of NEPA, creation of an advisory board attained higher priority. Clarke established the Environmental Advisory Board on 2 April 1970.²⁶ Members of the Institute were primarily responsible for the selection of six distinguished environmental experts: Lynton Caldwell, professor of political science at Indiana University; Roland Clement, vice president of the Audubon Society; Charles Foster, member of the New England Natural Resources Center; Harold Gilliam, newspaper reporter and environmental author; Richard Pough, chairman of the Open Space Action Institute; and Charles Stoddard, former director of the Bureau of Land Management. Each of these individuals had sharply criticized the Corps. Yet members of IWR sensed this as an opportunity to help the Corps' environmental planning and, given the board's composition, to improve the agency's performance regarding environmental quality. The Corps was the first and at that time the only federal agency to have created such an organization.²⁷

The Institute's assistance in setting environmental policy for the Corps expanded through the early 1970s. Quickly endorsed by Clarke, the Institute-produced Environmental Guidelines reappeared as ER 1165-2-500. The guidelines appeared in the 1970, 1971, and 1972 Reports on Civil Works.²⁸ The Institute's commitment to environmental quality gave it greater recognition as the environmental guidelines circulated through all Corps divisions and districts with civil works activities.

Field acceptance of the new environmental initiatives is difficult to assess. The Corps' decentralized organization undoubtedly contributed to an uneven acceptance of NEPA and of IWR's interpretation of how the Corps should implement the law. While some districts--such as Seattle and San Francisco, which had implemented a broad participatory program called "fishbowl planning"--were actually ahead of all federal responses to NEPA, other districts had more traditional civilian leadership in their engineering and planning divisions. Some military leaders in OCE, including Generals Clarke and Cassidy, recalled that the deepest resistance to implementing NEPA emanated from civilian members whose field operating agencies were located in regions where environmental activism was low, such as the South.²⁹ That the directives emanated from a new, Washington, DC-based group of mostly social scientists increased the resistance to environmental redirection.³⁰

The attitudes of Corps personnel regarding the environment, interdisciplinary planning, and nonstructural solutions to flood control greatly concerned those who wanted to see the agency change. In 1971, Colonel Richard L. Hunt, chief of the OCE Public Affairs Office, made a speech suggesting that the Corps needed to resist change by calling on its friends in Congress, construction companies, and "community elements" for support of the traditional civil works method. Hunt's unauthorized action angered Clarke and the Environmental Advisory Board.³¹ Partly in response, Clarke directed IWR to conduct "consciousness-raising seminars" on environmental quality for Corps personnel. From 28 June through 1 July 1971, the Institute sponsored an agency-wide Civil Works Environmental Planning Conference that included top civil works personnel

from headquarters and the field. The primary purpose of the conference was to dispel ideas that environmental quality issues were unimportant and to reiterate that the Chief of Engineers wanted the Corps' response to NEPA "to be reflected in deeds as well as words."³²

As the Corps and other federal agencies struggled with NEPA and the EIS requirement, the Institute became involved in the evaluation of field reports. Environmental groups had quickly discovered that NEPA provided an opportunity to challenge federal projects in court. During the first ten months of 1971, environmental groups had successfully used NEPA to gain injunctions against three major Corps projects: Gillham Dam, the Cross-Florida Barge Canal, and the Tennessee-Tombigbee Waterway. Moreover, the list of halted projects was growing.³³ The agency's leaders began to recognize that successful legal challenges to projects often depended on the quality of Corps' environmental impact statements. Meanwhile, the number of people in the Corps who believed NEPA was a fad was diminishing.

Identifying shortcomings in the EIS was the usual method of forcing the Corps to comply with NEPA. IWR EISs attempted to improve Corps efforts by evaluating Corps EISs occasionally with assistance from academics. By the end of fiscal year 1972, the Corps had produced approximately 750 environmental impact statements and filed them with the Council for Environmental Quality.³⁴ During that year, the director of civil works assigned the task of evaluating the "first generation" of Corps EISs to IWR's center for advanced planning. The Institute retained the services of two Stanford University planning professors, Leonard Ortolano and William Hall, to analyze the quality of 234

Corps EISs. The statements came from Corps district offices across the nation, and concerned construction activities ranging from dredging and spoil deposition to river channelization, dams, and reservoirs. The Institute published the results of the study as IWR Report 73-3, Analyzing the Environmental Impact of Water Projects. The report identified various weaknesses common to the early statements, including a layering of highly technical data that seemed to obstruct public insight rather than promote it. The authors also outlined eight major steps for improving EIS quality, including a response to the most basic criticism: "the need to discuss alternatives to the proposed action in more detail."³⁵

Early responses by the Corps to NEPA and other environmental initiatives were among the strongest by any federal agency. Considering the developmental tradition of the civil works program, the strong response was surprising. In part it has to do with the military-civilian hybrid that is the Corps. Under Chiefs of Engineers Cassidy and Clarke, compliance with NEPA took the form of orders to field military personnel, who, with military efficiency, transferred the directives to the planning divisions. Clarke took advantage of the multidisciplinary experience in IWR to develop his environmental directives.³⁶ While the early response was incomplete and the overall impact of environmental quality concerns on the civil works program debatable, the agency's efforts lent credence to the viewpoint that the Corps was changing, and that IWR had contributed to the changes.

The Emergence of Public Involvement

Closely associated with IWR's efforts to promote environmental quality was the effort to engage the public in civil works planning. In June 1970, General Clarke announced that the Corps would "encourage as broad public and private participation as practical in defining environmental objectives and in eliciting viewpoints of what the public wants and expects as well as what it is projected to need."³⁷ The Institute for Water Resources provided substantial support to public involvement (also called public participation). To evaluate the Corps' efforts in public involvement, IWR examined the Susquehanna study being conducted by the Baltimore District. Authorized by Congress in 1961 and begun in 1966, the study applied concepts of multiobjective planning, including national economic efficiency, regional development, and environmental quality, to a particular region of the nation, specifically to the largest river basin on the Atlantic coast. The study was in its fifth year when OCE and the Baltimore District decided to significantly expand public information and participation. Therefore, the Susquehanna study became the prototype for public involvement techniques throughout the Corps.³⁸

Some principal objectives of the Susquehanna study were to develop alternative strategies for increasing public involvement and to incorporate public preferences and suggestions into plans for present and future water resources needs.³⁹ The IWR evaluation actually began in July 1968, when the OCE policy and analysis division contracted the work to the Environmental Simulation Laboratory and the Institute for Social Research at the University of Michigan. With the establishment of IWR, the center for advanced

planning took over management of the University of Michigan research.

As the Susquehanna study continued, the researchers observed the public participation process in action, including public hearings, meetings, and workshops. The study, entitled The Susquehanna Communication-Participation Study: Selected Approaches to Public Involvement in Water Resources Planning, completed in December 1970, included interviews with local residents, questionnaire results, and survey analyses to assess the effectiveness of the methods used in a five-county sample area of New York and Pennsylvania.⁴⁰ The researchers concluded that residents had become highly sensitized to development of any kind in their area in the wake of 1960s activism and NEPA. Extensive public involvement could result in a smooth planning process and an acceptable project just as certainly as an absence of public involvement could mire projects in litigation and earn the developer the enmity of local residents. The researchers found that the methods applied in the Susquehanna study, especially the Corps' convening of public workshops and forums regarding potential water resources developments, were "groundbreaking" and highly effective.⁴¹

Although these findings might seem obvious with two decades of hindsight, it is important to remember that the very concept of public involvement was new to federal engineering organizations like the Corps until the late 1960s. Water projects were often driven by congressional advocates and local promoters and had minimal public involvement during planning. To the observers of Susquehanna, then, the impact of public participation was indeed educational. Water resources professionals also were

impressed by the impact of public involvement during the study. When the Water Resources Council reviewed the Susquehanna study late in 1970, even former critics praised the Corps' approach and commitment to public involvement. Gilbert F. White, the geographer who had taken the Corps to task for its flood control practices, stated that Susquehanna was "a genuinely pioneering effort. More power to it. Here it seems the Corps is taking a leadership role for which the rest of the water planning establishment should be grateful."⁴²

In the same month the Susquehanna Communication-Participation study was published, IWR published a second report entitled Public Participation in Water Resources Planning. The production of this report illustrates IWR's early efforts to seek out expertise and recruit new members. Members of the Institute learned about a thesis written by Captain A. Bruce Bishop, a Stanford University graduate student and a U.S. Army officer. Bishop had written the thesis for the California Department of Highways and the Bureau of Public Roads concerning socioeconomic and community factors in planning urban freeways. The IWR staff found strong parallels between planning urban freeways and developing water resources and recruited Bishop to work at IWR. Bishop completed his active assignment in residence at IWR while working on a public involvement report. He likened freeway construction to water resources development and identified several different public groups, or "publics," involved in any water resources plan. "To communicate with the publics," he wrote, "will require a well-planned program for identifying concerned local interests, for discovering and understanding perceptions of needs, and for opening of avenues for direct

planner-public communications."⁴³ Bishop's report served as blueprint for IWR's developing public involvement program.

IWR's discovery of Bishop at Stanford was no mere coincidence. The Corps of Engineers' association with Stanford dated back to the late 1960s, when the university was one of three chosen for a federal government employees' fellowship program. The primary purpose of this program was to train a select group of federal employees to help their organizations implement the PPBS for bringing rational, demand-based budgeting to federal spending.⁴⁴ The Corps selected a few employees with civil engineering graduate credentials for one-year fellowships.

Another initiative bringing the Corps in contact with Stanford was the planning fellowship program developed in the office of policy and analysis. The Corps selected employees in civil works who had graduate-level credentials to take courses in planning and related topics at four universities: Cornell, Georgia Tech, Wisconsin, and Stanford.⁴⁵ Before IWR's establishment, David Aggerholm of the office of policy and analysis had oversight responsibilities for the planning fellowship program. Those responsibilities transferred to IWR when he did. On several occasions, Aggerholm and IWR Technical Director Burnham Dodge traveled to Stanford to talk to Corps trainees about the agency's purposes in creating the program.⁴⁶ There they met Bishop and other trainees who they hoped to bring to the Institute. In 1970 and 1971, three civil engineers with graduate credentials--Richard McDonald from the St. Paul District, James R. Hanchey from the New Orleans District, and Patrick Johnson, who had recently completed his doctoral degree in engineering--came from Stanford to work at IWR.⁴⁷

Public involvement techniques were among the planning skills these individuals brought to the Institute. Building on the Susquehanna work and the Bishop report, IWR also drew upon evolving academic research in public involvement and communications. Late in 1970, IWR developed a course and conference in conjunction with the Georgia Institute of Technology Environmental Resources Center on communication with the public during planning. The week-long conference, held in Atlanta in February 1971, included chiefs of planning and public affairs from all field divisions and districts with civil works activities. General Clarke, in addressing the group, underscored his commitment by stating, "I consider public participation of critical importance to the Corps' effectiveness as a public servant."⁴⁸ The training sessions stressed the need for efficient use of the media to increase public knowledge, the potential of computerization for disseminating information, and the importance of making communication a continuous two-way process throughout planning.⁴⁹

With Clarke's support, IWR sought to make public participation commonly and universally practiced in Corps civil works planning. Clarke directed IWR to prepare a manual on public participation and made the Institute primarily responsible for implementing the program throughout the agency. In May 1971, OCE distributed the IWR-prepared Engineer Circular 1165-2-100 on public participation in water resources planning.⁵⁰ At the same time, IWR initiated a Technical Assistance Program (TAP) to support public participation in the field. The Institute formed consulting teams to provide 13 districts and 2 divisions with assistance in improving public participation techniques. David Aggerholm and James R. Hanchey

directed the consultants, who included one IWR employee, Bruce Bishop, and seven contractors. While there were some successes in TAP, most of consultants met with resistance to developing more effective public participation programs.⁵¹ Some field personnel were openly opposed to allowing laypersons with no technical knowledge into the planning process. To them, the public was an impediment to the civil works mission. Moreover, public participation was still in its formative stages, and its implementation was still elusive.

In another attempt to evaluate public participation techniques, IWR members looked to ongoing water resources planning activities around the nation. Two studies they examined were the Puget Sound and Adjacent Waters Study in the Seattle District and a floodplain management study in the Walla Walla District. In 1972, IWR published a report on the Puget Sound study. A task force of the Pacific Northwest River Basins Commission had undertaken the six-year study and had encouraged little public involvement. As the study neared completion, public response was predominantly negative. After a series of public workshops was held, however, public opinion of the study improved. The IWR report supported the argument that people who live near proposed water resources developments wanted more extensive information about agency plans and wanted involvement early in the planning process. The broad objectives of the study called for diverse water developments that would not degrade the environment. Increased public involvement helped planners to explain the complexities of the plan. The approach challenged the predominant technocratic planning practices that gave minimal attention to public views.⁵²

Beginning in 1973, IWR sponsored a series of training programs to improve public involvement techniques in field offices. The courses, taught by consultants, developed practical communications skills and identified various public values. Beginning in the same year, IWR worked with Leonard Ortolano of Stanford University in developing the "open-iterative planning process," including four main planning activities: identification of concerns, formulation of alternatives, impact analysis, and plan ranking.⁵³ By the mid-1970s, this process had become standard policy for Corps divisions and districts.⁵⁴ Through studies, technical assistance, and training programs, the Institute for Water Resources significantly influenced this evolving methodology.

Urban Studies

Increased public involvement resulted partly from a concurrent Corps of Engineers program: urban studies. The Corps' urban studies program began in response to demands for better wastewater and stormwater management in cities. Inadequate wastewater treatment and the water pollution it often caused confronted most American cities by the 1960s. Dating back to the Water Pollution Control Act of 1948, the federal government had comprehensively investigated pollution control programs. The Water Quality Act of 1965 directed federal resource agencies to develop plans for wastewater treatment.⁵⁵

Many in the Corps believed the agency should make water quality another principal water resources mission. In response, the civil works directorate began examining approaches to wastewater management. One was an

innovative plan developed by John R. Sheaffer. Sheaffer, who had studied under Gilbert White, was a professor in the University of Chicago Center for Urban Studies on loan as scientific advisor on the staff of the Secretary of the Army's Office of Civil Functions, the predecessor of the Office of the Assistant Secretary of the Army, Civil Works. His plan called for agricultural areas to be sprayed with partially treated urban wastewater that would filter through the soil. This would reduce the need for building expensive secondary and tertiary treatment plants advocated by the newly created Environmental Protection Agency (EPA) in its efforts to attain zero effluent.⁵⁶ Wastewater management could be coordinated with stormwater runoff programs (urban flood control). As pressure increased on the Corps to look at solutions other than structural for urban flood prevention, the agency recognized that each urban water problem could be better managed through comprehensive solutions.⁵⁷

As a result of these efforts, the urban studies program began officially in 1972. By then, the Corps already had five pilot studies under way. Congress and environmental groups were generally favorable to the Corps' urban study solution. The Corps planned to divert stormwater away from wastewater treatment plants, reducing the need to increase capacity and thereby saving money. In the first year of the program, the Corps initiated nine comprehensive studies around the nation; by 1974, there were 29 studies planned or conducted.⁵⁸

The Institute for Water Resources had been involved in the urban studies program since 1971. Members of the urban study team in OCE, including consultant Gilbert White, made IWR the principal consultant for the planning

and public involvement components of the studies. IWR used the opportunity to instruct field personnel about publicity for urban studies. The popularity of the program in district planning offices encouraged publicity and thereby allowed IWR-generated planning and public involvement initiatives to filter down into the field along with urban studies' directives. Providing assistance to the urban studies program brought additional interdisciplinary planning techniques to the Corps at large in the 1970s.⁵⁹

Social Impact Assessment

In 1970, Congress passed an Omnibus Water Resources Act. Included in the act were Title I: the River and Harbor Act, and Title II: the Flood Control Act of 1970. Provisions of the Flood Control Act concerned the economic, social, and environmental impacts of water resources developments, and IWR quickly became involved in interpreting the law. Of particular concern was section 122 of the River and Harbor Act, which called for the Secretary of the Army to "promulgate guidelines to assure that possible adverse economic, social and environmental effects relating to any proposed project have been fully considered in developing such project, and that the final decisions on the project are made in the best overall public interest, taking into consideration the need for flood control, navigation and associated purposes, and the cost of eliminating or minimizing such adverse effects."⁶⁰ Section 122 also required projects to promote community cohesion, thus calling upon the expertise of sociologists.⁶¹

Section 209 of the Flood Control Act had even more far-reaching considerations. The provision stated that federal

water resources project objectives included regional economic development, quality of the total environment, well-being of the people, and national economic development. Such considerations were to accompany planning and evaluation of all federally financed water resources developments.⁶² The provisions in the two acts were the culmination of post-World War II efforts to improve federal water resources planning. The new considerations elevated economic analysis, social impact, regional and national planning, and finally environmental concerns to new levels of importance, and went well beyond the multiple purpose and interagency standards of the 1962 Senate Document 97.⁶³ Advocates of these provisions included members of Congress interested in regional development of impoverished areas, environmental groups, and academics. For those concerned with regional development, social impact could prove an important benefit criterion for projects; for environmental groups opposed to development, there would be more legal obstacles in the way of a project; and for academics, the new laws required social science to be incorporated into the planning process.⁶⁴

The staff of IWR assisted the civil works directorate in developing guidelines for section 122 of the River and Harbor Act and meanwhile began to address the issues involved in determining how to evaluate social concerns, national economic development, and what eventually became known as "social impact assessment."⁶⁵ Researchers at IWR found many parallels between public involvement and social impact assessment. Social impact assessment called on the expertise of several disciplines, including sociology, anthropology, economics, and water resources planning. Staff members developing public participation

techniques, including Aggerholm and Hanchey, also coordinated social impact assessment. They often required the services of economists in IWR for statistical and analytical methodologies for social impact assessment.⁶⁶ The collaboration was an indicator of things to come as the interdisciplinary skills housed in the Institute increased. Some of the early social impact assessment studies illustrate this point. In July 1971, IWR published An Information System for Improving the Evaluation of Non-marketed Outputs. The report drew on the economic, sociological, and planning skills of IWR to explore a range of environmental and social impacts not generally evaluated in dollar terms.⁶⁷

Because the Institute had no more than 12 professionals in its first 3 years of existence (and only one sociologist, Charles Wolfe), it became necessary to bring in outside consultants to undertake parts of the social impact work. Drawing upon outside expertise was part of the IWR mission, and it looked nationwide for the best talent in sociological research. One of many examples of contracted-out work was A River, a Region, and a Research Problem, published in July 1971. The authors of the report, Charles L. Leven and R.B. Read of the Institute for Urban and Regional Studies at Washington University in Saint Louis, had written IWR's first report, Development Benefits of Water Resources Investments. Following up on that work, they conducted an "ex-post evaluation study" of the McClellan-Kerr Arkansas River Multipurpose Project completed in Oklahoma and Arkansas in the 1971.⁶⁸ "The problem," they wrote, "was to lay out the kind of research effort which should be undertaken by the Corps . . . if they are to 'learn' from the experience of the Arkansas River Development Project."⁶⁹ The study examined economic

modeling methods for evaluating a "with" and "without" project condition, as well as exploring ways to analyze social, political, and environmental impacts.⁷⁰ IWR would continue to promote postconstruction studies as a tangible method of assessing social impact and evaluating the actual benefits of a project compared with planning forecasts.

Concurrent with this study was another report being prepared for IWR by members of the Ohio River Division. In supporting the study, IWR responded to a Water Resources Council request for better techniques to assess "social well-being." The Institute drew upon work already under way in the Ohio River Division economics branch, and eventually published Quality of Life and Income Redistribution: Objectives for Water Resources Planning.⁷¹ The report assessed two measures of impact, quality of life and income redistribution, in terms of net gain or loss as a result of a project. The test case was an urban flood control project in the division. The method provided the Corps with another way to evaluate social impact, and its primary developer, Michael Krouse, an economist with the Ohio River Division, joined IWR in the following year.⁷²

Through such studies, IWR refined social impact analysis using an interdisciplinary team to explore the social and cultural significance of water resources development. "The definition of the 'social and cultural' considerations to be included in Corps planning," stated the 1972 IWR Annual Report, "is the first step in proper assessment of changes in social and cultural patterns which might result from a civil works project."⁷³ As the Corps' social impact assessment work broadened, IWR contracted with leading water resource planners and sociologists in academe, including Evan Vlachos of the Colorado State University

Water Resources Program. Vlachos coordinated a team of six researchers, including IWR's second sociologist, Magoroh Maruyama (then at Portland State University). The team completed "Social Impact Assessment: An Overview," published as an IWR paper in December 1975. The overview stressed the need for an interdisciplinary approach to incorporate social sciences into the Corps' planning. From the standpoint of social scientists, engineers built projects to solve or alleviate specific problems or to provide specific benefits. Rarely did they consider the social and cultural impact such projects might have on nearby communities. A flood control project, for example, could reduce flood risks in a certain area and encourage settlement there. At the same time, the project could economically depress a less protected area. These were the kind of considerations social scientists wanted to bring to Corps planning. However, the report acknowledged the difficulty of this endeavor when it stated, "The problem of social impact assessment is elusive, the language by necessity is often obscure, the argument occasionally tortuous, and the conclusions rather evasive."⁷⁴

The difficulty of incorporating social impact assessment into the planning during the 1970s would support this statement, as the civil works directorate struggled to meet the mandates of Congress. Assessing social impact involved a broad range of considerations but essentially sought to resolve disputes between increasing numbers of people who wanted to stop water resources projects and civil engineers who wanted to build them.

Regional and National Navigation Analysis

During the late 1960s, the civil works directorate of headquarters had contracted several studies still incomplete by the time of IWR's establishment.⁷⁵ When the Institute began operations, it became the coordinator and publisher of most of these studies, the majority of which were regional or national in scope. The McClellan-Kerr report completed in 1971 was one such study. Another was IWR Report 70-4, Cost-Benefit Analysis for Inland Navigation Improvements, a three-volume study by Northwestern University researchers that employed statistical sampling techniques to forecast traffic and commodity activity on the nation's waterways. Another extensive series of reports concerned the deepwater ports of the United States. In 1971, IWR had produced a three-volume study of various foreign governments' decision criteria for building deepwater ports, and this report provided the conceptual framework for the U.S. study.⁷⁶

In August 1972, the Institute published the five-volume national port study. After surveying the condition of the nation's major deepwater ports, the researchers analyzed commodity flows and future projections, the physical characteristics of ports, environmental and ecological impacts of ports, and various benefit-cost relationships involved in waterborne transportation.⁷⁷ They also analyzed the need for additional deepwater ports--able to accommodate supertankers and cargo vessels--on the Atlantic, Pacific, and the Gulf of Mexico. Although they examined several commodities, the researchers concentrated on crude petroleum as the most important import entering the nation's ports. Anticipating the energy crisis of the mid-1970s, the report predicted a vast increase in petroleum

imports by the year 2000 and argued that supertanker transport could result in an almost 50 percent cost saving over smaller vessels. Such vessels, however, drafted 60 to 70 feet fully loaded, and few domestic ports could accommodate them. The report contended that it would be impractical to dredge most harbors to such depths, and instead found large benefit-cost estimates for building regional deepwater ports near major refineries.⁷⁸ In addition, the report examined dry bulk commodity transport, use of restricted-draft vessels, and the environmental hazards of shipping petroleum by supertanker.⁷⁹

Like many long-range economic forecasts, IWR's early navigation studies were based on existing information. Researchers used the best economic evaluation techniques to gain a clearer picture of the current situation. Also like other forecasters, the researchers made their best predictions of the future. At that time, it appeared probable that petroleum imports would soar, that barge transport would carry much of the inland-produced petroleum, and that energy costs would continue to rise. The need for the level of improvements in deepwater ports and inland waterways outlined in these forecasts declined as economic conditions changed.

With earlier studies of the benefits and costs of inland navigation improvements, which were completed in 1970-71, and comparative analyses of various inland transportation modes, the Institute was developing expertise in each component of the navigation system.⁸⁰

With completion of deepwater port and inland navigation studies, IWR had developed a comparative framework for a comprehensive systems approach regarding the nation's waterways and ports.

New Federal Water Resources Mandates

As the 1970s progressed, the political forces changing water resources development practices continued to produce new studies, guidance, and legislation. Three items, the report of the National Water Commission, issued in June 1973, the Principles and Standards for Planning of Water and Related Land Resources (the product of the Water Resources Council) issued in September 1973, and the Water Resources Development Act of 1974, each significantly influenced the Corps of Engineers and the Institute for Water Resources.⁸¹ Congress had authorized the establishment of the National Water Commission in 1968 in response to water rights disputes in the Colorado River basin. The legislation stipulated that commission members not be associated with federal agencies. The commission's 1973 report stressed the need to reduce federal involvement in water projects that had limited regional or local benefits. Such projects, the report argued, should be directed toward the appropriate river basin commission, and the Corps' engineering expertise should be used for major water projects.⁸² The Corps leadership interpreted the National Water Commission report as a signal to reduce the federal role in water resources development.⁸³

Only two months later came the issuance of the Principles and Standards for Planning of Water and Related Land Resources. Reflecting the fiscal conservatism of the successor to the Bureau of the Budget, the Office of Management and Budget, the Principles and Standards made national economic development and environmental quality the two mandated criteria for project consideration. In addition, the Principles and Standards raised the discount rate for federal agencies in developing benefit-cost estimates

of proposed projects.⁸⁴ The other two objectives listed in section 209 of the 1970 Flood Control Act, regional economic development and the well-being of the people of the United States, were not mandated in the Principles and Standards. By making environmental quality an equal consideration with national economic development, the new guidelines made it more difficult to justify large, expensive water resources projects. The higher discount rate eliminated many marginal projects from consideration.⁸⁵ Budget cutters and environmental groups celebrated. The Principles and Standards presented new challenges to the Corps' water resources planning and ipso facto, to IWR.

Many in Congress were unhappy with the Principles and Standards. By reducing the significance given to social well-being and regional economic development, the Principles and Standards negated what the legislators had written into the 1970 Flood Control Act. In response, Congress reiterated these objectives in the Water Resources Development Act of 1974, which stated in section 80c that planning and evaluation of projects should include "consideration of enhancing regional economic development, the quality of the total environment, the well-being of the people of the United States, and the national economic development."⁸⁶ Section 73 of the act had still more impact on federal water resources planning. It stated that:

consideration shall be given nonstructural alternatives to prevent or reduce flood damages including, but not limited to, floodproofing of structures; flood plain regulation; acquisition of flood plain lands for recreational, fish and wildlife, and other public purposes; and relocation with a view toward formulating the most

economically, socially, and environmentally acceptable means of reducing or preventing flood damages.⁸⁷

In addition to these provisions, the Water Resources Development Act of 1974 directed the Water Resources Council to reexamine the Principles and Standards of 1973. In November 1975, the council published a revised study clarifying the Principles and Standards to emphasize water conservation and the need for at least one nonstructural plan in the alternatives to a project.⁸⁸ Like the reports and legislation above, these new guidelines served to make the Corps planning still more complex. What criteria to consider, what weight to give each account, and how to interpret each new directive were questions that often defied solutions.

The Flood Control Challenge

Since its establishment, the Institute for Water Resources had been working on solutions to Corps planning problems, including environmental quality assessment, public involvement, social impact assessment, and regional economic development. Much additional work concerned improving the Corps' flood control evaluation. Attempts to improve the economic analysis of flood damage reduction benefits in regard to national income originated in the economics branch of OCE during the late 1960s. They were transferred to IWR's center for economic studies. One study used a land valuation methodology to estimate benefits accruing to agricultural lands from flood control projects.⁸⁹ In a more extensive study completed in 1971, IWR developed a method to estimate the potential loss in

agricultural production that would occur in the absence of flood control works.⁹⁰

From these initial studies, an expanded and ongoing flood control evaluation program began at the Institute. Members of the center for economic studies assembled the developing work of water resources professionals on structural flood control technology, the national flood insurance program, and the continuing research of Gilbert White and others on floodplain management. An early study, conducted by the Menlo Park, California, consulting firm, INTASA, was published as IWR Report 70-3. The study addressed the problem of calculating "land enhancement" impact where flood protection projects encouraged development and the economic consequences of programs designed to protect or manage floodplains.⁹¹

Building on pilot work in the economics branch of OCE, the Institute also began exploring the possibility of using computers to assist in the time-consuming, expensive, and cumbersome task of measuring flood damages and benefits. In 1972 and 1973, the Institute published reports using computer modeling to simulate floodplain development through contracts with INTASA. The first phase of the study identified variables influencing flood control decisions, and the second phase developed a computer model called the SIMULATOR to assist in evaluating national economic benefits derived from flood protection works.⁹² The Institute also sponsored academic research that resulted in papers on computer modeling for floodplain management in 1974.⁹³ When nonstructural alternatives became a requirement, IWR assisted in developing guidelines for the field. Working closely with districts, divisions, and OCE, the Institute was building the

conceptual, analytical, and computational framework to assist the Corps in addressing the nonstructural alternative requirement and other issues regarding flood control.

Toward Reorganization

In retrospect, it appears that the Institute for Water Resources was ably fulfilling its mission tasks with only a handful of professional and support staff during its early years. By 1975, the professional staff had grown to 12 full-time employees: David Aggerholm, an environmental planner; economists George Antle, Robert Harrison, Michael Krouse, Brion Sasaki, James Tang, and Ralph Trisko; civil engineers James Hanchey, Patrick Johnson, and Richard McDonald; a geographer, Howard Olson; and a sociologist, Charles Wolfe.⁹⁴ Publications--which by 1975 were categorized into research reports (staff produced), contract reports, pamphlets, and papers--totaled almost 100 in less than six years. Members of the Institute had delivered papers and attended science, engineering, planning, and environmental conferences across the nation and internationally and had achieved recognition from academic and professional societies. They had also organized and conducted dozens of professional seminars to help the Corps improve communication with academe and professional societies, while striving to bring new planning methodologies into the agency.⁹⁵

Based on the 1969 mission statement for IWR, one would conclude that the organization was doing its job well. Such a favorable perception, however, was not universally accepted throughout the Corps. For a variety of reasons, some members of the agency in field offices and in

headquarters took a dim view of IWR's first 5 years of operation. The nature of IWR's products caused some of the discontent. Guidelines for environmental quality, public involvement, and social impact assessment were not endorsed by Corps employees who disagreed with those objectives. The fact that the directives were coming from an organization composed mostly of social scientists in Washington, DC, only made them less well received.⁹⁶

Another source of discontent among headquarters and field offices focused on IWR's role as a liaison with "educational institutions and non-public groups."⁹⁷ While many of IWR's reports and papers were entirely relevant to evolving planning methodologies, others--mainly those contracted out to university professors--were highly academic and often esoteric in nature. With the establishment of the Institute, the director of civil works appointed an IWR advisory board to monitor the organization. Members included Joseph Tofani, chief of the policy and analysis division; Irwin Reisler, chief of engineering; Augustus Smet, chief of programs; Harry Schwarz, chief of the civil works research and development program; and the deputy director of civil works, Brigadier General Richard H. Groves. Some members strongly criticized the academic orientation of some IWR reports. The board began meeting monthly in 1971 with Institute staff members and reviewed IWR's activities through quarterly contract progress reports. Study titles that were clearly academic in nature quickly became an issue. Board members who supported IWR's establishment grew defensive as critics questioned the practicality of the academic reports. Those who had not favored the Institute's establishment soon felt vindicated in their skepticism about its ability to help the Corps.⁹⁸

The field response to some of IWR's academic reports was negative. From the field came the moniker "yellow perils," describing some of the early yellow-paper-bound IWR reports.⁹⁹ Field personnel who reviewed certain IWR reports frequently doubted their effectiveness or applicability to planning problems and found them difficult to understand. But this was not surprising, since IWR often had to rely upon academicians accustomed to writing for an audience of sociological, planning, or economic specialists. Many resulting studies were written with academicians rather than the Corps in mind, and as such had wide acceptance and impact outside the agency. Some of IWR's studies examined not only the future of the Corps but also the future of American society. Yet the acceptance of IWR reports among academics and outside professionals did little to silence internal criticism of the Institute's work.¹⁰⁰

IWR's association with universities through seminars and training became a contentious issue as well. University-sponsored seminars such as the environmental planning conference at Georgia Tech in 1971, the Institute's connection with Stanford University in training, and the need to contract work to academics all strengthened IWR's relationship with higher education. The civil works directorate further strengthened IWR's academic ties when, in 1970, it transferred the Corps' professional development function from headquarters to IWR.¹⁰¹

By necessity, professional development involved close ties with universities. It became the Institute's role to administer long-term education, organize training and experience requirements for planners, design career ladders to evaluate Corps' employees who had received additional education, and develop a comprehensive planning education

program for the agency. IWR participated in the Board of Engineers for Rivers and Harbors-directed planning associates program, an 11-month course for Corps planners. The Institute oversaw the planning fellowship program offering a 12-month scholarship at five selected universities across the nation, as well as a similar planning specialist program for year-long study at any accredited academic institution. Both programs were designed to bring academic planning expertise into the Corps. Working in conjunction with BERH, the Institute conducted various short-term training programs, including 1- or 2-week courses in public involvement, planner orientation, district engineer orientation, hydrologic engineering (presented by the Hydrological Engineering Center (HEC) at Davis, California), impact assessment, and urban studies orientation. Meanwhile, IWR sponsored a wide variety of seminars, many in conjunction with universities, on economic methodologies, computer modeling, social impact assessment, aesthetics, inland navigation, industrial water supply, and public involvement.¹⁰²

Such visibility was a mixed blessing for the Institute. The increased contact with academic and professional groups undoubtedly brought more interdisciplinary expertise into IWR and the Corps. Academic and professional awareness of IWR's work significantly contributed to several favorable evaluations of the changing agency. In "Tradition Be Damned! The Army Corps of Engineers is Changing," a 1975 article by Daniel Mazmanian and Mordecai Lee in Public Administration Review, the authors cite IWR-assisted initiatives such as urban studies, establishment of the Environmental Advisory Board, and public involvement as prime examples of the new Corps.¹⁰³ But the accolades of

academics did not quiet criticism from those who questioned the value of interdisciplinary planning and wondered for whom IWR really worked.

Another factor adding to animosity in headquarters concerned facilities. By 1973, the Institute had moved from its small offices on North Washington Street in Alexandria (and a short time in another office in that community) to the Kingman Building at Fort Belvoir Military Reservation. The Kingman Building, situated in a forested area of Belvoir, was a new, modern facility, with large conference rooms and outdoor terraces. The new setting gave the Institute the opportunity to hold large seminars, training sessions, and conferences. Moreover, IWR was now even further removed from OCE, physically and perhaps psychologically. Many in headquarters, then located in the Forrestal Building in downtown Washington, DC, took a dim view of IWR's favored location.¹⁰⁴

Matrix Management

The unusual management structure of the Institute was another area of contention. The organization had begun with two operating arms: the centers for advanced planning and economic studies. Each center had two divisions: long-range planning and planning procedures, and research and evaluation and advanced economic studies. IWR had a military director, the deputy director of civil works, and the director of the center for advanced planning also served as technical director.¹⁰⁵ This structure underwent several changes during the early 1970s. In May 1971, Nathaniel Back, director of the center for economic studies, retired, and was succeeded by Robert Harrison.¹⁰⁶ Three years later,

Burnham Dodge, technical director and director of the center for advanced planning, retired. After Dodge's retirement, technical direction fell to Harrison, who had had a long career with the Economic Research Service of the Department of Agriculture before joining the Corps of Engineers. By this time the two centers had no divisions, since there were not enough permanent personnel to justify the additional substructure.¹⁰⁷

The military directorship of IWR also underwent changes. The first three military directors, Richard H. Groves, Kenneth B. Cooper, and James L. Kelly, were brigadier generals and deputy directors of civil works. While Groves had considerable impact in assigning in-house personnel to direct consultant research, each successive military director had fewer day-to-day dealings with the Institute. Deputy directors in residence were colonels.¹⁰⁸ The first was Colonel Lee Crosby, who was succeeded in 1971 by Colonel Richard J. Batson. In October 1973, OCE changed this policy to make the colonel-in-residence the director of IWR. The first was Colonel Charles O. Eschelman, a Vietnam veteran and graduate of Arthur Maass's Harvard Water Program.¹⁰⁹

The cumulative effect of these personnel and structural changes was the creation of a loosely based or "matrix management" style for IWR. From its beginnings, the Institute's work had spanned its centers, drawing upon the expertise of the whole organization to address specific problems.¹¹⁰ IWR's loosely based, crossover structure stood in contrast to the clearly defined hierarchy of headquarters, divisions, and districts.

As change agents of the Corps, IWR members worked well under such a management structure, and the

organization encouraged a sense of independence. IWR's business cards of the early 1970s, for example, did display the Corps' castle in the upper lefthand corner, but nowhere on them did "U.S. Army Corps of Engineers" appear.¹¹¹ Most people who came to work at the Institute were comfortable with its way of doing business. They usually did not desire to manage or to be managed, but instead to do research and long-range planning for the agency. However, the operation of IWR could not escape scrutiny, and the severest critics were among those in OCE who had promoted its establishment. Joseph Tofani complained frequently about aspects of the Institute's operations in the early 1970s. For example, Tofani nicknamed IWR "the Country Club" and argued that some of its leaders "only wanted to go to school and rub elbows with academics."¹¹² This critique was understandable given the tenor of the times. Between the late 1960s and the mid-1970s, the Corps of Engineers' civil works program was barraged by new, confusing, and vague legislation and directives as well as blistering criticism. Leaders in OCE like Tofani had long believed that an organization such as IWR would be able to provide timely and immediately applicable answers to complex and often intractable problems of water resources planning. When social, environmental, and macroeconomic considerations also became part of the planning agenda and the Corps' prestige and credibility were at stake, many looked to IWR for fast action. When the solutions did not come quickly enough, the operational style of IWR became an immediate target for criticism.

Regardless of the validity of OCE criticism, each meeting of the IWR advisory board grew more contentious after 1971. The appointment of a colonel-in-residence to

direct IWR in October 1973 was one step the board took to bring more OCE control over the Institute. A far more sweeping action was a general redirection of IWR beginning in 1974. Pivotal in this initiative was Major General John W. Morris. In 1972, Morris succeeded General Koisch as director of civil works. Before taking this position, he had been deputy district engineer in Savannah, district engineer in Tulsa, and division engineer for the Missouri River Division.¹¹³ Morris therefore arrived with extensive knowledge of civil works at the district and division levels and with definite opinions about how headquarters could better serve the field. He agreed with Tofani that IWR was not providing enough service to the field.

In August 1973, Morris dispatched a memorandum to the civil works research and development board, which included all division chiefs in the civil works directorate. "I have decided," he wrote, "to broaden the base of IWR's functions to make it an extension of Director's [Civil Works] management and policy-making capability."¹¹⁴ Attached were 34 one-page problem statements and an explanation memorandum from Tofani, then chief of policy. The chiefs were asked to rate each statement for relevance to Corps needs and for applicability to IWR's capabilities. The problem statements covered a wide variety of tasks, ranging from flood control and management, to sewage abatement from oceangoing vessels, to wetlands protection. While several of the problem statements concerned issues that already involved IWR, such as public involvement and inland navigation, others applied to making the Institute work on more urgent problems.¹¹⁵

The Research and Development Directorate and IWR

General Morris recognized IWR's value to the civil works directorate. He also recognized that the Institute might soon be transferred away from civil works. This was indeed the plan of incoming Chief of Engineers Lieutenant William C. Gribble, Jr., who succeeded General Clarke in mid-1973. On his recent tours of duty, Gribble had served on the Army staff as deputy chief and chief of research and development (R&D).¹¹⁶ As Chief of Engineers, Gribble wanted to establish a formal R&D program in the Corps of Engineers. To accomplish this, he wanted to bring all Corps laboratories under a directorate of research and development—including IWR and the Hydrological Engineering Center in Davis, California.¹¹⁷

Most people associated with IWR and HEC in the civil works directorate opposed the transfer. In February 1974, General Morris met with former IWR director Brigadier General James Kelly, current director Colonel Charles Eshelman, Joseph Tofani, and recently appointed IWR program monitor, Augustine J. Fredrich.¹¹⁸ Fredrich, a civil engineer who had served in Little Rock District, at HEC, and then as a staff advisor on water resources for Senator John McClellan of Arkansas, had been recruited by Tofani to come to the planning and analysis division in 1973. His variety of experience made him a natural choice to evaluate IWR's work during this period.¹¹⁹

The February meeting reflected the urgent concern that both IWR and HEC could be lost to the directorate of research and development. General Morris argued that the transfer was unwise since both entities served only civil works and were essentially extensions of the directorate staff. Moreover, only a portion of IWR's work was devoted to

R&D, and IWR was not a laboratory. He directed Colonel Eschelmann to prepare a one-page justification statement with these supporting arguments for General Gribble.¹²⁰ The remainder of the meeting concerned potential changes in IWR's operation, including abolition of the two centers and creation of a "line-type organization with project managers assigned to each of the major work items." Another suggestion favored restructuring the professional development program and using the recently passed Intergovernmental Personnel Act to obtain visiting scholars. Improved communications with HEC, which was then under the operational control of IWR, were also essential to retaining both organizations in the civil works directorate. Other issues included establishing better methods of enabling IWR to respond to field needs and getting the specialized high-priority work needed from the Institute, including social impact assessment, public involvement, planning manuals, guidance on the Principles and Standards, and evaluation of hydropower potential. The participants also discussed the advisability of establishing a single point of contact between the civil works directorate and IWR.¹²¹ In March 1974, Morris designated Fredrich as the point of contact.¹²²

Over the next few months, abolishing IWR's centers became the focal point of redirection. Colonel Eschelmann, who came to the Institute in October 1973, believed the centers were unworkable. In a July 1974 request to OCE for reorganization, he stated that the centers had "resulted in unjustifiable and unacceptable trends toward excessive overhead costs and harmful independence and even competition between two small centers of four to six working professionals each."¹²³ The loose structure of IWR

had indeed resulted in uncertainties over resource distribution between the two centers. Eschelmann argued that a "line organization composed of an executive and administrative office, and a professional staff representing the specific interdisciplinary skills needed for conduct of IWR studies and investigations" would best serve IWR and the civil works program. He also pointed out that this reorganization plan had the endorsement of the director of civil works.¹²⁴ In August 1974, the comptroller's office approved the reorganization and amended ER 10-1-23, the original establishing document, to reflect the change.¹²⁵

The August reorganization was one of several transformations that persuaded the Chief of Engineers to allow IWR and HEC to remain under the civil works directorate. By early 1975, the IWR advisory committee had plans under way to provide a separate source of funding for the "non-R&D functions" of IWR and HEC. The civil works directorate had decided that civil works training needed to be more centralized in OCE. It therefore removed the responsibility for management of the long-term education program from IWR. The reorganization was also designed to improve management of IWR and HEC. Operational control of HEC, which had been given to IWR in 1973, now went to the engineering division of the civil works directorate. The recently created office of policy in OCE gained broad responsibility for IWR staff supervision, IWR and HEC programs, budget justification, and program guidance. Finally, the civil works R&D committee assumed responsibility for coordinating the HEC-IWR efforts to assist the civil works R&D program.¹²⁶

The reorganization and redirection of late 1974 and early 1975 marked the end of the formative years of the

Institute for Water Resources. The Institute had produced a great deal of work in five years, much of it of high quality and influential within and outside the Corps. The work was consistent with the original mission of IWR to be a long-range planning organization. However, more immediate problems began to take priority by the mid-1970s. Environmental quality, macroeconomic applications, social impact assessment, public participation, and nonstructural flood control methods were only the most visible of many issues facing the Corps' civil works program. General Gribble's initiative to remove IWR and HEC from civil works prompted the civil works directorate to reorganize IWR and develop a new mission statement in 1975, which read as follows:

1. Develops methodology to be utilized by the Corps of Engineers for analyzing and planning the comprehensive development and management of the Nation's water and related resources.
2. Initiates, performs, and monitors research to evaluate existing water resources planning methods and criteria and to develop new and innovative techniques.
3. Identifies new applications for the Corps of Engineers' efforts in water resources development.
4. Develops guidance on water resources planning for the elements of the Corps of Engineers.
5. Performs studies and analyses to define water resources policy issues and to identify, formulate, and

recommend alternative water resources policy positions related to the civil works mission.

6. Undertakes investigations and studies as directed.¹²⁷

The list of tasks was smaller, and the mission statement was more succinct. Its intent was to bring IWR closer to the civil works directorate's needs. During the early 1970s, Corps policy in environmental quality and public involvement had been primarily shaped by IWR. In these and other ways, the Institute had fulfilled its original mission as a long-range planner in the Corps of Engineers civil works program. After the reorganization of 1974, however, the Institute for Water Resources had a more precise primary mission: to serve the needs of the civil works directorate.

¹ Memorandum, (Lt. Gen. W.F. Cassidy) to Special Asst. to the Sec. of the Army for Civil Functions, 23 June 1969, subj: Future program opportunities for the Corps of Engineers, Tofani interview file, OHA.

² Ibid.

³ "Policy Forecasting and Dissemination," unsigned and undated typescript (ca 1972), Tofani Interview file, OHA.

⁴ U.S. Army Engineer Institute for Water Resources, Annual Report of the Institute for Water Resources, Corps of Engineers, Department of the Army, 1969, pp. 10-15. Hereafter cited as IWR Annual Reports.

⁵ See Elaine Moss, ed., Land Use Controls in the United States: A Handbook on the Legal Rights of Citizens (New York: Dial Press, 1977), chapter 2, for a 1970s analysis of NEPA. See Stine, "Environmental Politics and Water Resources Development," chapter 2, for a discussion of the impact of NEPA on the Corps.

⁶ Moss, ed., Land Use Controls in the United States, pp. 18-19; Stine, "Environmental Politics and Water Resources Development," p. 34; Reuss, pp. 1-4.

⁷ Ibid.

⁸ U.S. Army Corps of Engineers, Annual Report of the Chief of Engineers on Civil Works Activities, Vol. I, p. i.

⁹ William O. Douglas, "The Public Be Dammed," Playboy (July 1969), passim; Elizabeth B. Drew, "Dam Outrage: The Story of the Army Engineers," Atlantic Monthly 225 (April 1970), passim; Sports Illustrated (16 Feb. 1970); Wall Street Journal (6 Jan. 1970); Other articles criticizing various activities of the Corps appeared in Reader's Digest (Jan. 1970), Science (13 Oct. 1967), American Forests (Nov. 1969), and Fortune (Apr. 1970).

¹⁰ Arthur E. Morgan, Dams and Other Disasters: A Century of the Army Corps of Engineers in Civil Works (Boston, MA: Porter Sargent Publisher, 1971), passim; Interview, Frank N. Schubert, U.S. Army Corps of Engineers Office of History, with Lt. Gen. Emerson C. Itschner, Dec. 1986, OHA.

¹¹ "Policy Forecasting and Dissemination."

¹² U.S. Army Corps of Engineers Office of History, Engineering Memoirs: Interviews with Lieutenant General Frederick J. Clarke (Washington, DC: Office of Administrative Services, 1979), EP 870-1-5, p. 203.

¹³ Annual Report of the Chief of Engineers on Civil Works Activities, 1970, p. 6

¹⁴ National Environmental Policy Act, L. 91-190, 42 U.S.C. 4321-4347, 1 Jan. 1970.

¹⁵ Stine, "Environmental Politics and Water Resources Development," p. 38.

¹⁶ Reuss, Shaping Environmental Awareness, pp. 5-6.

¹⁷ IWR Annual Report, 1969, p. 17

¹⁸ *Ibid.*, p. 20.

¹⁹ *Ibid.*, Holmes, History of Federal Water Resources Programs 1961-1970, pp. 114-117.

²⁰ Stine, "Environmental Politics and Water Resources Development," p. 37.

²¹ U.S. Army Corps of Engineers, Office of History, Engineering Memoirs: Interviews with Lieutenant General Frederick J. Clarke, p. 203.

²² Memorandum, Clarke to Div. and Dist. . . . Engrs., 23 Nov. 1970, subj: Environmental Guidelines for the Civil Works Program, in U.S. Army Engineer Institute for Water Resources, Environmental Guidelines for the Civil Works Program of the Corps of Engineers, IWR Report 70-5 (Nov. 1970).

²³ Memorandum, Brig. Gen. R.H. Groves to Chief of Engrs., 19 Nov. 1970, subj: submission of Environmental Guidelines, in *Ibid.*.

²⁴ Aggerholm interview; IWR Annual Report, 1970, p. 8.

²⁵ Institute for Water Resources, "Environmental Guidelines," pp. 2, 4, 8-9, 12.

²⁶ Tofani interview, 26 Dec. 1994; Daniel A. Mazmanian and Jeanne Nienaber, Can Organizations Change: Environmental Protection, Citizen Participation, and the Corps of Engineers (Washington, D.C.: The Brookings Institution, 1979), pp. 25-26.

²⁷ See Reuss, Shaping Environmental Awareness, for a full discussion of the Environmental Advisory Board; Stine, "Environmental Politics and Water Resources Development," pp. 40-41; Annual Report, 1971, p. 5

²⁸ *Ibid.*, pp. 6-7; Annual Report, 1970, pp. 4-5.

²⁹ Mazmanian and Nienaber, Can Organizations Change?, pp. 145-148; Aggerholm interview; U.S. Army Corps of Engineers, Office of History, Engineering Memoirs: Interviews with Lieutenant General Frederick J. Clarke, pp. 50-52; See also Serge Taylor, Making Bureaucracies Think: The Environmental Impact Statement Strategy of Administrative Reform (Stanford, CA: Stanford University Press, 1984), chapter five, for more on the Corps' difficulty in conforming to NEPA because of its decentralized structure.

³⁰ Interview, author with Richard McDonald, Washington Level Review Center, 22 Mar. 1994. Hereafter cited as McDonald interview.

³¹ Reuss, Shaping Environmental Awareness, pp. 20-21; Stine, "Environmental Politics and Water Resources Development," p. 65.

³² Report of the Corps of Engineers Civil Works Environmental Planning Conference, June 28-July 1, 1971, OHA, CW/E files; Stine, "Environmental Politics and Water Resources Development," pp. 65-66.

³³ Ibid., pp. 55-56; Aggerholm interview; McDonald interview; IWR Annual Report, 1972, p. 18.

³⁴ Annual Report, Civil Works, 1972, Vol. 1, p. 14.

³⁵ Ibid.

³⁶ Aggerholm interview.

³⁷ Quoted in Mazmanian and Nienaber, Can Organizations Change?, p. 25

³⁸ Ibid., pp. 26-27; Annual Report, Civil Works, 1970, Vol. I, p. 14; Interview, author with Kenneth Murdock, Water Resources Support Center, 21 Mar. 1994; Hereafter cited as Murdock interview; IWR Annual Report, 1970, p. 10; Spenser W. Havlick, "The Construction of Trust: An Experiment in Expanding Democratic Processes in Water Resource Planning." Water Spectrum Vol. 1, No. 2 (Fall 1969), pp. 13-19.

³⁹ Havlick, "The Construction of Trust," pp. 13-14.

⁴⁰ Ibid; IWR Annual Report, 1970, p. 10; The Susquehanna Communication-Participation Study: Selected Approaches to Public Involvement in Water Resources Planning IWR Report 70-6 (Dec. 1970), pp. i-6; Public participation and public involvement are used interchangeably in this and other documents. The semantics of the two terms are instructive in that some in the Corps believed "participation" connoted too much public influence and succeeded in having the agency refer to it as "involvement" by the mid-1970s. Hanchey interview.

⁴¹ The Susquehanna Communication Participation Study, p. iii; Murdock interview; Havlick, "The Construction of Trust," pp. 16-19.

⁴² "Policy Forecasting and Dissemination."

⁴³ A. Bruce Bishop, Public Participation in Water Resources Planning, IWR Report 70-7 (Dec. 1970), p. iv.

⁴⁴ See Otis L. Graham, Jr., Toward a Planned Society: From Roosevelt to Nixon (London: Oxford University Press, 1979), pp. 166-176, for a discussion of PPBS.

⁴⁵ Aggerholm interview; Hanchey interview; McDonald interview.

⁴⁶ Hanchey interview.

⁴⁷ Telephone interview, author with Richard McDonald, 28 Apr. 1994; Hanchey interview; Aggerholm interview; Telephone interview, author with David Aggerholm, 28 Apr. 1994.

⁴⁸ Quoted in Mazmanian and Nienaber, Can Organizations Change?, p. 27.

⁴⁹ IWR Annual Report, 1970, pp. 14-15; See also Charles W. Dahlgren, "Public Participation in Water Resources Planning: A Multi-Media Course," IWR Professional Development Paper 72-1 (Apr. 1972) for the proceedings of the course.

⁵⁰ U.S. Army Corps of Engineers, Office of the Chief of Engineers, "Water Resources Policies and Authorities: Public Participation in Water Resources Planning," Engineer Circular 1165-2-100 (28 May 1971).

⁵¹ See Mazmanian and Nienaber, Can Organizations Change?, pp. 62, 74, 78, for an account of how well TAP worked during the planning of a controversial levee project in the Kansas City District.

⁵² IWR Annual Report, 1970, p. 15; IWR Annual Report, 1972, pp. 19-20; Institute for Water Resources, Public Workshops on the Puget Sound and Adjacent Waters Study: An Evaluation, IWR Report, 72-2, pp. i-iv; Susquehanna River Basin Study Coordinating Committee, Susquehanna River Basin Study: Summary Washington, DC, U.S. Government Printing Office, (June 1970), p. i.

⁵³ Hanchey interview; See also Leonard Ortolano, "A Process for Field Level Water Planning," in Public Involvement Techniques: A Reader of Ten Years Experience and the Institute for Water Resources, IWR Research Report 82-R1 (May 1993), p. 105.

⁵⁴ Ibid., p. 3.

⁵⁵ See David Alee and Burnham H. Dodge, The Role of the U.S. Army Corps of Engineers in Water Quality Management (IWR Report 71-1), Part II, for an historical overview of federal water pollution control efforts.

⁵⁶ See Ibid., Part II, for the details of this plan; Mazmanian and Nienaber, Can Organizations Change?, pp. 113-118; "Chronology of the Wastewater Management Program," undated ca. 1973, Jim Tozzi papers, OHA; This dispute between the Corps and EPA was the beginning of an ongoing rivalry in water quality management, between the engineering-minded Corps and the regulatory-minded EPA. See Engineering News Record 25 Nov. 1971 and The Providence Journal, 24 Nov. 1971, for articles describing the conflict.

⁵⁷ Reuss, Shaping Environmental Awareness, p. 32; IWR Annual Report, 1973-1974, pp. 3-4; John R. Sheaffer, "Wastewater Management: A New Vision for the Environment," undated typescript, Jim Tozzi papers, OHA.

⁵⁸ U.S. Army Corps of Engineers, Chicago District, Alternatives for Managing Wastewater in Chicago-South End Lake Michigan Area: Summary Report, July 1971, I-1-I-3; Annual Report, Civil Works Activities, 1972, pp. 17-21.

⁵⁹ Hanchey interview.

⁶⁰ Department of the Army, U.S. Army Corps of Engineers, Digest of Water Resources Policies and Authorities, EP 1165-2-1 (15 Feb. 1989), p. 2-4; Water Resources Development Act of 1970, L. 91-611. 31 Dec. 1970, p. 1823.

⁶¹ Ibid.

⁶² Ibid., p. 1829.

⁶³ U.S. Congress, Senate, Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources, S. Doc. 97, 87th Cong., 2d sess., 1962.

⁶⁴ Ibid.; Reuss, "Coping With Uncertainty," p. 131; Moore and Moore, The Evolution of Federal Flood Plain Management Policy, p. 106; Taylor, Making Bureaucracies Think, p. 98.

⁶⁵ Interview, author with Jerome Delli Priscoli, Institute for Water Resources, 21 Sept. 1993. Hereafter referred to as Delli Priscoli interview.

⁶⁶ Telephone interview, author with Evan Vlachos, Colorado State University, 11 Jan. 1994. Hereafter cited as Vlachos interview; Aggerholm interview; Hanchey interview.

⁶⁷ U.S. Army Corps of Engineers, Institute for Water Resources, An Information System for Improving the Evaluation of Non-marketing Outputs (IWR Report 71-5) July 1971, p. i; IWR Annual Report, 1971, p. 11; IWR Annual Report, 1972, p. 36.

⁶⁸ The first study was U.S. Army Corps of Engineers, Institute for Water Resources, Development Benefits of Water Resource Investments, Report 69-1, U.S. Army Corps of Engineers, Institute for Water Resources, A River, a Region, and a Research Problem, IWR Report 71-6 (July 1971), p. iii.

⁶⁹ *Ibid.*, p. vii.

⁷⁰ *Ibid.*, pp. iv-v.

⁷¹ U.S. Army Corps of Engineers, Institute for Water Resources, Quality of Life and Income Redistribution: Objectives for Water Resources Planning, IWR Report 72-4 (July 1972), pp. i-1.

⁷² *Ibid.*; Interview, author with Michael R. Krouse, Institute for Water Resources, 20 Sept. 1993. Hereafter cited as Krouse interview.

⁷³ IWR Annual Report, 1972, p. 21; Vlachos interview.

⁷⁴ U.S. Army Corps of Engineers, Institute for Water Resources, "Social Impact Assessment: An Overview," IWR Paper 75-P7 (1975), p. i

⁷⁵ See, for example, U.S. Army Corps of Engineers, Institute for Water Resources, A Methodology for Flood Plain Development and Management, IWR Report 69-3 (Dec. 1969); U.S. Army Corps of Engineers, Institute for Water Resources, Estimation of First Round and Selected Subsequent Income Effects of Water Resources Investment, IWR Report 70-1 (Feb. 1970), and U.S. Army Corps of Engineers, Institute for Water Resources, Cost-Benefit Analysis for Inland Navigation Improvements, IWR Report 70-4, (Oct. 1970), 2 vols., for reports published by IWR and contracted by the planning division of OCE.

⁷⁶ U.S. Army Corps of Engineers, Institute for Water Resources, Foreign Deep Water Port Experience, IWR Report 71-11 3 vols., (Dec. 1971); IWR Annual Report, 1972, p. 37.

⁷⁷ U.S. Army Corps of Engineers, Institute for Water Resources, U.S. Deepwater Port Study, IWR Report 72-8 Vol. I, (Aug. 1972), Vol. I, "Summary and Conclusions," pp. 4-7; IWR Annual Report, 1972, p. 39.

⁷⁸ IWR Annual Report, 1972, pp. 14-15; Institute for Water Resources, U.S. Deepwater Port Study, p. v, 7.

⁷⁹ IWR Annual Report, 1972, p. 16.

⁸⁰ U.S. Army Corps of Engineers, Institute for Water Resources, Cost-Benefit Analysis for Inland Navigation Improvements, U.S. Army Corps of Engineers, Institute for Water Resources, An Application of Discriminate Analysis to the Division of Traffic Between Transport Modes, IWR Report 71-2 (May 1971).

⁸¹ National Water Commission, Water Policies for the Future: Final Report to the President and to the Congress of the United States by the National Water Commission (Washington, DC: U.S. Government Printing Office, 1973); U.S. Water Resources Council, "Principles and Standards for Planning of Water and Related Land Resources," Federal Register, Vol. 38, No. 174, 10 Sept. 1973, 24778-869; Water Resources Development Act of 1974, P.L. 93-251.

⁸² National Water Commission, Water Policies for the Future, pp. ix-xi; Theodore M. Schad, "The National Water Commission," Water Spectrum Vol. 1, No. 2, (Fall 1969), pp. 27-31; Reuss, Reshaping National Water Politics, pp. 30-31; Moore and Moore, The Evolution of Federal Flood Plain Management Policy, p. 105.

⁸³ Ibid.

⁸⁴ Reuss, Reshaping National Water Politics, pp. 30-31; Stine, "Environmental Politics and Water Resources Development," pp. 99-100.

⁸⁵ Ibid.; Moore and Moore, The Evolution of Federal Flood Plain Management Policy, p. 105; U.S. Army Corps of Engineers, Digest of Water Resources Policies and Authorities, p. 2-7-2-8.

⁸⁶ Water Resources Development Act of 1974, P.L. 93-251.

⁸⁷ Ibid.; U.S. Army Corps of Engineers, Digest of Water Resources Policies and Authorities, p. 2-4; This so-called "section 80" study had little actual impact when President Jimmy Carter came to office in 1977 with an even stronger environmental agenda.

⁸⁸ Ibid., pp. 2-7-2-8; Reuss, Reshaping National Water Politics, pp. 30-32.

⁸⁹ U.S. Army Corps of Engineers, Institute for Water Resources, Agricultural Flood Control Benefits and Land Values, IWR Report 71-3 (June 1971), pp. i-iii.

⁹⁰ The more extensive study was entitled Analysis for Alternative Procedures for the Evaluation of Agricultural Flood Control Benefits, IWR Report 71-4. IWR Annual Report, 1972, p. 16.

⁹¹ U.S. Army Corps of Engineers, Institute for Water Resources, Preliminary Review and Analysis of Flood Control Project Evaluation Procedures, IWR Report 70-3 (Sept. 1970); IWR Annual Report, 1972, pp. 3, 34; See also U.S. Army Corps of Engineers, Institute for Water Resources, A Methodology for Flood Plain Development and Management, for an examination of "trade-off analysis" regarding flood protection decisions.

⁹² U.S. Army Corps of Engineers, Institute for Water Resources, A Computer Simulation Model for Flood Plain Development, IWR Report 72-1 (Feb. 1972); U.S. Army Corps of Engineers, Institute for Water Resources, A Computer Simulation Model for Flood Plain Development, Part II: Model Description and Applications, IWR Report 73-1 (Nov. 1972); IWR Annual Report, 1973-1974, pp. 5, 50, 52.

⁹³ "A Methodology for Planning Land Use and Engineering Alternatives for Flood Plain Management: The Flood Plain Management Model" IWR Paper 74-P2; "Analysis of Theories and Methods for Estimating Benefits of Protecting Urban Floodplains", IWR Paper 74-P7.

⁹⁴ IWR Annual Report, 1975, p. 18.

⁹⁵ See IWR Annual Reports, 1969-1975, for a year-by-year progression of the organization's activities.

⁹⁶ Aggerholm interview; Antle interview, 25 Mar. 1994; McDonald interview.

⁹⁷ Memorandum, Brig. Gen. F.P. Koisch to Dir., Institute for Water Resources, 29 Apr. 1969, subj: Letter of instructions, IWR Director's Office files. Hereafter cited as IWR DO files.

⁹⁸ IWR Regulation No. 1180-1, "Studies and Contracts, 22 July 1971. IWR DO files. files; Hanchey interview; Tofani interview, 26 Dec. 1993.

⁹⁹ According to several interviewees, Missouri River Division Chief of Planning, Gus Karabatsis coined the term "yellow perils"; Hanchey interview; Antle interview, 25 Mar. 1994; Harrison interview.

¹⁰⁰ Videotape, "IWR: The Video," produced in 1991 by the Institute for Water Resources. Hereafter cited as "IWR: The Video"; Harrison interview.

¹⁰¹ Memorandum, Maj. Gen. F.P. Koisch, Dir. of Civil Works, to Kenneth J. Bousquet, U.S. Senate Subcommittee on Public Works, 16 Feb. 1970, subj: Transfer of Professional Development to IWR, OHA, Civil Works/Env. files.

¹⁰² IWR Annual Report, 1973-1974, pp. 25-37; IWR Annual Report, 1972, pp. 23-33.

¹⁰³ See Daniel A. Mazmanian and Mordecai Lee, "Tradition Be Damned! The Army Corps of Engineers is Changing," Public Administration Review 35 (Mar./Apr. 1975), pp. 166-172; Also see Taylor, Making Bureaucracies Think, chapter 3, and Mazmanian and Nienaber, Can Organizations Change?, chapters 1-4, for numerous references to IWR initiatives that indicated demonstrable change in the Corps' planning during the early 1970s.

¹⁰⁴ Harrison interview; Hanchey interview.

¹⁰⁵ Job Description, "U.S. Army Engineer Institute for Water Resources, Supervisory Civil Engineer," 30 Mar. 1970, IWR DO files.

¹⁰⁶ Letter, Lt. Gen. F.J. Clarke, Chief of Engineers to Nathaniel A. Back, Dir., Center for Economic Studies, IWR, 21 May 1971, subj: Back's retirement, IWR Historical files.

¹⁰⁷ Memorandum, Col. R.J. Batson, Dep. Dir. of Civil Works, to DAEN-CWZ-A, 26 Apr. 1972, subj: Change in the institute's organizational structure, IWR DO files.

¹⁰⁸ Disposition Form, Col. R.J. Batson, Dep. Dir., IWR, to DAEN-CWZ-A, 26 Apr. 1972, subj: Request for approval of organization structure changes, IWR DO files; Groves interview; telephone interview, author with George Antle, 28 Apr. 1994.

¹⁰⁹ Harrison interview; Hanchey interview; Antle interview, 10 Jan. 1994; "Directors of IWR," undated and unsigned typescript, IWR DO files; interview, Reuss with Arthur Maass, p. 8.

¹¹⁰ Hanchey interview; Antle interview, 10 Jan. 1994; Batson to DAEN-CWZ-A, 26 Apr. 1972.

¹¹¹ Hanchey interview.

¹¹² Tofani interview, 26 Dec. 1993.

¹¹³ U.S. Army Corps of Engineers, Office of the Chief of Engineers, The Genesis of the United States Army Corps of Engineers EP 360-1-2; (Washington, DC: U.S. Government Printing Office, 1978) Interview, author with Lt. Gen. J.W. Morris, 23 Mar. 1994. Hereafter cited as Morris interview; "Remarks of Maj. Gen. J.W. Morris, Dir. of Civil Works, before Arkansas Basin Development Association," 15 Mar. 1974, OHA CW/Gen. files, Box 65.

¹¹⁴ Memorandum, Maj. Gen. J.W. Morris, Dir. of Civil Works, to Civil Works Directorate Chiefs, 24 Aug. 1973, subj: Reorientation of IWR Mission, OHA, Tofani interview file.

¹¹⁵ Ibid.; Not all in OCE were in agreement that IWR needed redirection. Colonel John F. Wall, then deputy director of civil works for environmental programs, argued after reviewing the problem statements that such work would bring IWR too close to short term OCE needs. Wall pointed out General Clarke's directives of 1969 and maintained that IWR's mission was to be "a change mechanism to move the Army Corps of Engineers into new and broader areas of thinking. See Memorandum, John F. Wall, Dep. Dir. of Civil Works for Env. Programs, to DAEN-CWZ-P, 5 Sept. 1973, subj: Redirection of IWR Mission, OHA Tofani interview files.

¹¹⁶ Morris interview; U.S. Army Corps of Engineers, The Genesis of the United States Army Corps of Engineers.

¹¹⁷ Lt. Gen. William C. Gribble, Jr., "Perspectives on the Army Engineers Water Management Mission," Water Spectrum Vol. 6, No. 3 (Spring 1974) pp. 1-9; Memorandum for the Record from A.J. Fredrich, Policy and Analysis Division, 1 Feb. 1974, subj: Meeting on IWR Organization and Program, IWR DO files

¹¹⁸ Ibid.; Morris interview.

¹¹⁹ "IWR: The Video"; Telephone interview, author with Augustine J. Fredrich, Indiana Southern University, 11 Jan. 1994. Hereafter cited as Fredrich interview.

¹²⁰ Memorandum for the Record from Fredrich, 1 Feb. 1974.

¹²¹ Ibid.

¹²² Letter, Maj. Gen. J.W. Morris, Dir. of Civil Works, to Dir., U.S. Army Engineer Institute for Water Resources, 27 Mar. 1974, subj: Designation of IWR point of contact, IWR DO files.

¹²³ Memorandum, Col. C.O. Eschelmann, IWR Dir., to DAEN-EGM, 18 July 1974, subj: Request for Approval of IWR Reorganization, IWR DO files.

¹²⁴ Ibid.

¹²⁵ Deposition Form, DAEN-ECM-E to IWR Dir., 6 Aug. 1974, subj: Approval of IWR reorganization, IWR DO files.

¹²⁶ "Summary of Recent Decisions Affecting IWR and HEC," unsigned typescript, Sept. 1974, IWR DO files.

¹²⁷ Department of the Army, Office of the Chief of Engineers, "Organization and Functions: U.S. Army Engineer Institute for Water Resources, 24 Jan. 1975, ER 10-1-23 (supersedes ER 10-1-23, 18 Apr. 1969; U.S. Army Engineer Institute for Water Resources, "Mission Statement," undated typescript, ca. 1975, IWR DO files.



CHAPTER THREE: REDEFINITION AND POLICY ORIENTED STUDIES

From the mid-1970s to the early 1980s, the Institute for Water Resources underwent some of the most significant changes in its history. If the Institute was ever an actual "think-tank" for the Corps of Engineers, that status ended with the reorganization of 1974 and 1975. To solve the increasingly complex array of water resources development challenges, the civil works directorate had given substantial support to IWR during its first years of operation. In response, the Institute produced a wide range of studies, reports, and papers, generated internally or on a contractual basis. The value of such products varied widely. Some work, while perhaps broadly used and well received outside the agency, had little effect on Corps of Engineers civil works planning policies. In reality, a purely research-based organization devoted principally to broad national planning was neither useful nor acceptable to the Corps' civil works leadership. Primarily for this reason, the civil works directorate refocused the Institute's resources more directly on Corps planning needs, both in policy and guidelines. This redirection marked the beginning of a new era for the Institute for Water Resources.

The reorganization of 1974 and 1975 made the Institute more accountable to the civil works directorate but also gave it new work and funding sources. The swiftly

changing world of federal water resources development saw even faster change in the late 1970s, as environmental initiatives and budget constraints shaped thought and practice. The Corps of Engineers remained under great pressure to fulfill its water resources and environmental missions, and the multidisciplinary composition of IWR became increasingly influential. The Institute provided policy analysis and research for the civil works directorate, study leadership, and training for field personnel. When the Corps expanded its regulatory permit activities in the mid-1970s, headquarters found technical support in the Institute. As the issues of wetlands protection coalesced, IWR provided analytical support. When Congress authorized major studies of national hydroelectric power potential and the status of the waterways, the Corps gave the management tasks to IWR. By the end of the decade, IWR was a larger and more diverse organization, performing multiple tasks for the civil works directorate, field offices, and the Congress.

Changes in Organization and Funding

The details of IWR's reorganization continued to unfold in 1975. As of January, the Institute had no "formal organizational breakout."¹ Instead, the former members of the two IWR centers now worked for the director, who, at that time, was a military officer. Principal civil works planning personnel in OCE believed that IWR's centers competed unnecessarily for funding. Moreover, they acknowledged that there had always been frequent cross-over of expertise between the centers and that a "matrix-management system" would work well for IWR.²

Personnel changes accompanied the reorganization. Colonel Daniel Ludwig succeeded Colonel Charles Eshelman in September 1975. Ludwig served as director until August 1976. At the same time that Ludwig assumed the directorship, Augustine J. Fredrich became the technical director. As IWR's point of contact in OCE from 1974 to 1976, Fredrich reviewed all reports and work in progress and had become the headquarters expert on the Institute. As technical director, he was responsible for oversight of IWR's economic studies and planning work.³ General Morris, who became Chief of Engineers in 1976, and the leadership in OCE hoped these changes would maximize IWR's ability to support headquarters and the field.⁴

As significant as the organizational changes were the funding transformations occurring during the same period. Funding IWR's work had been an issue since the first discussions of its creation. While promoting the establishment of IWR to Congress, Lieutenant General William Cassidy, Chief of Engineers, wrote in February 1969 that "the Institute will depend on a variety of funding sources as determined by its program."⁵ The following month, Director of Civil Works Major General Frank Koisch also testified that funding would come from several sources.⁶ Despite such predictions, funding for IWR came almost completely from R&D funds during its first five years of operation. This became a significant problem when the Corps began reorganizing its R&D management system under Chief of Engineers Gribble. With more formalized requirements for R&D objectives, much of IWR's R&D work became more difficult to justify.⁷

General Gribble's establishment of the Research and Development Office in April 1974 heightened the IWR

funding problem. Much of the difficulty lay in definition. The Institute's work in environmental quality, public involvement, and social impact assessment was undoubtedly policy-oriented in that the Corps sought policy evaluations of these objectives through special studies. Yet R&D funds supported the work. Following General Morris's prevention of IWR's transfer to the R&D directorate, the OCE R&D Review Board insisted that the Institute secure funding outside the R&D program.

Although it was too late to arrange for separate funding for non-R&D activities for fiscal year 1976, the board revised the program for the coming fiscal year. The IWR program was divided into three components: policy studies, planning methodologies, and analytical techniques.⁸ Of these three components, policy studies encompassed IWR activities undefined in the framework of the R&D management system. Irwin Reisler, successor in 1974 to retiring Chief of Policy Joseph Tofani, explained, "Because we have been directed to secure alternative sources of funding for the non-R&D activities of IWR and because these activities are by their very nature an extension of the work of the Office of Policy, I believe that the most logical source of funding for the work is the General Expenses account."⁹ The Corps had six funding accounts: General Expenses, General Investigations, Mississippi River and Tributaries, Construction General, Navigation, and Flood Control. While Reisler believed most policy studies could be defined and presented in the normal budget proceedings, he also anticipated that there would be a variety of "hot" policy items that could not be budgeted. Therefore, he advocated that a portion of the IWR policy budget be uncommitted, in recognition that "we cannot forecast all of the policy issues

that will need to be addressed 18 to 20 months in the future."¹⁰

Working with Reisler and others in OCE, the directors of IWR set about implementing these proposals. They organized IWR's activities around policy studies, planning methodologies, and analytical planning techniques. Planning methodologies included flood control and floodplain management, hydroelectric power, social impact assessment, institutional analysis, regional development, shoreline works, water supply and water quality, recreation, and public involvement. Analytical planning techniques included water transportation and other economic evaluations. Policy studies included an examination of private management of Corps recreational facilities, the role of land use analysis in Corps planning, and the impact of flood insurance and agricultural policies on the Corps' flood control program.¹¹ In November 1975, IWR implemented a system of program management whereby administrative officers were responsible for accomplishing the objectives of various assigned work tasks. Task force leaders were required to establish milestones and objectives as well as to develop quarterly reviews for all of the Institute's work.¹²

While IWR employees adjusted to the reorganization, OCE continued to refine the funding arrangements for fiscal year 1977. Fredrich believed that part of the IWR credibility problem surrounded its traditional R&D funding status. He worked closely with Chief of Programs Augustus (Augie) Smet to acquire more work that would be directly relevant to OCE. Their negotiations created a line item in the general expense budget for policy studies. From such funds IWR received work that the OCE policy division could not undertake.

Another portion of IWR's funding in fiscal year 1975 came from so-called "reimbursable" work, which included work for Corps divisions, districts, other field operating agencies, and other government agencies. Research and development work, policy studies, and reimbursable activities gave the Institute varied sources of funding and new opportunities to prove its value to the Corps.¹³

As a result of the new funding divisions, research and development work took on a new definition for IWR. R&D work during fiscal year 1977 included assistance to the construction-operations division of OCE in implementing the regulatory permit program for navigable waters and wetlands, social impact assessment, planning shoreline protection, and various economic analyses. Work also included an evaluation of the Corps' Environmental Action Program (EAP), an initiative of the office of the Assistant Secretary of the Army for Civil Works (ASA-CW), begun in 1975. Policy studies for the same year reflected the redirection, including an urban studies evaluation, a presidential water resources project review and drought appraisal study, nonstructural flood damage and social impact, and a feasibility study of establishing a water resources data center in the Corps. Reimbursable work included a wetlands evaluation manual for the EAP, basic training courses for regulatory personnel, and a public involvement manual for citizens.¹⁴ Separation of the various IWR studies occurred more for funding purposes than in actual division of labor. There continued to be extensive crossover in policy studies, research and development, and reimbursable work.

The Corps Regulatory Program

Environmental quality, social impact assessment, and public involvement remained significant, and often perplexing, conundrums for the Corps throughout the 1970s. Each of these issues spanned the new divisions of IWR. The Institute had worked on such problems since its establishment, but its efforts now focused on specific elements, such as developing the analytical framework for the agency's environmental policy development.

Except for the National Environmental Policy Act, no federal legislation of the late 1960s and early 1970s had greater impact on the Corps of Engineers than the Federal Water Pollution Control Act Amendments of 1972. The amendments gave new direction and responsibility to the traditional Corps' regulatory activities which date back to the 1890s. The Rivers and Harbors Act of 1899 contained two regulatory provisions affecting the Corps: section 10, authorized the agency to establish a permit program to regulate activities affecting the nation's navigable waters, and section 13 (frequently called "the Refuse Act") called on the Corps to regulate the discharge of refuse material into or on the banks of navigable waters and their tributaries.¹⁵ During the next decades, the Corps based its section 10 permit decisions primarily on navigation considerations, but in 1967 the secretaries of Army and Interior signed a formal memorandum of understanding directing the Corps to consider the impact of permit proposals on "fish, wildlife, recreation, and pollution problems associated with dredging, filling, and excavation operations."¹⁶ Following this memorandum, Robert E. Jordan III, special assistant to the secretary of the Army for civil functions, directed the Corps to develop new guidelines honoring the agreement. Jordan's

concern for environmental quality led to greatly expanded regulations formalized by the Corps in December 1968.¹⁷

The revised regulations of 1968 ushered in a new and controversial role for the Corps of Engineers regarding its regulatory activities. Many traditionalists in the agency decried the expanded regulations, arguing that the 1899 law permitted no considerations other than obstacles to navigation. A test case of this dispute soon surfaced. In 1967, Jacksonville District Engineer Colonel Robert Tabb denied a permit to development company Zabel and Russell on the basis that filling in 11 acres of tideland property would cause irreversible environmental damage to marine life. The company argued in federal court that the Corps could not deny the permit since the company's plans did not interfere with navigation, and the federal district court in Florida agreed in 1969. Attorneys in the Corps' Office of Counsel decided to appeal, and in 1970 the U.S. Court of Appeals reversed the district court ruling in *Zabel v. Tabb*. The higher court held that the Corps not only had the right, but also, in light of NEPA, the obligation to deny permits on environmental grounds.

The *Zabel v. Tabb* decision validated the expanding regulatory functions and opened the door to greater responsibilities. When Congress overrode President Nixon's veto of the Federal Water Pollution Control Act Amendments (FWPCA) in October 1972, the Corps gained new regulatory authority. Under section 404 of the act, the Corps had authority to issue permits for discharges of dredged or fill materials into the waters of the United States. The key change in this provision was the elimination of the word "navigable"; the Corps was being directed to regulate the waters of the United States under the expanded

considerations specified in the 1968 regulations. By removing "navigable" from the law, the authors intended that the Corps monitor the wetlands of the United States as well.¹⁸

The Corps did not respond to this added responsibility with universal enthusiasm. In fact, the Corps' final regulations issued in April 1974 narrowed section 404 authority to the traditional definition of "navigable waters."¹⁹ Environmental advocates and authors of the 1972 amendments were dismayed by the Corps' refusal to accept the broadened regulatory mission. The National Resources Defense Council (NRDC) filed suit against the Department of the Army in U.S. District Court, alleging that the Corps' regulations were in violation of FWPCA. In March 1975, the court ruled for the plaintiffs in NRDC v. Callaway. In doing so, the court ordered the Corps to revise and expand the April 1974 regulations. The ruling did not end dissatisfaction over the 404 program within the Corps.²⁰ To many veteran civilians and military officers, regulating wetlands and waters to prevent environmental degradation ran counter to the Corps' primary civil works mission: water resources development for economic prosperity. This attitude harkened back to the battles of the 1950s and 1960s within the agency over the value of interdisciplinary planning. The new regulations might sometimes force the Corps to regulate and revoke permits on some of its own activities.

After intense internal strife, including the 1975 publication of an inflammatory press release by the OCE Public Affairs Office warning that the Corps would be forced to regulate "stock ponds . . . or . . . irrigation ditches," the Corps accepted its broadened regulatory role.²¹ In the spring

of 1976, the Corps of Engineers validated this acceptance by revoking section 404 permits for a development project on Marco Island in Florida. "As far as improving the Corps' environmental image," wrote historian Jeffrey Stine, "[this] was the most important single event of the 1970s."²² The decision to revoke permits for a development project in which a powerful company had invested large amounts of money was not an easy one for the Corps and Chief of Engineers Gribble. Yet in doing so, the Corps honored its mandate to carry out the expanded 404 regulations.²³

The Regulatory Program and IWR

As the expanding regulatory program took shape in the early and mid-1970s, the Corps struggled to interpret the new laws just as it struggled with NEPA and the Omnibus Water Resources Development Acts of 1970 and 1974. The regulatory functions branch of the construction-operations division of OCE had responsibility for administering the program, but as events unfolded in the 1970s, the branch was overwhelmed with the expanded 404 program. At the same time, the Institute for Water Resources sought more OCE work. Fredrich and other members of IWR approached George Brazier, Chief of Construction-Operations, with a proposal to assist the division in developing and implementing the program.²⁴

Brazier needed to develop a program that included environmental considerations, but his division had no environmental specialists. The Institute, on the other hand, had been established in part to assist the Corps in responding to environmental quality concerns and interdisciplinary planning. In 1975 and 1976, IWR added

to its interdisciplinary strength with the addition of a water resources planner, Eugene Z. Stakhiv; an environmental planner, Richard T. Reppert; and an urban planner, Thomas M. Ballentine.²⁵ In 1976, the Institute began work for the construction-operations division.

The need to develop new regulatory guidelines and directives was heightened by the election of Georgia Democrat Jimmy Carter to the Presidency in 1976. As a candidate, Carter made environmental quality one of his top priorities. As President, Carter opened his administration to a variety of environmental organizations, appointed environmentalists to his cabinet, and expanded the role of the Council on Environmental Quality in ensuring federal environmental compliance.²⁶ Among several initiatives that directly affected the Corps of Engineers was Carter's May, 1977 executive order mandating and expanding provisions for the protection of wetlands. The order directed each federal agency to provide leadership in minimizing the destruction of wetlands and to avoid undertaking or "providing assistance to new construction located in wetlands" unless no valid alternatives existed. Carter's order supported provisions of the Clean Water Act of 1972 requiring the Corps of Engineers to regulate all of the nation's waters and associated wetlands regarding dredging or filling operations.²⁷ Federal agencies were to protect wetlands, and the Corps was to expand its regulatory program to consider environmental concerns in all the nation's waters.

The expanded regulatory program and the President's support compelled the construction-operations regulatory functions branch to act quickly. In IWR, it found expertise existing nowhere else in the Corps. Although at

times viewed skeptically, IWR's public involvement, social impact assessment, floodplain management, interdisciplinary planning, and environmental quality now appeared essential for developing an environmentally responsive regulatory program.²⁸

The primary objective of IWR's regulatory work was to develop uniform guidelines and instructions for the 38 Corps field offices charged with regulatory functions. Institute members worked with OCE to develop additional objectives, procedures, and work phases for the permit program. On the basis of discussions with division engineers and information gained from public involvement models, the Institute designed a questionnaire to assess the needs and responsibilities of regulatory branches in the districts and the effectiveness of the current system. IWR then tested the questionnaire in the Baltimore District and conducted interviews to learn more about how field personnel viewed the permit program. The IWR staff also interviewed members of other federal agencies, state resource agencies, and public interest groups to learn their responses to the questionnaire and their overall reaction to the regulatory program.²⁹

To provide a medium of information, IWR developed The Coordinator, a bulletin of the Corps regulatory program. Published periodically, The Coordinator provided information on the program from across the nation and detailed the experiences of various districts in carrying out the new mandates. Meanwhile, IWR developed a training course for Corps regulatory employees and revised a pamphlet to inform the public how to apply for a Corps of Engineers permit.³⁰ In developing these components of the regulatory program, IWR assisted in

developing a system of information exchange that would make it an important resource on the sensitive and evolving issues of wetlands regulation.

Environmental Initiatives and IWR

Because of its environmental quality work, the IWR staff participated in other new headquarters directives in the mid-1970s. Two examples were the development of new environmental guidelines and the Great River Environmental Action Team (GREAT) program. By 1975, Chief of Engineers Gribble believed that the Environmental Guidelines for the Civil Works Program of the Corps of Engineers, written by IWR in 1970, needed revision in light of recent environmental legislation, nonstructural requirements for flood control planning, and the expanded regulatory functions now charged to the Corps. Gribble directed General Ernest Graves, director of civil works, to undertake the revision. Graves consulted with IWR and the OCE planning division to produce new guidelines, a draft of which was presented at the annual division engineers' conference in October 1975.³¹

While retaining the four general policy objectives of the original document, the authors sought to incorporate a sense of recent legislation and thought. The original objectives had been as follows:

To preserve unique and important ecological, aesthetic, and cultural values of our national heritage, to conserve and use wisely the natural resources of our Nation for the benefit of present and future generations, to enhance, maintain, and restore the natural and man-made

*environment in terms of its productivity, variety, spaciousness, beauty, and other measures of quality, and to create opportunities for the American people to use and enjoy their environment.*³²

The new guidelines reflected the 1973 Principles and Standards for Planning Water and Related Land Resources which established an environmental quality objective on equal ground with the national economic development objective. The new guidelines also reflected the Corps' commitment to protecting the nation's waters and wetlands in its regulatory functions.³³ The Institute assisted in production of the new guidelines, which were released in October 1976.³⁴

The GREAT program, developed by the Upper Mississippi River Basin Commission, was an attempt to respond to nonfederal concerns about dredging channel maintenance. Working with the U.S. Fish and Wildlife Service, the Corps developed methods to reduce environmental problems along the upper Mississippi River between Minneapolis, Minnesota, and Guttenberg, Iowa. Portions of the river served as a 9-foot navigation channel, a recreation area, a National Wildlife Refuge, and a municipal and industrial water supply. Among other activities, the GREAT program examined the impact of maintenance dredging on the river habitat. The GREAT team also included representatives from the Bureau of Outdoor Recreation, EPA, Soil Conservation Service, Coast Guard, and the states of Minnesota, Wisconsin, and Iowa. The Corps civil works directorate, the primary funding agency, directed IWR to develop a scope of work for evaluating the

study and its potential application in other parts of the United States.³⁵

Another environmental initiative came not from OCE but from another office destined to have great impact on the Corps and IWR. The antecedents of the Office of the Assistant Secretary of the Army for Civil Works dated back to the Office of Civil Functions in operation since the early 1960s. Although established by law in section 211 of the Flood Control Act of 1970, the position of the ASA-CW remained unfilled until 1975. This was mainly because the Nixon administration had hoped to establish a Department of Natural Resources that would take the civil functions of the Corps away from the Army. Nixon's attempt failed, and the Ford administration placed Victor V. Veysey, a former Republican congressman from California, in the assistant secretary position.³⁶ Following a mandate from Secretary of the Army Howard H. Callaway that the Corps give environmental concerns equal consideration with its other missions, Veysey accelerated the agency's environmental response. In developing his game plan to meet this objective, Veysey created the Environmental Action Program in December 1975.³⁷ Veysey's EAP called for improved communication between government and nongovernment agencies, increased public involvement, an improved planning process, and applied technology.³⁸

Veysey's program brought IWR additional work as well as expanded contact with ASA-CW. Because of the Institute's experience in public involvement, it conducted that function of EAP. In addition, the expanding work of IWR in the regulatory program and wetlands inventory work prompted Veysey's office to contract those elements of EAP to the Institute's research and development division. Such

work required increased association with the Corps Environmental Advisory Board and Public Affairs Office.³⁹ All these factors combined to bring the Institute closer to meeting the immediate needs of the civil works directorate.

The Melding of Public Involvement and Social Impact Assessment

By legislation, engineering regulations, and Executive order, the Corps of Engineers was required to consider the social impact of its projects. Social analysis, while mandated by law in 1970, remained an elusive goal for the Corps. The Institute for Water Resources had hired some of the agency's first sociologists and contracted a number of studies to academicians. In 1975, Jerome Delli Priscoli, who had recently earned a Ph.D. in political science from Georgetown University, came to work at the Institute. In his dissertation entitled "Public Participation in Regional Water Resources Planning," produced under a grant from the Water Resources Council, Delli Priscoli examined four regional river basin systems. Through interviews, questionnaires, and demographic study, he evaluated the level and quality of public participation in the planning process. Researching the dissertation brought Delli Priscoli in contact with IWR members working on public participation and social impact assessment. Working with James R. Hanchey, who directed IWR's public involvement activities, Delli Priscoli began to establish a bridge between public involvement and social impact assessment.⁴⁰

A similar attempt came from IWR contractor Leonard Ortolano of the Stanford University Department of Civil Engineering. In Water Resources Decision Making on

the Basis of the Public Interest, Ortolano identified alternative perspectives for defining approaches to more publicly oriented planning during the preauthorization phases. According to Ortolano, multiobjective planning needed to include "direct involvement of citizens" throughout the process. Ortolano believed this was the best way to assess the social impact of a potential water project.⁴¹ The following year, Ortolano and Thomas P. Wagner wrote Testing an Iterative Open Process for Water Resources Planning for IWR. Following the progress of a water resources planning study done by the San Francisco District, Wagner and Ortolano praised the district's progress toward "open-iterative planning" and encouraged its replication throughout the Corps.⁴²

Public involvement proponents at IWR believed the techniques could shape the social, economic, or environmental effects of a potential project. Early public involvement was critical in learning public opinion about a water project, and that knowledge could enable field planners to respond to many potential problems early in the process. As Delli Priscoli wrote in 1977, "Public involvement programs themselves generate social impacts . . . First, public involvement in planning is forcing our political system and planning activities to adapt to new public demands and changing values. Secondly, public involvement is beginning . . . to force integrated program level explanation rather than project by project justification of agency activities."⁴³ In other words, extensive public involvement could and should be used to assess social impact, and public concerns should help to shape projects themselves.

To transfer information to the field, IWR in 1975 published Public Involvement in the Corps of Engineers Planning Process. The manual contained detailed instructions for field personnel to design their public involvement programs.⁴⁴ About the same time, IWR developed executive-level training programs for district and division engineers and chiefs of engineering and planning. By the early 1980s, more than 200 Corps executives had taken part in the training course.⁴⁵ The success of this basic course led IWR to create an advanced course in public involvement. Instructors initially included Hanchey, Delli Priscoli, and two consultants. In late 1978, C. Mark Dunning, a sociologist formerly with the Saint Louis District, became involved in program instruction when he came to work at IWR. Dunning, who had been responsible for incorporating social impact assessment techniques in the Saint Louis District, combined his experiences with those of other instructors to teach the techniques of public involvement and social impact assessment in concert.⁴⁶

Sociologists in the Corps and IWR learned through experience that for their specialties to be useful to planners, they had to apply directly to Corps needs. Finding a method of having an impact became a primary objective of "applied sociology" within the agency. In contrast to academic social analysis intended only to identify and quantify impacts, social analysis for the Corps had to provide specific responses to specific questions of planning. No set of rules could apply to all situations, so policy had to be flexible and interdisciplinary.⁴⁷

As the Corps began to assume new regulatory responsibilities, IWR staff members stressed the importance of educating and involving the public regarding the program.

Working with contractor James L. Creighton, IWR developed a training manual entitled Public Involvement in Regulatory Functions. The authors' assumption was that a successful regulatory program required public access to information and public knowledge of what activities require permits. Public involvement techniques, moreover, could be useful in carrying out the mandates.⁴⁸

Intent on increasing interdisciplinary applications in the Corps planning process, IWR hosted a social scientists' conference in Memphis, Tennessee, during September 1976. About 125 social scientists and economists from OCE and Corps field offices attended to discuss the process of applying their skills to planning flood control, navigation, and other water resources developments. Other participants included academicians and members of other federal agencies. The Institute later published the proceedings under the title Social Aspects of Comprehensive Planning.⁴⁹ During the late 1970s, IWR established an ongoing social impact assessment unit to respond to new laws and directives, to develop training courses, and to produce the Social Science Information Exchange Bulletin distributed periodically to Corps planners.⁵⁰ The Institute helped position the Corps of Engineers as the most advanced water resources agency with regard to public involvement. Public meetings, workshops, interviews, and questionnaires became the basic trademarks of Corps field planning during the 1970s. Moreover, the Corps' successful public involvement techniques became the model for many resource agencies at each level of government.⁵¹

Post-construction Analysis

Applied social and economic analysis continued through the 1970s in IWR's "ex-post-facto analyses" (a term coined by Gilbert White) of the McClellan-Kerr waterway system.⁵² Conceived in the 1940s and 1950s and completed in 1971, the McClellan-Kerr project contained cost and benefit projections that had not materialized by the late 1970s. In 1970, IWR began a multiyear study of the project, partly in response to pressure from Office of Management and Budget (OMB) officials who believed McClellan-Kerr would prove to be an economic failure. The last of the major river basin development projects, McClellan-Kerr had been the subject of bitter disputes between the Eisenhower administration and two powerful senators, Robert S. Kerr from Oklahoma and John McClellan from Arkansas. The successful appropriation of the project in the early 1950s reversed President Eisenhower's "no new starts" policy and returned significant power to Congress.⁵³

As the system neared completion, OMB and Chief of Engineers Frederick Clarke looked to IWR to provide critical review of the planning process, determine the accuracy of the economic projections, and evaluate the regional income impacts. The study, managed by George Antle, proceeded through the 1970s. It provided an opportunity to examine how a project became integrated into a large, regional economy. The study employed an integrated economic input model, which evaluated how cost savings to project users transfer into larger markets and different production combinations. Essentially, the model calculated the "with and without project" economy across several economic sectors and several regions.

When the study concluded in 1980, its authors had some far-reaching findings for water resources planners. With an overall thirteen-percent return to capital, higher than envisioned upon construction, McClellan-Kerr was well justified. However, the mix of benefits was much different than that predicted in the project decision documents. Hydropower and recreation benefits were much higher than projected, navigation was lower, and flood control and bank stabilization projections were roughly accurate. A significant design challenge had been to create a stable navigation channel requiring little maintenance dredging on a river that naturally carried a tremendous amount of sediment. The reservoir system reduced sediment dramatically and at the same time enhanced recreational use of the project. Sport fishing and recreational boating increased. The lakes in Oklahoma and Arkansas, with their high chloride content, supported the introduction of striped bass, a highly prized sporting fish. Meanwhile, rising energy prices of the 1970s quadrupled actual hydropower benefits over the original projections.⁵⁴

The findings point to a simple planning reality: The future is likely to resist successful prediction. Petroleum transportation, for example, was lower than anticipated because of extensive oil and gasoline pipeline construction during the 1950s and 1960s. Navigation benefits were therefore lower than projected. Recreational benefits, however, not even considered in the original analyses, were substantial, and they contributed to the economic and social well-being of eastern Oklahoma and Arkansas.⁵⁵ IWR's analysis notwithstanding, many Corps planners continued to believe that recreational benefits could not be quantified. Nonetheless, recreation and other unforeseen benefits were

often part of projects planned 30 years ago. Few predicted during World War II that Americans would flock to water recreation sites after the war, that recreational fishing and boating would soar in popularity, and that Corps reservoirs would become vacation destinations. Through several social and economic assessments of the project continuing into the 1980s, planners and economists in IWR made the following observations: The regional benefits to residents of Arkansas and Oklahoma were substantial and included improvements in water supply, lower transportation costs, flood control, and the development of large commercial fisheries. Although navigation had not been as extensive as predicted, shipments of heavy equipment produced in Oklahoma exceeded predictions.⁵⁶ Planners also concluded that it was impossible to predict the impact of a major project such as McClellan-Kerr with a great deal of accuracy. With the time lapse involved in large civil works projects, social, economic, and demographic conditions would inevitably change.⁵⁷

Although many people in the Corps civil works program were uncomfortable with such conclusions--as well as the entire concept of conducting postconstruction evaluations--economists and social analysts believed this was the only realistic way to analyze the impacts of large regional systems. The Institute for Water Resources continued to develop this economic and social analysis approach with a view toward evaluating the cumulative impact of all water resource developments.

The Carter Hit List

As the Institute for Water Resources continued to refine its research and development and policy studies activities, a new

President of the United States took office. Elected in 1976, Jimmy Carter entered the White House with a broad agenda that stressed federal water policy reform and environmental quality. As governor of Georgia in the early 1970s, Carter developed a strong environmental ethic. He introduced legislation to reduce pollution and development of wild lands and rivers, and he also participated in the founding of the Georgia Heritage Trust.⁵⁸ As governor, Carter's experience with the Corps of Engineers had not been a positive one. The controversy surrounded the proposed construction of the Spewrell Bluff Dam on the scenic Flint River. Environmental organizations in Georgia opposed it strongly and organized letter-writing campaigns to the governor in the early 1970s. In response, Carter made a lengthy study of the Corps' proposal and concluded that the benefit-cost ratios and justifications were questionable. Carter then rafted the Flint River, which increased his skepticism about the dam. In October 1973, Carter issued a statement officially opposing the dam, and he ultimately prevailed in halting the project.⁵⁹

In his campaign for the Presidency, Carter did not forget his conflict with the Corps, which he branded an agency "biased in favor of dam construction" and "insensitive to environmental concerns."⁶⁰ As President, Carter promised to "end the unnecessary construction of dams by the Corps of Engineers," and, in essence, put the Army Engineers out of the dam-building business.⁶¹ In early 1977, the Carter administration announced it would review 61 federal water projects planned by the Corps and the Bureau of Reclamation. Shortly thereafter, Carter listed 19 projects totaling \$239 million to be deleted from the public works appropriations budget because of economic,

environmental, or safety problems. Both Corps and Bureau of Reclamation projects were included, and Carter directed the secretaries of the Army and the Interior to review the 19 projects.⁶²

Carter's message was clear: Economically questionable and environmentally damaging water resources projects would receive no support from his administration. Moreover, Carter was also determined to increase nonfederal participation in already authorized water resources projects. His position accelerated the forces that eventually fashioned the sweeping Water Resources Development Act of 1986, but in the late 1970s he only antagonized federal agencies and Congress. Accustomed to the traditional course of Corps water project approval, powerful congressional leaders such as Robert Byrd of West Virginia, Bennett Johnston of Louisiana, and Jim Wright of Texas were incensed by Carter's tightening of authorization criteria, and they vigorously opposed his initiatives.⁶³

Despite the conflict over Spewrell Bluff Dam, the Corps was in some ways receptive to Carter's water resources initiatives. Lieutenant General John W. Morris, who became deputy chief of engineers in September 1975 and then Chief of Engineers in July 1976, took the long view of the Corps' civil works program. He believed that many of the Corps' current problems involved commitments to projects authorized before NEPA. In that respect, Carter's review might help the Corps eliminate some marginal projects still not authorized.⁶⁴

In February 1977, the civil works directorate presented a plan to respond to the hit list. It formed a working group consisting of members of the White House staff, the Tennessee Valley Authority, Department of the

Interior, Department of Agriculture, Council on Environmental Quality, and Office of Management and Budget. At the same time, the directorate called upon IWR to develop a public involvement program to help in the review and to monitor public meetings taking place in nine cities across the nation. Later in the year, General Morris enlisted A.J. Fredrich, the technical director of IWR, to assimilate the data of the 19 project reviews. Fredrich and other staff members evaluated the minutes of public meetings held on potential projects, analyzed the Corps benefit and cost justifications, and produced a report based on the available sources. The resulting policy study, completed in June 1978, helped to persuade President Carter to significantly reduce his hit list. The success of the report gave IWR additional credibility and favor with principal civil works personnel.⁶⁵

While preparing the study, IWR developed new contacts with the Office of the Assistant Secretary of the Army for Civil Works. Assistant Secretary of the Army Veysey's commitment to defining the purpose of the office more clearly, and to improving the Corps' environmental image, paved the way for Carter's appointee, Michael Blumenfeld. With Carter's aggressive water resources policy agenda, the ASA-CW role became more significant and more closely tied to the Corps civil works policy. Although not officially appointed until 1978, Blumenfeld worked with the civil works directorate and IWR on the policy review of 1977-78, evaluating the report and presenting the administration's views. Blumenfeld had a particularly difficult job. Carter's attempt to halt authorized and funded projects not only irked Congress but also damaged the administration's relationship with the Corps. Throughout his

tenure, Blumenfeld straddled the line between supporting the administration and supporting the Corps. During this struggle, however, Blumenfeld increased contact with IWR. This relationship with the ASA-CW would grow stronger in coming years and have significant impact on the future work of the Institute.⁶⁶

Policy and Water Supply

During the early Carter years, several other water resources issues came under the purview of IWR's policy studies program, including a review of the urban studies program and an analysis of drought and water conservation problems. In each study the OCE policy division enlisted the personnel of IWR to do the "quick-turnaround" work. The Corps' urban studies program dated back to the late 1960s, when federal money for public works projects became increasingly scarce. With wastewater treatment a pressing--and expensive--problem in all of the nation's urban areas, OMB looked for ways to meet the mandates in section 208 of the Clean Water Act of 1972. One approach was for the Corps to explore the possibilities of adding wastewater treatment to its resources mission. Wastewater treatment was the primary topic examined in the urban studies program.⁶⁷

By the mid-1970s, urban studies projects were taking place throughout the country, and evaluations were needed. The Institute's role in evaluating urban studies began in 1976, when General Graves directed Fredrich to conduct a "dispassionate analysis" of the program.⁶⁸ Fredrich assigned a new member of the Institute, Kyle Schilling, to conduct the analysis. Before coming to IWR, Schilling, a civil engineer, had served as the senior study manager of the Northeastern

U.S. Water Supply Study (NEWS) conducted by the North Atlantic Division. The analysis employed interviews and questionnaires to ascertain public and Corps opinion about the success of the Corps' urban studies program. Combined with the Institute's own independent analyses, this approach allowed for a fair and objective examination. Completed in July 1977, the study concluded that without greater resources and commitment by the Corps, adding wastewater treatment and water supply as a major mission would be unwise. By this time, the EPA had greatly expanded its wastewater management program, and expanded Corps' involvement would result in unnecessary competition between two federal agencies.⁶⁹

Another water supply issue challenged federal agencies during the mid-1970s. Shortly before President Carter took office, a serious drought had begun in the western United States. By the summer of 1977, reservoirs had dried up, urban water supplies were seriously threatened, water rationing was common, and the geographic extent of the drought had vastly expanded. During that summer, President Carter asked all federal water agencies to submit reports on possible responses to the drought. After receiving the initial reports, the President established an interagency task force to assess the severity of the drought and to propose coordinated federal policy responses.⁷⁰

Brigadier General Drake Wilson, director of civil works from May 1976 to August 1978, viewed the drought as an opportunity for the Corps of Engineers to elevate the importance of water supply and conservation. A severe drought in the East had in part prompted the Northeastern U.S. Water Supply (NEWS) study in the 1960s and early 1970s; now some of the principal NEWS researchers

worked at the Institute. As a result, IWR directed the task force assigned to study the current drought. The IWR team, headed by Kyle Schilling, included economists Robert Harrison and George Antle, and Eugene Stakhiv, a water resources planner by training, who had also worked on NEWS with the North Atlantic Division.⁷¹

To produce the study efficiently, the task force set up working space in the executive branch offices and quickly assimilated available data. Some agency representatives and the administration favored a water conservation or "demand" approach, and assumed that water conservation should always be an objective. In contrast, water resources agencies like the Corps and Bureau of Reclamation had traditionally focused on building on excess capacity in projects, a "supply" approach. By setting up a "straw-man study," the task force pointed out liabilities in both approaches. Conservation was at times a wise practice, but in times of excess supply it could cause revenue-generation problems for water delivery agencies.⁷² Increasing storage capacity by expanding reservoirs was often an impractical solution in light of environmental and social impact considerations. Taking such considerations into the policy analysis, along with drought statistics from IWR and the Water Resources Council (WRC), the task force produced the "Presidential Drought Appraisal Study" in late 1977. The study formed the basis of the President's Drought Assistance Program and earned IWR a commendation from the White House.⁷³

The Institute's work in drought appraisal led to continuing water supply policy studies into the 1980s. In 1978, the office of policy directed IWR to conduct a water conservation study with three main objectives: defining water conservation in terms of water savings and management,

defining research needs, and applying water conservation practices to Corps of Engineers programs. The Institute hired a contractor to assemble an annotated bibliography of water conservation. It also established a task force from OCE and other Corps laboratories, including the Waterways Experiment Station (WES) and HEC, to monitor the project. IWR coordinators worked with the contractor to develop a manual of water conservation planning procedures for the civil works directorate.⁷⁴

The water conservation study proved timely. The Water Resources Council was completing a revised Principles and Standards in response to President Carter's discontent over the existing Principles and Standards, updated in 1975. Carter did not believe the requirement that project benefits must exceed costs was being "rigorously or uniformly applied."⁷⁵ Nor did he believe that federal agencies gave serious consideration to non-structural alternatives or environmental values in planning water resources projects. The President enthusiastically applied conservation principles to water resources. He had vigorously supported water conservation as a method of managing drought, and he now told the WRC of his desire to make water conservation a planning objective of the revised Principles and Standards.⁷⁶

The Institute's Water Conservation Study attempted to define Corps policy. A task force of IWR personnel, OCE representatives, and a field representative from each Corps division prepared the report. As with the Presidential Drought Appraisal Study, the researchers presumed that water conservation should not necessarily be designed into each project. They favored instead a flexible approach, balancing supply and demand issues in rough parity. For

water conservation to be regarded as a primary objective, they argued, it would have to be assumed that conservation in and of itself was always good, irrespective of costs and other impacts. Concluding that this was a flawed assumption, they developed more realistic and flexible procedures. The task force used field examples, experiences of other water agencies, and data produced in the drought study of 1978. In 1979, the task force produced a manual for water conservation that described Corps policy and approaches to achieving the goals of adequate water supply. "Water conservation," the report stated, "is any beneficial reduction in water use or water losses."⁷⁷ Water conservation occurred when water use declined and when the reduction produced a net increase in social welfare.⁷⁸

In December of 1979, the Water Resources Council issued its revised Principles and Standards. While emphasizing water conservation, the Principles and Standards did not give it equal value with the other primary planning accounts (environmental quality and national economic development) or the secondary accounts (recreational developments and other social effects). The arguments made by the Corps through its water conservation studies were compelling, and WRC agreed. Water conservation, while often a valid objective, should not be a primary goal of all water resource development planning.⁷⁹ This was not to suggest that conservation was insignificant. It was an important goal, but secondary to the basic objectives.

The Corps lead role in water conservation also came into play as part of President Carter's Water Policy Initiatives. On July 12, 1978, the President issued thirteen memoranda to federal agencies to begin implementation of

his water policy directives. Nineteen task forces were created to address such issues as water conservation, floodplain management, and protection and maintenance of instream flows for aquatic ecosystems. Eugene Stakhiv, then in the policy division, was detailed to OCE to represent the Corps on three of the task forces. The water conservation work of IWR, published in the final task force reports in May 1979, proved useful in framing the federal agency response.

High-profile policy studies such as the project review, drought appraisal, President Carter's Water Policy Initiatives, and water conservation assessment for the White House increased IWR's visibility. The Institute's multidisciplinary composition and interdisciplinary approach secured it an increasing number of civil works policy studies in the mid- and late 1970s. Steadily changing environmental, social, and economic planning objectives required the Corps to revise and develop new policies constantly. Policy studies that used inferential data resulted. Probably more than any other chief of policy development, Donald Duncan, who assumed the office in 1976, recognized the need to produce quick policy studies to help the Corps adapt to new conditions. Duncan had earlier served on BERH and in the assistant secretary's office. He believed strongly in an interdisciplinary approach to policy studies that would persuasively argue for or against a change in Corps regulations. As chief of policy development, Duncan turned increasingly to IWR for water resources policy analysis.⁸⁰

An Expanding Workload

The growing policy studies component stretched the capabilities of IWR's in-house personnel under the original limitations of 15 professional and 5 clerical positions. In March 1977, the acting technical director of IWR, James R. Hanchey, proposed an increase in staffing to the Director, Lt. Col. William M. Toskey. Citing the recent increase in policy studies work, Hanchey listed other items of an expanding workload.⁸¹ Hanchey noted in his proposal that IWR had an expanding research and development program as well. "There is nearly unanimous agreement within the Civil Works organization," he wrote, "that the planning issues in the [civil works] program are considerable and increasing in complexity and scope. Yet the level of effort devoted to developing planning techniques and methods is relatively small."⁸² The planning methodologies workload steadily increased in the mid-1970s, and as part of the R&D program, Hanchey defined its purpose:

*To increase the knowledge and understanding of the physical, economic, social and environmental relationships inherent in planning for development and management of the nation's water resources; and to develop concepts and procedures for incorporating this knowledge into the planning process in a way which provides a better basis for professional, public, and governmental evaluation without producing inordinate increases in planning costs or time.*⁸³

Major components of the planning methodologies program at that time included flood control planning and management, the impact of water resources projects on

regional development, economic projections for U.S. foreign trade and commodity activity, social impact assessment methods, and development of accurate methods of evaluating recreational benefits.⁸⁴

Other reasons for increased staffing included reimbursable work. By definition, reimbursable work included "studies, conferences, and training activities actually carried out for and funded by other groups within and outside of the U.S. Army Corps of Engineers."⁸⁵ Although IWR had always conducted training programs and held conferences, prior to 1977 funding had come from the general investigations budget. By 1977, however, most of IWR's training activities were reclassified as reimbursable work. In that year, IWR held 16 week-long training sessions on six different subjects: public involvement for Corps executives, advanced public involvement for planners, water resources planning for district engineers, forecasting techniques for water resource planners, wetlands science and technology, and analytical techniques for water resources planners and hydroelectric power planners. Some of the sessions were conducted jointly with the Bureau of Reclamation, EPA, and HEC.⁸⁶ By 1978, IWR was conducting nine training courses, including land use analysis for planners; basic public involvement; social impact assessment; and economic, social and institutional aspects of water resources planning. More than 800 Corps planners attended these courses, making them a primary outlet for technology transfer to the field.⁸⁷ Training sessions and seminars completed a long list of activities that added to the IWR workload.⁸⁸

Wetlands and IWR

Part of IWR's work on behalf of the regulatory program was classified as reimbursable beginning in 1977. Additional emphasis on this issue coincided with President Carter's 24 May 1977 executive order. The order defined wetlands more broadly than past definitions and proposed a "concerted federal effort to protect our wetlands."⁸⁹ Carter's three-step program to accomplish this goal directed federal agencies to refrain from giving financial support to proposed developments in wetlands and supported a stronger implementation of the section 404 permit program for regulating filling and disposal of dredged materials in the nation's waters and wetlands.⁹⁰ Carter directed the Secretary of the Army to "support continued implementation" of the section 404 program.⁹¹

Following the Carter executive order, IWR expanded its work on the regulatory program and its evaluation of wetlands. In February 1977, for example, IWR hosted a basic training course for regulatory personnel. One hundred twenty-five Corps employees from divisions and districts with regulatory responsibilities attended. Instructors in the three-day course included IWR, OCE, and field personnel, as well as two representatives of the Natural Resources Defense Fund and Environmental Defense Fund. The course attempted to sort out the vagaries of the Corps' regulatory responsibilities, clarify the legal requirements of the process, and explore public involvement and interagency coordination methods to enhance the program's efficiency.⁹²

As a part of the Corps' Environmental Action Program, initiated in 1976, IWR had begun preparation of a wetlands evaluation manual and completed an interim report in July 1977.⁹³ Carter's emphasis on wetlands protection

compelled the Corps to write a more extensive manual to identify wetlands, assess their value, and provide a blueprint for regulatory personnel. IWR designated five individuals (three in-house and two consultants) to coordinate and write the manual. Wetland Values: Concepts and Methods for Wetlands Evaluation, published in February 1979, was the result. The 109-page manual focused on defining wetlands and delineating objectives and procedures for evaluating them, including deductive and comparative analyses. The manual described wetlands as an integral part of the food chain and as an important resource that must be protected.⁹⁴ The operations division distributed the manual to each Corps regulatory office, adding consistency to the complex and evolving program.

The National Studies

The expanding reimbursable workload helped justify the requests for more staffing, but two large special studies guaranteed IWR's expansion. The Water Resources Development Act of 1976 directed the Secretary of the Army, acting through the Chief of Engineers, to conduct two major studies: one on the nation's waterways and another to assess the potential of hydropower resources in the United States.⁹⁵ Their scheduled start time was fiscal year 1978, and IWR's senior members quickly expressed their willingness to have the Institute direct the studies. Large analytical studies, they argued, were becoming increasingly important to Congress and to the nation. In the past, the Corps had usually assigned such work to a division engineer, to a division or branch in OCE, or to various other ad hoc study teams in the Corps.⁹⁶ Assigning the work to a field

division worked well in regional studies like the Northeastern U.S. water supply study. However, for this kind of study, the Corps would be best served by placing study management in the Corps R&D laboratories, where the staffs were flexible and could easily be shifted to special study needs. "As the key planning research organization in the Corps," the Institute's proponents wrote, "IWR can and should be given management responsibilities for special studies on national water planning issues, policies, and programs."⁹⁷

The Institute's arguments were apparently convincing. In August 1977, General Ernest Graves, then deputy chief of engineers, wrote to Senator John Stennis, chairman of the Senate Subcommittee on Public Works, requesting a gradual increase in IWR staffing "to fulfill additional and emerging requirements in the Civil Works program."⁹⁸ Graves also expressed his desire to make IWR manager for the national studies. Graves commented that "the Institute has proven its worth and has demonstrated considerable capability to carry out its previously assigned work."⁹⁹ In November, Stennis informed Graves that the committee had approved an increase in the total staff of IWR to 35 people, and approved of assigning the national studies to IWR.¹⁰⁰

In the actual personnel allocations for 1978, however, IWR gained an additional 10 spaces rather than 15, bringing the authorized staff to a total of 30 (20 professionals and 10 administrative personnel). This staff level, too, was in jeopardy when all Corps of Engineers laboratories faced 10 to 30 percent budget reductions as part of an effort in 1977 to reduce the agency's civil works budget and a more general movement to reduce the size of

the federal government. This directive for "reduction planning" of Corps laboratories came at a time when IWR's workload was increasing. In early December 1977, the laboratory reviewers visited IWR. After the visit, acting director Fredrich prepared reduction planning tables for 10, 20, and 30-percent losses. While "critical mass" (the necessity of disbanding major programs) might not accompany a 10-percent reduction, he argued, any larger cuts would force the termination of some of the five major work elements of IWR: planning methodologies, policy studies, reimbursable work, training, and special studies. Twenty to thirty percent reductions would result in "the total loss of all gains made over the last three fiscal years in converting IWR from a predominantly contract research to a predominantly in-house research organization."¹⁰¹ At a 30 percent reduction, Fredrich warned, "only the Special Studies [primarily national studies] and the Civil Works R&D would remain as viable elements of the IWR program." Policy studies would be eliminated.¹⁰²

As a result of the review and IWR response, the Institute retained 30 spaces and actually added more positions. By August 1978, 19 permanent professionals and 9 permanent administrative personnel worked at the Institute. Seven economists, five civil engineers, one water resource planner, one urban planner, one environmental planner, two sociologists, one community planner, and one geographer made up the permanent technical staff. Nine temporary appointments in both technical and administrative positions rounded out the staff. By this time, Fredrich, who had been acting director since early 1977, had become the first civilian director of IWR, and Major Edward Willis, Jr., had become executive officer.¹⁰³

IWR's long-range planning efforts provided useful experience in directing the national studies. Since the opening of IWR, economists, both staff members and outside consultants, had conducted port and waterways analyses. IWR had also had experience in hydropower analysis. For example, in May 1975, Ralph Trisko, an IWR economist, had completed a study entitled Hydroelectric Power Potential at Corps of Engineers Projects: Recommendations and Executive Summary.¹⁰⁴ The report had recommended a broad investigation of Corps dam sites for their hydropower potential and a variety of approaches for the agency to generate more power in existing projects.¹⁰⁵ The timing of the report was crucial. In the wake of the Arab oil embargo of 1973, oil prices had doubled, and doubled again by 1976. President Carter entered office urging Americans to regard the "energy crisis" as "the moral equivalent of war." He established the Department of Energy and made part of its mission the development of alternatives to fossil-fuel energy.

General Morris, who became deputy chief of engineers in 1975, supported IWR's studies in navigation and hydropower and had actively promoted the establishment of national studies in the Water Resources Development Act of 1976. Morris also hoped to gain congressional approval for national recreation, water supply, and flood control studies, but he did not succeed in these efforts.¹⁰⁶ He believed that the Corps needed to look to the future as the civil works construction program began to decline. National planning, operation and maintenance, and environmental engineering were among the most significant "bridges to the future" Morris envisioned for the Corps. Better use of hydropower potential and a "waterway system"

that resembled the national interstate highway system were two elements of that future.¹⁰⁷

The National Hydroelectric Power Resources Study

The National Hydroelectric Power Resources Study (NHS) was authorized to help meet two national goals: energy efficiency and environmental quality. Its premise was that additional use of hydropower could reduce dependence on fossil fuels. Since many of the projects in question were already built, the adverse environmental impact of increasing hydropower might often be minimal. When work began on the study, the Institute was conducting a nationwide assessment of small-scale hydroelectric potential at existing dams on a reimbursable basis for the Department of Energy.¹⁰⁸ As the lead agency in the 3-year, \$7 million NHS, IWR hoped to define the need for national hydroelectric power, assess the potential for increasing capacity and generation, analyze policymaking with regard to hydroelectric power planning, and determine the feasibility of developing new hydropower sites. James R. Hanchey became the study manager in late 1977, and three other permanent and four temporary personnel joined him on the NHS team. Initially, the team prepared a plan of study and developed a methodology for making an inventory of sites and hydropower needs. Next, IWR met with representatives from the departments of Energy, Interior, Agriculture, the Water Resources Council, and the Tennessee Valley Authority.¹⁰⁹

Less than a year after beginning the study, IWR published a "Preliminary Inventory of Hydropower Resources." Working in conjunction with HEC and 47

Corps field offices, the researchers reviewed nearly 55,000 federal and nonfederal dams, and compiled information on more than 11,000 potential sites. The early estimates suggested that national hydropower could produce more than 500,000 megawatts of electricity; currently it produced only 64,000 megawatts. Much of this potential (166,000 megawatts) existed in Alaska, and the preliminary report was quick to point out that development there would be physically difficult. Moreover, the early estimates were only basic economic assessments, and did not consider environmental concerns or flood control conflicts that would be a part of full benefit-cost analyses.¹¹⁰

To publicize recent work in small-scale hydropower, the Institute sponsored Waterpower '79, an international conference held in conjunction with the Department of Energy. More than 1,200 people attended the conference, at which 83 papers were delivered on issues ranging from engineering design and capability to planning, safety, and environmental concerns.¹¹¹ James R. Hanchey and James F. Johnson, OCE planning division coordinator for the hydropower study, gave papers discussing the progress of the NHS.¹¹² The inventory and identification of hydropower sites neared completion at the end of 1979. The researchers had divided the nation into six regions and were conducting environmental assessments of adding capacity. The second major phase of NHS, the policy and technical overview, was also under way by the end of 1979.¹¹³

The National Waterways Study

The Institute for Water Resources also oversaw the National Waterways Study (NWS). By the end of 1979, the 3-year,

\$5 million study was fully under way. As a preliminary step, researchers on the waterways study had reviewed the only other national study of waterways, the 1908 report of the Inland Waterways Commission (created by Theodore Roosevelt). That report provided a historical view of the development of inland waterways, the condition of waterways in 1908, and economic forecasts of future water transportation needs.¹¹⁴ Similarly, NWS was to assess the capability of the existing waterway system, describe the relationship between navigation benefits and other uses of waterways, analyze and define present waterway needs, and forecast future waterway system needs.¹¹⁵

Unlike the 1908 report, NWS had to address other factors, including environmental and socio-economic impacts, and define the concept of a "waterway system." The systems idea implied that the nation's waterways should operate in a well-coordinated manner to promote efficient transportation and avoid congestion. However, many of the nation's waterways had not been built systematically, but on a project-by-project basis.

The overall question Congress and the Chief of Engineers posed to the NWS team was, "Given all these realities, what should a first-class waterway system look like by the year 2000?"¹¹⁶ To answer this question, IWR assembled a research team representing a broad range of public and private interests. In November 1977, Arlene Dietz, an economist who had recently come to IWR from the North Central Division, became the study manager. Because most of the in-house staff was committed to other work, Dietz used temporary employees, consultants, and Intergovernmental Personnel Act (IPA) employees throughout the study.¹¹⁷ By January 1978, IWR had selected

a steering committee composed of OCE chiefs of planning, construction-operations, engineering, and policy; the director of IWR; the technical director of BERH, and representatives from the Department of Transportation and the U.S. Maritime Commission. Initially, the NWS team developed a draft plan of study and a public involvement plan to publicize the study and ascertain the views of nonfederal agencies, interest groups, and citizens.¹¹⁸

NWS was an unprecedented attempt to analyze the entire national waterway system. The "institutional culture" of IWR facilitated the work of NWS. IWR economists, engineers, and water resources planners were experienced in regional studies, public involvement, and social impact assessment techniques. Within the Institute, Arlene Dietz coordinated the project; Howard Olson, an economist who had come to IWR from the North Central Division in 1975, developed the draft plan of study and managed the field activities; and Robert Harrison oversaw the planning components. Once they had completed the plan of study in mid-1978, they developed a detailed work plan to match consultants, staff, and other team members with specific tasks.¹¹⁹ By February 1979, the NWS team presented some preliminary findings. The team identified almost 26,000 miles of commercially navigable waterways in the United States and 155 commercial harbors serving the waterways. The Corps of Engineers built, operated, and maintained most of the navigation improvements along the waterways, which included locks at 265 sites. In 1947, nationwide waterborne commerce totaled about 700 million tons; by 1977, that figure had increased to 1.9 billion tons. Foreign waterborne commerce had increased at a more rapid rate than domestic activity, but both statistics pointed to the

importance of waterways and ports to the national economy.¹²⁰

To assess the current and future capabilities of the waterways, the researchers divided the nation into twenty subdivisions in order to focus on current use, future needs, and development strategies. During 1979, the NWS team completed a series of workshops and briefings to discuss the study with the steering committee and other interested groups, such as shippers, railroad associations, and environmental organizations. The team published first issues of the NWS Information Bulletin, a quarterly digest of progress on the study distributed to more than 10,000 individuals and organizations. And in conjunction with the U.S. Geological Survey, the NWS team released a series of 19 maps of waterborne commerce flows, and detailed cartographic information of the national waterways. In April 1980, a National Waterways Roundtable consisting of Corps personnel, academicians, businesspeople, and representatives from other public agencies convened in Norfolk, Virginia. The four sessions concerned the history and evolution of national waterways and ports, the impact of waterways on regional development, technology, and forecasting.¹²¹

Incorporation into the Water Resources Support Center

The Institute for Water Resources had undergone considerable change during the late 1970s. With the national studies fully under way and research and policy work expanding, IWR had 25 permanent technical, 11 permanent administrative, and 12 temporary professionals in residence. Three divisions existed: research and development, policy studies, and national planning studies.

Research and development work included continuing social impact assessment, the ex-post-facto study of the McClellan-Kerr Waterway, and computer modeling studies for inland navigation, flood control, and low-flow hydropower.¹²²

Water conservation studies, wetlands jurisdiction, nonstructural planning evaluations, and investment strategies were major policy studies under way at the same time. Both policy studies and research and development increasingly involved reimbursable work. The Institute's new acting director, James R. Hanchey, assumed the position when A.J. Fredrich resigned in 1979 to accept a teaching position at Indiana State University at Evansville.¹²³

Another significant development at this time was the incorporation of IWR into the Water Resources Support Center (WRSC). This umbrella organization was in part the result of General Morris's desire to bring many of the activities of OCE from downtown Washington, DC, to Fort Belvoir. With IWR and BERH occupying the Kingman Building by the late 1970s, Morris viewed this as a nucleus of a "Center for Water Resources Engineering."¹²⁴ Other factors, such as the move of the Corps' dredging division to Fort Belvoir, precipitated the creation of WRSC. Permanent Order 13-1, issued on 15 June 1979, called for incorporation of IWR into WRSC. WRSC was to be a field operating agency "under the command of the Chief of Engineers and the staff supervision of the Directorate of Civil Works."¹²⁵ It would be located at Fort Belvoir and would house the publications and training office, the data collection and management division, and the dredging division. Other elements of WRSC were the Waterborne Statistics Center in New Orleans, the Marine Design Center

in Philadelphia (which was part of WRSC until the late 1980s), HEC in Davis, California, and IWR.¹²⁶

Incorporation of IWR in the new WRSC had minimal impact on the Institute's work or mission. In fact, the new mission statement reflected IWR's increasing responsibilities and the broader scope of its work since the early 1970s:

The Institute for Water Resources . . . provides the Director of Civil Works and other Corps offices with support and analytical capability to both meet and identify major current and future U.S. water resources needs. IWR is the principal Corps laboratory for water resources planning methodology. The methodology is primarily directed to projecting and assessing the economic, social, and environmental impacts of water resources development to National Economic Development, Environmental Quality, and other social effects; increasing public involvement in water resources decisionmaking and evaluating and implementing water conservation and other nonstructural allocations. IWR provides policy analyses, program evaluation, design and management of special nationally scoped water resource studies, and navigation data bases, analytical techniques, and studies.¹²⁷

After the reorganization of 1975, the IWR workload had increased significantly. IWR's funding for fiscal year 1975 totaled less than \$2 million; by fiscal year 1980, funding was nearly \$8 million, with the national studies comprising nearly \$5 million of the total. Staffing, including temporary employees and IPA personnel, increased from 17

in 1975 to almost 50 in 1980. The Institute had come far in making its abilities known and useful to the civil works directorate.

This is not to suggest, however, that everything IWR worked on during this period was a "winner," in the words of technical director A.J. Fredrich.¹²⁸ For example, IWR invested considerable time in a methodology called "Energetics." H.T. Odum of the University of Florida developed the concept, which used energy flow relationships as the basis for recording environmental and economic impacts. The Corps directed IWR to analyze whether the methodology could replace environmental and economic analysis. It proved inapplicable to water resources planning.

IWR unsuccessfully attempted to establish a program for social impact assessment similar to the Environmental Action Program.¹²⁹ In 1977, IWR had done a policy study on the feasibility of creating a water resources data center in the Corps. Such a center would create an electronic archive of all civil works data produced by the agency. The IWR policy study argued for creation of such an entity as another element in improving the Corps' civil works planning, but the idea never materialized, in part because of the decentralized data collection methods used throughout the Corps.¹³⁰

Members of the Institute involved in policy studies believed that regardless of the outcome, policy studies were efficient and beneficial to the Corps. Doing an IWR study was far less expensive than implementing a program agency-wide. As the 1970s drew to a close, "testing the waters" of new initiatives to determine if they warranted longer term consideration was becoming one of IWR's most valuable and enduring functions.

The Carter administration had introduced many new variables into the water resources planning field, while energy and environmental exigencies confronted federal agencies. IWR, with its multidisciplinary composition, grew in importance to the Corps as the agency struggled to cope with changing times and a host of emerging water resources issues. As the 1980s began, IWR was really three Institutes-policy, research, and national studies--all caught up in a whirlwind of activity.

¹ Amended ER 10-1-23, "Institute for Water Resources," 24 Jan. 1975.

² Ibid.

³ Ibid.; IWR Annual Report 1976-1977, p. 21; Fredrich interview.

⁴ Morris interview; Hanchey interview; Fredrich interview.

⁵ Letter, Cassidy to Chairman, Senate Public Works Appropriations Subcommittee, 10 Feb. 1969.

⁶ Ibid; Disposition Form, Irwin Reisler, Chief of Planning?, to DAEN-CWR, subj: Funding Policy Formulation Studies from General Expense, 10 Sept. 1975, IWR DO files.

⁷ Ibid; Fredrich interview; "IWR: The Video."

⁸ Reisler to DAEN-CWR.

⁹ Ibid.

¹⁰ Ibid.; Fredrich interview; Interview, author with William Lockwood, Dep. Chief for Policy, HQ-USACE, 25 Mar. 1994. Hereafter cited as Lockwood interview.

¹¹ IWR Annual Report, 1975, pp. i, 13.

¹² Office Memorandum No. 4, Institute for Water Resources, 7 Nov. 1975, IWR DO files.

¹³ IWR Annual Report, 1976-1977, pp. 65-67; "IWR: The Video"; Fredrich interview.

¹⁴ IWR Annual Report, 1976-1977, pp. 25-30, 41-43, 59-60.

¹⁵ Stine, "Environmental Politics and Water Resources Development," pp. 123, 127; see also River and Harbor Act of 1899.

¹⁶ See "Memorandum of Understanding between the Secretary of the Interior and the Secretary of the Army," 13 July 1967, in Stine, "Environmental Politics and Water Resources Development," Appendix A.

¹⁷ *Ibid.*, p. 124.

¹⁸ Digest of Water Resources Policies and Authorities, pp. 22-23; Stine, "Environmental Politics and Water Resources Development," pp. 128-132; Jeffrey K. Stine, "Regulating Wetlands in the 1970s: U.S. Army Corps of Engineers and the Environmental Organizations," Journal of Forest History (April 1983), pp. 71-74.

¹⁹ "Permits for Activities in Navigable Waters or Ocean Waters," Federal Register 39 (3 April 1974), pp. 12115-12137.

²⁰ Natural Resource Defense Council, Inc. v. Callaway, 392 F. Supp. 685 (D.D.C., 1975, Civil Action No. 74-1242); Complaint filed by plaintiffs, 16 Aug. 1974.

²¹ See Stine, "Environmental Politics and Water Resources Development," pp. 137-144, for details of the press release and its impact; See Gregory Graves, "The Pacific Ocean Division and Honolulu Engineer District in the 1980s" (Honolulu, HI: Pacific Ocean Division, forthcoming 1994), chapter 6, for an overview of regulatory activities on a district level in the late 1970s and 1980s; See "Wetlands and the Corps of Engineers," Washington Post, 3 June 1975, for an example of reactions to the Corps press release, and Letter, Maj. Gen. J.W. Morris, Dir. of Civil Works, to Editor, Washington Post, 4 June 1975, OHA CW/Env. files, for a rebuttal to the Post article.

²² Quoted in Stine, "Environmental Politics and Water Resources Development," p. 148.

²³ Stine, "Regulating Wetlands in the 1970s: U.S. Army Corps of Engineers and the Environmental Organizations," pp. 71-74.

²⁴ Fredrich interview; Annual Report, Civil Works Activities, Vol 1, pp. 53-59; Interview, author with Jim Crews, Operations and Maintenance Division, HQUSACE, 10 June 1994. Hereafter cited as Crews interview.

²⁵ IWR Annual Report, 1976-1977, p. 21.

²⁶ See Stine, "Environmental Politics and Water Resources Development," chapter 6, for details on President Carter's environmental initiatives; Reuss, Reshaping National Water Politics, pp. 48-49.

²⁷ Executive Order #11990, Protection of Wetlands, Office of the White House Press Secretary, 25 May 1977, OHA Civil Works/Env. files.

²⁸ Hanchey interview; IWR Annual Report, 1976-1977, p. 27.

²⁹ Ibid.

³⁰ Ibid., p. 43.

³¹ Fact Sheet, "Corps of Engineers Environmental Program," 31 July 1974, OHA, CW/Env. files; Lt. Gen. W.C. Gribble, Chief of Engrs., to Maj. Gen. F.P. Koisch, Div. Engr., Lower Miss. Valley, 27 Aug. 1975, subj: Update of Env. Guidelines, OHA, CW/Gen. files; Memorandum for Dir. of Civil Works from Gribble, 27 Aug. 1975, subj: Env. Guidelines, OHA, CW/Gen. files, box 58.

³² See U.S. Army Corps of Engineers, Institute for Water Resources, Environmental Guidelines for the Civil Works Program of the Corps of Engineers, IWR Report 70-5 (Nov. 1970), for the original guidelines; Memorandum to Div. Engrs. from Gribble, 7 Jan. 1976, subj: Env. Guidelines for the Civil Works Program, OHA, CW/Gen. files, box 58.

³³ Ibid.

³⁴ Ibid.; Letter, Maj. Gen. Ernest Graves, Dir. of Civil Works, to John D. Stewart, Editor, Environmental Reporter, 7 Dec. 1976, subj: Rebuttal of Environmental Reporter analysis of new Corps guidelines, OHA, CW/Gen. files, box 58.

³⁵ IWR Annual Report, 1976-1977, p. 28; Annual Report, Civil Works, 1975, p. 59; Memorandum For the Record from Col. D.D. Ludwig, subj: Program briefing for Deputy Director of Civil Works, 23 Apr. 1976, IWR DO files; Memorandum for the Chief of Staff from John O. Anfinson, 26 July 1993, subj: GREAT, IWR historical files.

³⁶ Nelson, "The Office of the Assistant Secretary of the Army for Civil Works," p. 90.

³⁷ Quoted in Stine, "Environmental Politics and Water Resources Development," p. 105.

³⁸ Ibid., p. 106; Reuss, Shaping Environmental Awareness, p. 40; Memorandum for Director, Civil Works from, Gribble, 10 Dec. 1975, subj: Environmental Action Program, OHA Civil Works/Env. files.

³⁹ Ibid.; Stine, "Environmental Politics and Water Resources Development," pp. 105-113.

⁴⁰ Delli Priscoli interview; See Paul R. Edwards, "A Public Involvement Strategy," Water Spectrum Vol. 6, No. 3 (Spring 1974), pp. 34-40, for a case study of the Corps' public involvement experiences in the Kansas City District.

⁴¹ Leonard Ortolano, Water Resources Decision Making on the Basis of the Public Interest, IWR Contract Report, 75-1 (February 1975), preface, pp. 1-4.

⁴² Thomas Wagner and Leonard Ortolano, Testing An Iterative, Open Process for Water Resources Planning, IWR Report 76-2 (Dec. 1976), passim.

⁴³ Quoted in Jerry Delli Priscoli, "Public Involvement and Social Impact Analysis: A Union Looking for Marriage," IWR Working Paper 78-2 (Jan. 1978). See also Jerry Delli Priscoli, "Public Involvement Techniques," Water Spectrum (Summer 1981), pp. 9-17, for the changing relationship of social scientists and engineers in planning.

⁴⁴ U.S. Army Corps of Engineers Institute for Water Resources, Public Involvement: Ten Years of Experience, pp. 2-6.

⁴⁵ Ibid., p. 4.

⁴⁶ Ibid., p. 5; Interview, author with C. Mark Dunning, Institute for Water Resources, 13 June 1994. Hereafter cited as Dunning interview.

⁴⁷ Jerry Delli Priscoli, "Integrating Social Analysis into Water Resources Planning: Some Emerging Trends in the Corps of Engineers," Water Resources Bulletin Vol. 13, No. 5 (Oct. 1977), pp. 953-958; Delli Priscoli interview; Dunning interview.

⁴⁸ U.S. Army Corps of Engineers Institute for Water Resources, Public Involvement: Ten Years of Experience, pp. 2-6.

⁴⁹ Memorandum For the Record from A.J. Fredrich, subj: Proposed Corps Action Plan for Social Analysis, 18 May 1977, IWR historical files.

⁵⁰ IWR Annual Report, 1979, p. 13.

⁵¹ IWR Annual Report, 1976-77, pp. 7-8.

⁵² See Jim J. Tozzi, "The Expost Evaluation of Federal Water Resource Projects in the United States," paper presented at the Organization for Economic Cooperation, The Hague, Netherlands, Oct. 1970 for general comments on why ex-post evaluations were needed for water projects. Copy located in Tozzi papers, OHA.

⁵³ See Warren J. Papin, "Take 17 Giant Steps," *Water Spectrum*, Vol. 2, No. 3 (Fall 1970), pp. 6-15.

⁵⁴ Interview and comments of George Antle, 9 Nov. 1994. Hereafter cited as Antle interview and comments, 9 Nov. 1994.

⁵⁵ U.S. Army Corps of Engineers Institute for Water Resources, An Overview of the Impact Study of the McClellan-Kerr Multiple Purpose Arkansas River System IWR Research Report 75-R3, (July 1975), pp. 3-4; Memorandum For the Record from Col. Daniel D. Ludwig, subj: Briefing for Deputy Chief of Engineers, Major General Morris on McClellan-Kerr Arkansas Study, 30 Jan. 1976, IWR DO files.

⁵⁶ During the 1970s and early 1980s, the Corps sponsored nearly 40 ex-post studies of McClellan-Kerr, many of them produced by IWR. See U.S. Army Corps of Engineers, Institute for Water Resources, A Tale of Three Cities: A Research Strategy for Social Impact Assessment IWR Research Report 77-R2, (Dec. 1977), for a good example of a contracted study examining the social impact of the project on three small cities located along the waterway.

⁵⁷ George Antle, "Evaluation of Completed Projects--Why Is It Important?" in Gordon G. Green and Earl E. Eiker, eds., *Accomplishments and Impacts of Reservoirs: Proceedings of a Symposium Sponsored by the ASCE Water Resources Planning and Management Division* (New York: American Society of Civil Engineers, 1983), pp. 6-19.

⁵⁸ "Jimmy Carter on the Environment," campaign flyer, located in CW/Env. files, Box 59, OHA.

⁵⁹ Stine, "Environmental Politics and Water Resources Development," pp. 170-171, 177-178; Reuss, Reshaping National Water Politics, pp. 47-51.

⁶⁰ "Jimmy Carter on the Environment."

⁶¹ Ibid.

⁶² Reuss, Reshaping National Water Politics, p. 49; IWR Annual Report, 1976-1977, pp. 41-42.

⁶³ Stine, "Environmental Politics and Water Resources Development," pp. 179-182; Reuss, Reshaping National Water Politics, pp. 49-50.

⁶⁴ Maj. Gen. J.W. Morris, "A Time for Reflection," Water Spectrum Vol. 7, No. 3 (Fall 1975) pp., 1-8.

⁶⁵ IWR Annual Report, 1976-1977, pp. 41-42; Fredrich interview; Morris interview; "IWR: The Video."

⁶⁶ Nelson, "The Office of the Assistant Secretary of the Army for Civil Works," pp. 190-197; Interview, Frank N. Schubert with Lt. Gen. Ernest Graves, 1987, (transcript in OHA); Telephone interview, author, with Edward Dickey, 16 June 1994. Hereafter cited as Dickey interview.

⁶⁷ Kyle E. Schilling, Urban Studies Program Evaluation, IWR Policy Study (July 1977), p. 1; Interview, author with Kyle Schilling, 13 June 1994. Hereafter cited as Schilling interview.

⁶⁸ Memorandum For the Record from Col. D.D. Ludwig, subj: Program briefing for Deputy Director of Civil Works, 23 Apr. 1976, IWR DO files.

⁶⁹ Schilling, Urban Studies Program Evaluation, pp. 2-4; Schilling interview.

⁷⁰ See Robert Harrison, "Response to Drought," Water Spectrum Vol. 9, No. 3 (Summer 1977), pp. 34-37, for general information on the drought and potential responses at all governmental levels; IWR Annual Report, 1976-1977, p. 42.

⁷¹ Schilling interview.

⁷² Southern California municipal water agencies are particularly troubled by the drought cycle in which they encourage and force conservation during drought, and then have excess capacity in wet years that people do not use because they are trained to conserve. The increased water sales would allow new construction and system upgrades. See Gregory Graves, A History of the Las Virgenes Municipal Water District (Los Angeles: The Laufer Group, 1993).

⁷³ Schilling interview; IWR Annual Report, 1976-1977, p. 42; IWR Annual Report, 1979, p. 5.

⁷⁴ IWR Annual Report, 1978, p. 35.

⁷⁵ Memorandum For the Record from Pres. Jimmy Carter, subj: Improvements in the planning and evaluation of federal water resources programs and projects, 12 July 1978, OHA CW/Env. files.

⁷⁶ Ibid.

⁷⁷ Duane D. Bauman, John J. Boland, John H. Sims, Bonnie Kranzer, Philip H. Carver, The Role of Water Conservation in Water Supply Planning, IWR Contract Report 79-2 (Apr. 1979), p. 107.

⁷⁸ *Ibid.* pp. 107-108; IWR Annual Report, 1979, p. 15; Schilling interview.

⁷⁹ Headquarters, U.S. Army Corps of Engineers. Digest of Water Resources Policies and Authorities, p. 2-8; Schilling interview.

⁸⁰ Schilling interview; Interview, author with Donald Barnes, 10 June 1994. Hereafter cited as Barnes interview.

⁸¹ Disposition Form, James R. Hanchey to Lt. Col. W.M. Toskey, 25 Mar. 1977, subj: Transmittal of proposal for increasing the capability of IWR, IWR DO files.

⁸² *Ibid.*

⁸³ *Ibid.*

⁸⁴ *Ibid.*

⁸⁵ IWR Annual Report, 1976-1977, p. 59.

⁸⁶ Unsigned Information Paper, subj: Institute for Water Resources--Program and Accomplishments, ca. 1979, IWR DO files.

⁸⁷ Ibid.; "IWR: The Video"; Fredrich interview; Hanchey interview.

⁸⁸ Ibid; Unsigned Memorandum For the Record, subj: FY 1977 Research Program Narrative Rationale, Planning Methodologies, undated, 1977, IWR DO files.

⁸⁹ Council on Environmental Quality, The President's Environmental Program--1977 (Washington, DC: U.S. Government Printing Office, 1977), p. M-7.

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⁹² IWR Annual Report, 1976-1977, p. 60.

⁹³ Larry Messman et al., Wetland Values--Interim Assessment and Evaluation Methodology, IWR Report (July 1977), passim.

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⁹⁵ Fact Sheet, National Hydroelectric Power Resources Study, 13 Jan. 1978, IWR DO files; IWR Annual Report, 1978, pp. 55, 59; Water Resources Development Act of 1976, L. 94-587.

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⁹⁷ Ibid.

⁹⁸ Letter, Maj. Gen. Ernest Graves to Sen. John Stennis, 23 Aug. 1974, subj: Increasing IWR staffing and assigning national study responsibility, IWR DO files; Stennis to Graves, 21 Nov. 1977, subj: Response to Graves's request, IWR DO files.

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¹⁰⁰ Information Paper, Institute for Water Resources--Program and Accomplishments, ca. 1979, IWR DO files.

¹⁰¹ DF, Jay Fredrich to DAEN-RDM, 27 Dec. 1977, subj: Corps Laboratory Review, IWR DO files; Fredrich interview.

¹⁰² Ibid.

¹⁰³ Fredrich interview; Personnel List, IWR, 18 Aug. 1978, IWR DO files.

¹⁰⁴ Ralph L. Trisko, Hydroelectric Power Potential at Corps of Engineers Projects: Recommendations and Executive Summary, (IWR Research Report 75-R2) May 1975, passim.

¹⁰⁵ Ibid., pp. 1-7.

¹⁰⁶ Morris interview; "A Look to the Future," draft of speech by Lt. Gen. J.W. Morris, 3 Aug. 1978, IWR DO files; "IWR: The Video"; Fredrich interview.

¹⁰⁷ Interview, author with Arlene Dietz, 20 Sept. 1993. Hereafter cited as Dietz interview; Morris interview.

¹⁰⁸ IWR Annual Report, 1978, p. 51.

¹⁰⁹ Fact Sheet, National Hydroelectric Power Resources Study, 13 Jan. 1978, IWR DO files; IWR Annual Report, 1978, p. 55; McDonald interview; Hanchey interview.

¹¹⁰ "The National Hydroelectric Power Resources Study," Engineering News Record Vol. 203, No. 13 (27 Sept. 1979), p. 14.

¹¹¹ U.S. Army Corps of Engineers and U.S. Department of Energy, Waterpower '79: An International Conference on Small-scale Hydropower, October 1-3, 1979, Abstracts, pp. 104-105.

¹¹² Ibid.

¹¹³ Ibid.; IWR Annual Report, 1979, pp. 18-19.

¹¹⁴ Dietz interview.

¹¹⁵ Fact Sheet, National Waterway System (NWS), 13 Jan. 1978, IWR DO files.

¹¹⁶ Ibid.; Dietz interview; Morris interview.

¹¹⁷ Dietz interview.

¹¹⁸ Fact Sheet, NWS, 13 Jan. 1978; Annual Report of the Chief of Engineers on Civil Works Activities, Vol. 1, p. 7.

¹¹⁹ Dietz interview.

¹²⁰ IWR Annual Report, 1979, pp. 17-18; Arlene L. Dietz, "National Waterways Study," Water Spectrum Vol. 11, No. 4 (Fall 1979), pp. 32, 35.

¹²¹ National Waterways Study (brochure with accompanying maps), undated, OHA CW/Env. files; NWS Information Bulletin Vol. 1, No. 3 (Sept. 1979); IWR Annual Report, 1979, pp. 16-17; IWR Annual Report, 1980, p. 20.

¹²² Unsigned Memorandum for Brig. Gen. Drake Wilson, 22 June 1978, subj: FY 79 R&D Funds, IWR DO files; IWR Annual Report, 1979, p. 13.

¹²³ IWR Annual Report, 1979, p. 1; Hanchey interview; Fredrich interview.

¹²⁴ "A Look to the Future," speech by Gen. J.W. Morris, 3 Aug. 1978, IWR DO files; Interview, Martin Reuss with Lt. Gen. E.R. Heiberg, III, 19 Apr. 1993, OHA.

¹²⁵ ER 10-1-23, 9 Nov. 1979.

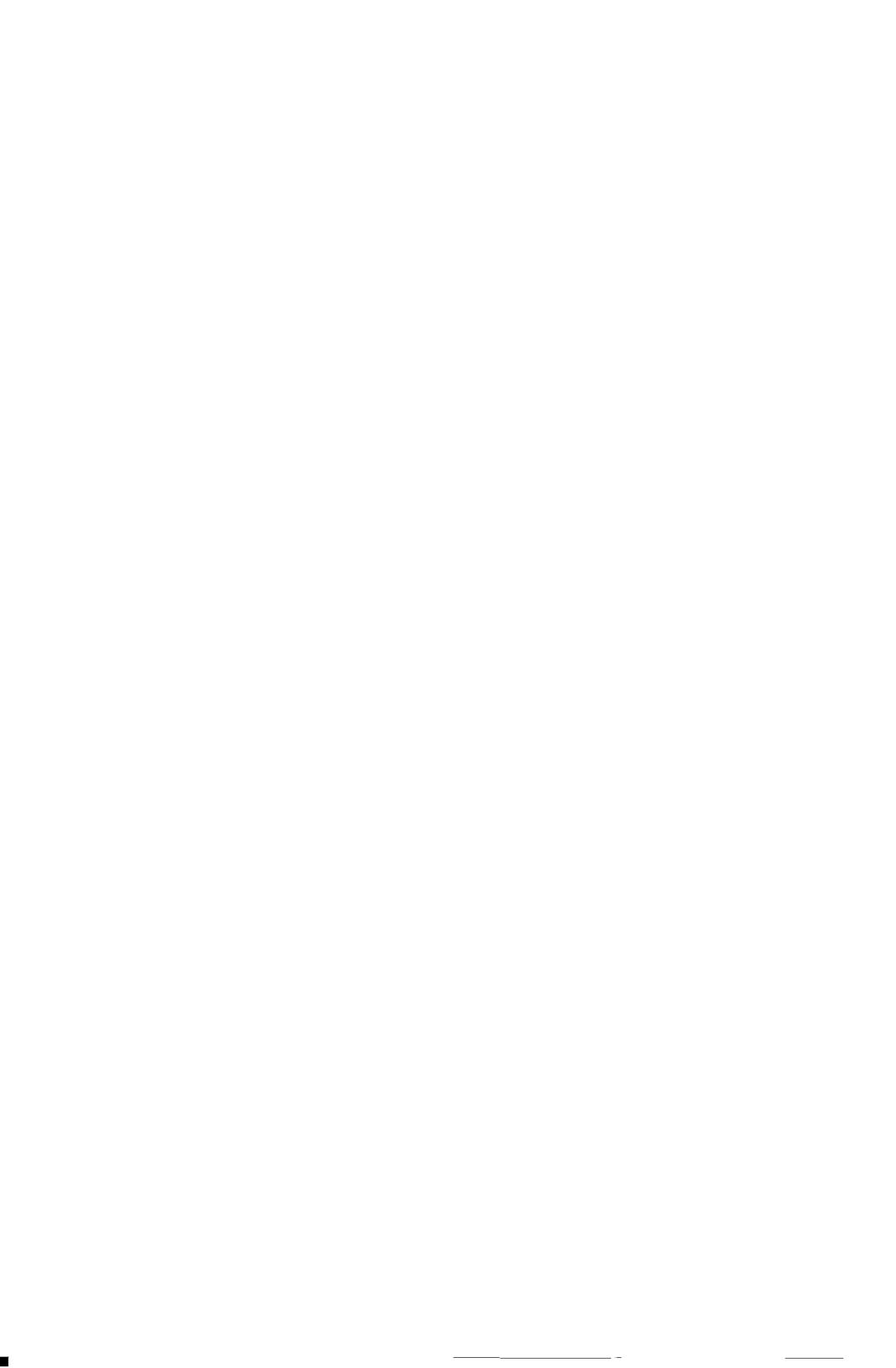
¹²⁶ IWR Annual Report, 1979, p. 6.

¹²⁷ Ibid.

¹²⁸ Fredrich interview.

¹²⁹ See IWR Annual Report, 1978, p. 30; The program was called Corps Action Plan for Social Analysis (CAPSA). See Memorandum, Fredrich to DAEN-CWP-P, subj: Proposed Corps Action Plan for Social Analysis (CAPSA), 18 May 1977, IWR Historical files.

¹³⁰ IWR Annual Report, 1979, p. 5.

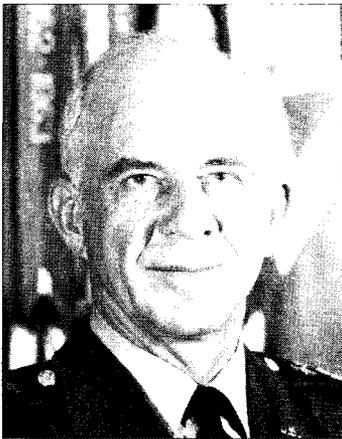




BG Richard H. Groves
Jan 69 - Aug 71



BG James L. Kelly
Dec 72 - Sep 73



BG Kenneth B. Cooper
Aug 71 - Nov 72



COL Charles O. Eshelman
Oct 73 - Aug 75



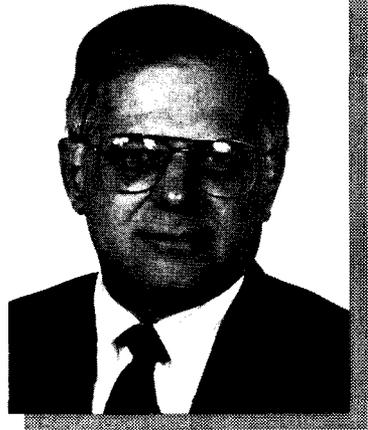
LTC William M. Toskey
Aug 76 - Feb 77



COL Daniel D. Ludwig
Sep 75 - Aug 76



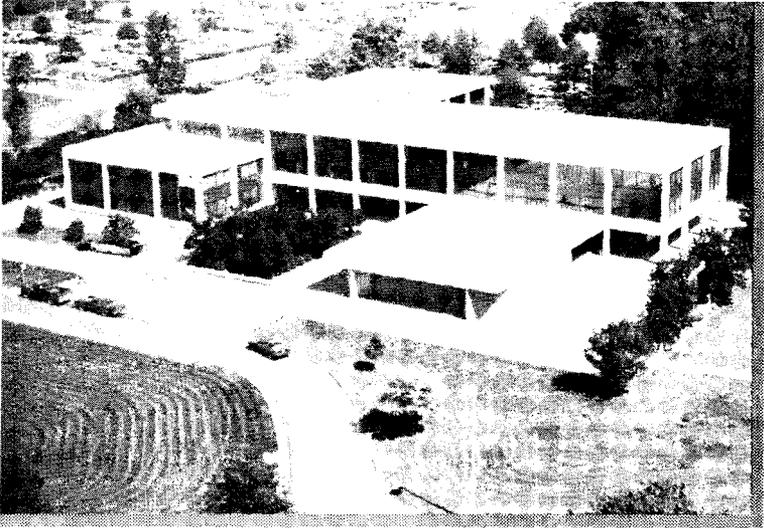
Mr. Augustine J. Fredrich
Feb 77 - Jul 79



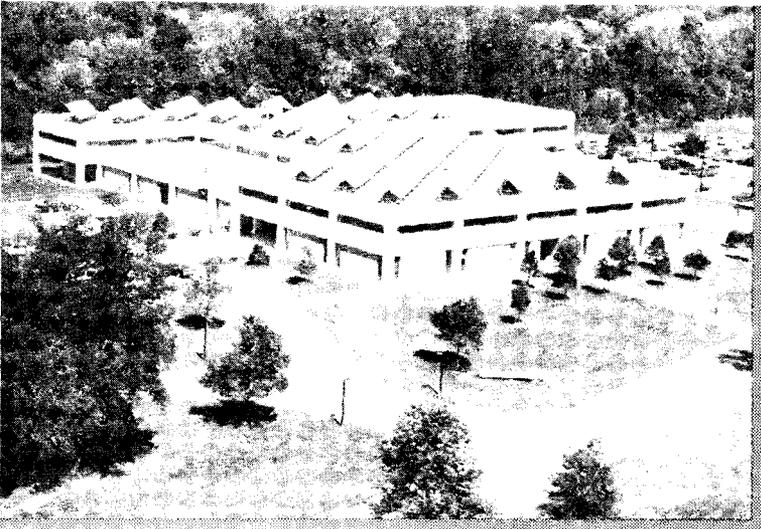
Mr. Kyle E. Schilling
Jun 90 - Present



Mr. Randy R. Hanchey
Aug 81 - Sep 89



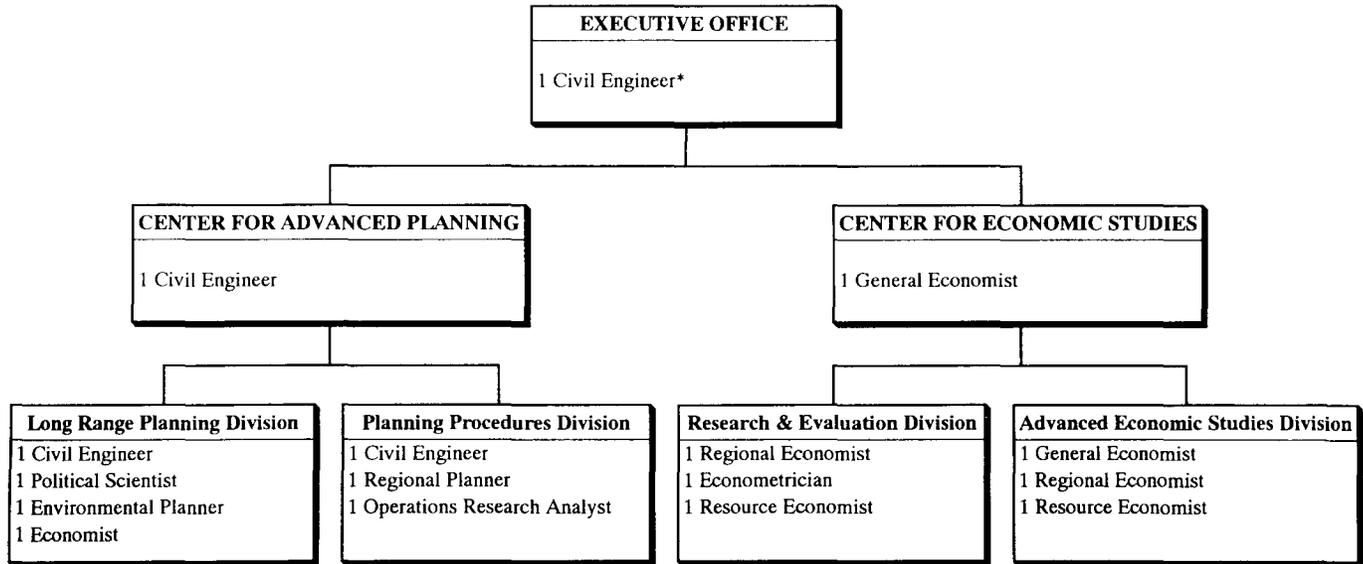
Kingman Building



Casey Building

**INSTITUTE FOR WATER RESOURCES
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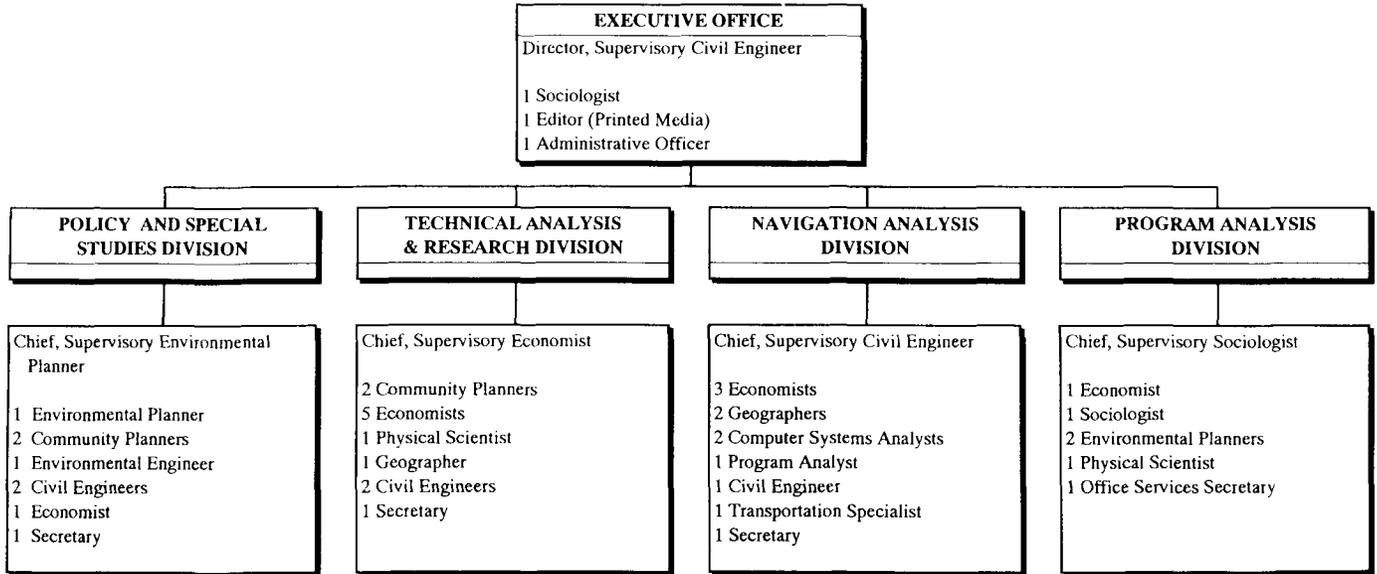
**Organization and Professional Staff
(As of 31 December 1969)**



* Dual Assignment of the Deputy Director of Civil Works, Office, Chief of Engineers

**INSTITUTE FOR WATER RESOURCES
CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY**

**Organization and Professional Staff
(As of 31 December 1995)**





CHAPTER FOUR: IWR AND WATER RESOURCES DEVELOPMENT IN THE REAGAN YEARS

The sweeping changes occurring in federal water resources planning during the 1970s were matched, and perhaps even exceeded, by the transformations of the 1980s. All federal water agencies, including the Corps of Engineers, faced new challenges exacerbated by soaring federal deficits, environmental concerns, and issues of federal and nonfederal responsibilities. With a decade of experience, the Institute for Water Resources added new planning tools to enhance its value as a resource for the Office of the Chief of Engineers. With national studies on waterways and hydroelectric power proceeding, policy studies expanding and diversifying, reimbursable work appearing from a number of Corps and other customers, and research and development activities increasing, IWR's workload reached an unprecedented level as the new decade began.

During the course of the 1980s, a host of evolving water resources issues further diversified the Institute's activities. The 1981 change in Presidents of the United States topped the list of forces that transformed federal water resources development. The Reagan agenda included reducing the role of the federal government and promoting economic growth more than environmental concerns. To

those ends, the administration attempted to break the impasse in water resources funding that had gone on for the previous ten years. Reagan appointed a forceful Assistant Secretary of the Army for Civil Works who significantly influenced the Corps and broadened tasks for IWR. The Principles and Standards were superseded by the Principles and Guidelines in 1983, again revising the rules for water resources planning. Formulating cost sharing methods and developing new project evaluations based on risk and uncertainty analysis were also important goals of the Reagan administration. The Institute for Water Resources played an important role in helping the Corps adapt and respond to each of these initiatives while also maintaining its traditional research and policy functions. The period ended with passage of the pivotal Water Resources Development Act of 1986, the first major authorizing legislation since 1970, and a law that dramatically affected the Corps.

From Carter to Reagan

The presidential term of Jimmy Carter perplexed the Corps and other federal water resources agencies. Carter came to office with an agenda to eliminate federal water projects that were questionable economically, objectionable environmentally, or--in the wake of the 1976 collapse of the Bureau of Reclamation's Teton Dam and the Kelly Barnes Dam at Toccoa Falls, Georgia, in 1977--unsafe structurally. However, Carter's agenda ran headlong into congressional obstacles. Like several other elements of his domestic program, Carter's water resources goals alienated him from Congress, the Corps, and the Bureau of Reclamation. Forced to compromise deeply on his "hit list" of water projects, Carter alienated environmental groups at the same

time. Meanwhile, Carter's demands for increased "cost sharing" for water resources projects managed to alienate states and localities, members of Congress, and federal agencies.¹

While foreign affairs such as the Iranian hostage crisis and the Soviet invasion of Afghanistan finally undid the Carter administration, domestic policies were political liabilities as well. Double-digit inflation was Carter's greatest problem. However, a water resources development impasse between Carter and Congress--stemming in part from Carter's desire for environmental quality and increased cost sharing--had resulted in minimal funding for projects throughout his term of office. With no major omnibus water resources act passed, Carter was in some ways achieving his goal of stopping unsound federal projects, but his stance gained him little support in Congress or among federal agencies.² His loss to former California governor Ronald Reagan in the 1980 Presidential election came as no surprise to those who knew how much Carter had damaged his relations with Congress over domestic issues like water resources.

Federal water resources planners anticipated little better cooperation from the incoming Reagan administration. Neither Reagan's goal of reducing federal spending nor his determination to "get the government off the people's backs" boded well for federal water resources development. However, Reagan's favorable attitude toward economic development and his opposition to increasing environmental and regulatory restraints made his ascension to office an uncertain situation for federal water resources development.³

Two of Reagan's appointees indicated that there would be a changed, but not altogether negative,

administrative attitude toward federal water projects. As Secretary of the Interior, Reagan appointed James Watt, a Denver attorney and avowed member of the Sagebrush Rebellion who headed the Mountain States Legal Foundation. Watt was in league with developers determined to overcome environmental constraints and bring additional state control over the western public domain. Nonetheless, Watt favored federal water projects, regarding them as major components of western economic development.⁴ Of a similar mind was William Gianelli, Reagan's appointee to the position of Assistant Secretary of the Army for Civil Works. Gianelli, a civil engineer, had served as director of the California Department of Water Resources during Reagan's two terms as governor (1968-1976). He had overseen the first phase of the California State Water Project, a multibillion-dollar aqueduct to bring water from the Feather River in the northern part of the state to southern California.⁵

Both Watt and Gianelli had seen water resources development augment the economic prosperity of the West. Both agreed, however, that economic and political realities no longer would permit total federal financing of water projects in the United States. Gianelli was the first assistant secretary to have a civil engineering degree and extensive experience in water resources development. He was familiar with the Corps from World War II experience as a Corps officer and from dealing with the agency while serving as director of the California Department of Water Resources. He came to office with the strong support and interest of the Reagan administration and with definite viewpoints about the Corps' way of doing business.⁶ Gianelli's views about the civil works program, the financing of water resources

development, and the reevaluation of Corps' engineering design criteria soon brought him in close contact with IWR.

During the turbulent 4 years of the Carter administration, the Institute for Water Resources had played an important role for the Corps and ASA-CW, including participation in the Presidential Project Review, drought studies, and water conservation studies. With policy studies and longer term research, IWR was prepared to devote part of its resources to the new administration's directives while the rest of the Institute completed the national studies and reimbursable work. Institute planners, like planners throughout the Corps, expected changes in the new Presidential administration that were likely to include water project financing, economic analysis, environmental analysis, and regulatory procedures.

Incorporation of the Navigation Analysis Center into IWR

The national political changes of 1980 and 1981 coincided with significant organizational changes within IWR. As a part of the establishment of the Water Resources Support Center, the OCE planning division transferred the Systems Analysis Branch to IWR, where it became the Navigation Analysis Center (NAC). During the 1960s, the branch had been part of BERH, where it remained until transferred to the planning division in the early 1970s. Responsible for developing the analytical capabilities for planning, operating, and maintaining the national water transportation system, NAC primarily gathered and compiled navigation data on waterways, harbors, and ports, other transportation modes, the carrier industry, and general commodity flow. Since IWR had undertaken the National Waterways Study through which it was developing an overall assessment of the inland

navigation system, the incorporation of NAC was a logical step. Managed by Frank Sharp, an economist specializing in organizational research, NAC developed the Inland Navigation Systems Analysis Model. Other professionals of NAC included two civil engineers, Arthur Hawnn and David Bastian; economist Morris Clark, Jr.; mathematician Marilyn Fleming; transportation specialist James Gould; and geographer John Lane.⁷

Within IWR, the Navigation Analysis Center refined and expanded its mission of supplying the field with navigation data. Consistent data regarding commodity flows and traffic had always been an impediment to a "systems approach" to navigation. NAC attempted to generate consistency through use of computers and developed the Inland Waterways Performance Monitoring System (PMS), a computerized data base tracking the operation and performance of all Corps locks on the inland waterways. With PMS, the Corps began collecting standardized information about the vessels and goods passing through the inland system and the efficiency of each lock. By mid-1981, 13 of 24 Corps districts had entered all of their 1980 navigation data into the system; by 1982, 18 districts participated. In 1982, NAC began a PMS users group and prepared a user guide. PMS provided Corps districts and divisions that had navigation activities with the first reliable performance statistics and established IWR as a clearinghouse for navigation data.⁸ NAC compiled information from other agencies as well. Working with the federal Maritime Administration, the NAC produced a revised and standardized listing of operating costs for both shallow- and deep-draft vessels in 1981 and created a file on vessel characteristics with the Corps' Waterborne Statistics Center, North Central Division, and the Saint Louis District.

NAC also worked with the Department of Transportation, Interstate Commerce Commission, and National Bureau of Standards to establish a common geographic code for all transportation points, including waterways and ports. Other activities included efforts to improve the costing methodologies of the Corps for inland waterways and railroads, and creation of a foreign trade data base, waterborne traffic forecasting, and a systematic method of correlating inland waterway traffic statistics with national economic indicators.⁹ NAC converted the automated library files for navigation and ship characteristics of the Maritime Data Network (MARDATA) for online use by Corps divisions and districts, thereby adding to the computer and data base capabilities of the Institute.¹⁰

The Special Studies Division

To improve coordination of the national studies, develop new reimbursable work, and manage the IWR training program, IWR formed a special studies division in 1980. Headed by economist George Antle, the new division expanded reimbursable and training activities as the national studies neared completion. Through the technical assistance program, the division provided services to other Corps offices and other government agencies, usually on a reimbursable basis. During 1981 and 1982, the division conducted more than 20 technical assistance projects concerning environmental quality, personnel, navigation, regulatory activities, socioeconomics, and water quality. The division also conducted studies of navigation user charges, a study for a blue ribbon panel on maintaining engineering capability in Corps divisions, and a socioeconomic and labor demand analysis of the impact of the construction of the

proposed MX missile system for the South Pacific Division of the Corps of Engineers and the U.S. Air Force.¹¹

Education and training expanded with addition of NAC and special studies division. The Institute carried on its traditional training in public involvement, water resources planning, forecasting techniques, wetlands evaluation techniques, and hydropower planning. In the late 1970s, IWR added land use and water supply planning analysis to its training program as experience increased regarding these issues. When the Navigation Analysis Center became part of IWR, training in navigation planning and instruction in PMS became part of the program. Under the direction of the special studies division, IWR brought more than 600 Corps employees to the Institute for instruction in eight different training courses.¹²

Completing the National Studies

The primary function of the special studies division was coordination of the critical final stages of the national studies. During 1982, both the National Hydroelectric Power Study and the National Waterways Resources Study neared completion. For the NWS, contractors prepared the technical reports using the Corps PMS and waterborne commerce statistics, the Water Resources Council's National Water Assessment and accident and collision statistics from the U.S. Coast Guard. The resulting reports profiled commercial water transportation users and the nation's transportation industry and then analyzed other water uses of inland navigation. Additional reports examined present and future trends in waterways technology, environmental aspects of inland navigation, and national defense, emergency, and safety issues involving the inland waterways.

At the same time, the Corps Office of History oversaw the completion of a 10-volume appendix of navigation history and evolution.¹³

With the information from these reports, the in-house members of the NWS team developed methodologies, forecasts, and needs en route to the final report. The team evaluated historical trends, the present navigation system, and future strategies and alternatives. In July 1981, the NWS team released its final draft of the study for internal review.¹⁴ The report, entitled "The National Waterways Study Draft Report: A Framework for Decision Making," profiled many aspects of the national transportation system. The report concluded that while all transportation modes risked undercapacity and obsolescence, none was more at risk than the present waterway system. The history of the inland waterway system was a story of piecemeal design and construction carried out over more than 100 years by the Corps, state governments, and even private companies. "State-of-the-art locks" designed and built in the 1930s were usually inadequate for the larger tows of the 1980s. The Corps' historic relationship with Congress contributed to local or regional projects that often plagued the modern system with restrictive capacity. Although recently built and rehabilitated locks served inland navigation well, the weakest links compromised the system's efficiency. Operators often had to break large capacity tows into smaller tows to pass through the undersized locks of the waterway. This situation existed in virtually every region of the nation.¹⁵

The draft report characterized an aging waterway system and a project authorization process that took far too long to meet the needs of users and other supporting interests. The authors predicted a steadily increasing inland waterway traffic flow to the year 2003, especially in coal,

grain, and iron ore shipments. They stressed the critical role inland navigation played in the national economy and its importance to the efficient transportation of bulk commodities. An improved waterway system would also enhance activity among other transportation industries, particularly railroads and trucking companies that served the waterways. The authors recommended a system to prioritize the improvement of deepwater ports in coordination with the waterway improvements. Finally, they cited an increasing defense and emergency use for the system and called for a thorough assessment of the present and future requirements for these needs.¹⁶

While the NWS draft report made its way through Corps divisions, districts, and OCE for review, the NHS team released its 23-volume National Hydroelectric Power Resources Study report. The report contained three major components: a comprehensive inventory of hydropower resources in the United States, projections for hydropower demands through the year 2000, and identifications of socioeconomic, environmental, institutional, and other policy issues affecting hydropower development. Public participation continued to be an important part of the study, as IWR oversaw dozens of meetings and workshops with architectural and engineering firms, energy equipment manufacturers, environmental groups, and state and local natural resource agencies. Building on the success of the Waterpower '79 conference, the NHS team, now under the direction of IWR's Richard McDonald, held a second international conference in June 1981. Waterpower '81 attracted more than 1,000 participants, 100 speakers, and 50 exhibitors.¹⁷

The study found vast hydropower potential for existing and new sites. Ten volumes of the final report

examined potential sites by region. In total, the study found 1,948 potential hydropower sites with an aggregate capacity of 46,000 megawatts and an average annual energy potential of almost 125,000 gigawatt hours. The study also identified 261 Corps sites nationwide with a capacity to produce additional hydropower. At those sites, the total potential power capacity was 6,800 megawatts, with an average annual energy potential of more than 19,200 gigawatt hours.¹⁸

The conclusions of the final report reflected IWR's policy-study philosophy. Preliminary judgments about the best sites for expansion and new development were based on the criteria of physical potential, economic feasibility, and environmental acceptability. However, the study stopped short of making actual recommendations, suggesting only preferred sites for feasibility studies. The study illustrated the social, economic, and environmental impacts of hydropower development or expansion on a local area when it acknowledged that "[c]omplex regulatory and project approval processes may be one of the most important barriers to expeditious development of hydroelectric power resources."¹⁹ Like all major water resources development projects, hydroelectric projects continued to be environmentally volatile and often economically questionable. The authors concluded that additional hydropower development at existing projects would require sufficient market incentives driven by the high cost of other energy sources.²⁰ The greatest potential for increased hydropower was in new projects, but their justification depended even more on the cost of producing energy by other alternatives.²¹

The national report of the NHS study referred often to the "post-oil embargo" and the "revolution in oil prices." To a large extent, both the waterway study and the

hydroelectric power study were responses to the energy crisis of the 1970s. As the price of fossil fuels continued to soar throughout the decade, the relatively low cost of waterway shipping and the potential for expanding an energy source that did not consume coal or oil provided strong study incentives. The Institute therefore based much of its work on the existence of an energy crisis. By the time the studies were completed, however, economic conditions had changed dramatically.

A combination of forces, including conservation, increased domestic production, the dissolution of the Organization of Petroleum Exporting Countries, and the 1982 recession, eased the energy crisis. Oil prices dropped dramatically, reducing inflationary pressure on coal as well. The result was diminished national concern about energy alternatives--in regard to both the cost of transporting commodities and the production of electricity.²² As the NHS and the NWS reached completion in 1983, the energy crisis had become an energy glut, and some of the central objectives of the Ford and Carter administrations--alternative energy production and fuel efficiency--were political anachronisms in the Reagan administration. Improvement of inland waterways and expansion of hydropower, moreover, meant increased federal spending on public works. For fiscal conservatives like Reagan's director of OMB, David Stockman, and members of Congress who had been elected on promises to reduce the size of the federal government, national water resources studies, whatever their conclusions, were suspicious. Therefore, the studies mandated in 1976 appeared before legislative and executive branches whose interests were substantially different than those of the originators of the laws.

The National Waterways Study came under careful scrutiny when the draft report appeared in 1981. After an OMB review, Stockman objected to a basic component of the study: the national defense and emergency use of inland waterways. In the original mandate for the study, Congress had authorized the defense use consideration, and this additional benefit weighed significantly in recommendations for an improved waterway system. Stockman and OMB now insisted that defense use of inland waterways be removed entirely from the report and that only commercial uses be evaluated. The impasse ended only when Chief of Engineers Lieutenant General John K. Bratton directed the NWS team to remove defense considerations from the report.²³

Over the next 2 years, the NWS team, various divisions and districts, OCE, OASA-CW, and OMB worked out the final wording of a report significantly different from its original design. Removing defense needs required revision of forecasts and extensive wordsmithing of the text. So did OMB's insistence on requiring navigation users to pay a portion of the cost of waterway improvements. Though no detailed formula for cost sharing of navigation improvements appeared in the waterways study, changes in the final document presented a limited role for the federal government. Despite the changes, OMB directed the NWS team to distribute the final report (completed in early 1983) only in a limited fashion. Only upon request could copies of the study be obtained, and its availability could not be advertised.²⁴

Some recommendations of both studies were objectionable to the new power structure in Washington, but they were only a small portion of two detailed, systematic analyses. Viewed in the aggregate, both studies contributed

significantly to the knowledge of waterways and hydroelectric power and to a systematic view of these developments. The waterways study contained histories of the commercial waterways and ports of the nation from the settlement era to the completion of the Erie Canal in 1825. It also contained a chronology of major historical events in navigation and the evolution of waterborne commerce technology. The study included histories of navigation activities on seven major river, lake, and intercoastal waterway systems. The study profiled water transportation users, evaluated the overall transportation industry, analyzed environmental impacts of waterway systems, and developed new methodologies for forecasting inland waterway traffic.²⁵ As a result, the NWS report was the first comprehensive analysis of the nation's waterways since the 1908 Inland Waterways Commission Report to President Theodore Roosevelt.

The final report of the National Hydroelectric Power Resources Study similarly was the first comprehensive review of hydropower potential in the United States. Identification of all of the nation's principal hydropower producers and marketers, analysis of the legal and institutional aspects of hydropower development, and an overall assessment of present and future demands for electricity contributed to knowledge of the nation's power consumption. Regional and national data bases provided the first aggregate picture of existing and potential hydroelectric power. The NHS report included environmental impacts of hydropower development and, probably most important, offered market-driven economic assessments of needs for federal expansion. Only when other sources of energy became extremely expensive, the authors argued, would there be justification for expanding national hydropower extensively.²⁶

The national studies raised some basic issues of federalism. Federally financed and maintained waterways were an important part of the national transportation system, but significant improvements would be expensive and would increase the role of the federal government. In addition, waterway improvements would lower the costs of tow and barge operators to the disadvantage of rail shippers and truckers. Extensive federal hydropower expansion would consume tax revenues and increase the federal role in the electricity marketplace in competition with regional power authorities and other public utilities. Moreover, hydropower itself competed with coal, oil, natural gas, and geothermal production of electricity. To pay for waterways and hydropower, the federal government would have to increase deficits or levy additional taxes. Either action would increase the power of the federal government and raises the question of its appropriate responsibilities. Improving waterways and expanding hydropower also implied greater government participation in the marketplace. This raised another basic question: How much should the federal government be involved in the marketplace?²⁷ The national studies, prompted by general alarm over soaring energy prices, offered federal action in response tempered by the reality of costs and environmental consequences. When the studies appeared in the early 1980s, the energy crisis had passed, and their outlines for a greatly expanded federal role met with severe opposition from proponents of limited government.

IWR in the Wake of the National Studies

From 1978 to 1982, IWR had grown steadily to produce national studies, policy studies, and research work. During

1982, the IWR staff included 34 technical specialists, 5 secretaries, 3 clerk-typists, and an editorial assistant. Five temporary staff members, three of whom came via IPA, also worked at IWR in 1982. In addition, IWR used the services of nearly 50 contractors and interagency exchange personnel. In August 1982, the staff moved to the new, 90,000-square-foot Casey Building across the street from the Kingman Building at Fort Belvoir. The Casey Building housed most of the other elements of the Water Resources Support Center. James R. Hanchey, who was acting director of the Institute in 1979, became official director in 1980.²⁸

By early 1983, IWR's staff, budget, and workload were at an all-time high. However, the Institute was at a turning point. Completion of the national studies meant the end of a substantial funding source. IWR's professional expertise had increased considerably with new personnel for the national studies and incorporation of the Navigation Analysis Center. The research and policy studies divisions were continuing to respond to the needs of OCE and the field, and those who believed IWR was valuable to the Corps wanted its work carried on and even expanded. They also believed that to disperse of the talent accumulated during the national studies would be an unfortunate mistake. As the national studies ended, the principals at IWR devised a reorganization plan to maintain the resources of the larger organization. Director Hanchey and division chiefs George Antle, Kyle Schilling, and Michael Krouse submitted a plan to WRSC director Colonel George Kleb in October 1983 to eliminate the special studies division and create a navigation division. The new division would have two branches: navigation data management and applications, and navigation planning. The research division could assume responsibility for the IWR training program. In addition, the

staff of the special studies division would be reassigned within IWR according to individual expertise, and each division would undertake special studies ordered by the director.²⁹ Hanchey cited several advantages of the proposed reorganization, including the concentration of navigation planning and analysis resources within IWR into one division allowing better response to OCE and field needs "in the navigation planning, policy analysis, and special studies areas."³⁰ Moreover, the reorganization would permit maximum use of the clerical and secretarial staff.³¹

On 24 October, Colonel Kleb approved the reorganization. Members of the national studies teams were reassigned. George Antle, who had been chief of the special studies division, became chief of the navigation division. Joining him there were Arlene Dietz, Howard Olson, and David Grier. Thomas Ballentine and James Dalton joined the policy studies division, and Richard McDonald and Darrell Nolton went to the research division. All members of the Navigation Analysis Center were transferred to the navigation division.³² In a memorandum to the IWR staff, Hanchey stated,

The role of IWR is to support the Civil Works program, both in OCE and at field office levels. We do not have a mandate to make Corps' policy, which is the responsibility of OCE, or to execute the program, which is the field responsibility. In our support role to the other elements of the Corps, we must be sensitive to the need to be responsive to priorities which will be established external to IWR. We need to continue to provide the excellent support in the area of data development and management which our Navigation Analysis Center has provided, but we also need to improve our support to the

*Corps in the area of navigation systems analysis. I believe that this reorganization will lead to this improvement by focusing additional resources on these problems and bringing all of our various navigation related activities under central management.*³³

The October 1983 reorganization was significant in several ways. Consolidating most of the technical staff from the national studies into IWR's three divisions--rather than dispersing them throughout the Corps--indicated that top civil works personnel viewed the Institute favorably. The three divisions, with more specific missions, reflected a maturing of the Institute. These more specific missions were the result of the fact that OCE had an increasing amount of work for IWR. As the 1980s progressed, the immediate needs of OCE and the field grew increasingly complex and diverse.

The Navigation Division

Creation of the navigation division placed the Corps' expertise in civil works planning and data collection within IWR. The combination of the NWS staff and NAC made the division the primary organization in the Corps devoted to systemwide analysis of navigation. The division continued NAC's data collection and efforts to provide that information to field offices in a standardized format. It developed a data base of vessel operating costs that assisted in economic forecasting. Other work ranged from product-oriented data bases for the field to policy studies on project financing for OCE.³⁴ As the politics and economic issues of water project financing intensified during the mid-1980s,

OCE directed the division to develop strategies for port authorities on alternatives to costly harbor deepening and to compile consistent statistics on the nation's ports.³⁵

Policy and Research

Policy studies had steadily evolved in the Corps of Engineers since the creation of the OCE office of policy in the mid-1960s. Some of the original IWR staff members had come from the office of policy. With the establishment of a policy studies element during the mid-1970s, the Institute began preparing fast-response, short-turnaround studies for the office of policy. Relations between IWR and the office of policy grew closer when Donald Duncan became the chief of policy development in 1976. Duncan established more detailed procedures and set guidelines for exploring civil works policy issues. In succinct terms Duncan stated, "A policy issue is a question: What is the Corps position or policy with respect to _____? It is not a procedural or methodological question."³⁶

By the early 1980s, Duncan developed the policy issue program on the basis of those guidelines and initiated general procedures. The first stage was identification. "Policy issues," he wrote in a memorandum in June 1982, "are identified by a small group of 'involved' policy advisors that monitor the Civil Works program for current policy problems and attempt to recognize problem areas emerging from potential changes in the field of water resources."³⁷ Such issues should not arise from annual queries of field operating agencies, but from the "day-to-day activities" of the field, OCE, or ASA-CW. After identifying the issue, the office of policy assigned appropriate staff members to develop a policy decision and rationale for that decision.

Policy issues often were those that "no one has been able to resolve," according to Duncan, and they sometimes presented intractable challenges. Nonetheless, he believed, the current policy apparatus served the agency well. Assessing the program in 1982, Duncan concluded,

*For the first 200 years of its existence, the Corps had no formalized process for addressing policy issues outside of the regulation system which by-passed the key decision makers. In 1976, the current [policy studies] system was created. The system is not perfect, but it functions well.*³⁸

An integral part of the system was the Institute for Water Resources. If extensive data collection or the use of outside contractors became necessary during the identification and decision stages, the office of policy consulted the Institute.³⁹ Duncan relied on IWR to produce timely assessments of broad and indepth Corps policy issues, and he enlisted its services increasingly throughout the 1980s.⁴⁰ "Each year," Duncan wrote in a memorandum to the chief of policy in 1982, "the [IWR] program becomes more synchronized with the Civil Works program. Its products are therefore becoming more useful to Civil Works."⁴¹

Through this more directed policy studies process, IWR experienced a steady separation of policy and research activities from the late 1970s into the early 1980s. All of IWR's work was research funded through the general investigations budget in its early years. For some years after the establishment of policy studies, the lines between the two divisions blurred, and the Institute's work bridged both divisions. Some policy work, such as water conservation, became large and long-term enough to warrant GI funding.

Such work then became research and development. Added to the traditional research work, including public involvement and planning methodologies, the new work, often drawing on IWR studies, gave the Institute's research program greater visibility.⁴² By the early 1980s, the policy studies division became a conduit for much new work from OCE, ASA-CW, and the Executive Office, while the research division conducted longer term analysis of planning methodologies for use by the field.⁴³

The Research Division and Water Conservation

Policy issues that grew into research endeavors included water supply and conservation studies and, eventually, the development of the computer program IWR-MAIN (Municipal and Industrial Needs). In the 1983 reorganization, the research division was involved in a variety of projects ranging from grain commodity flow studies to evaluation procedures for fish and wildlife habitat enhancement. The reorganization gave the division a slightly different mission and transferred some of its navigation work to the navigation division. The functions of the division were to conduct research under the direction of the OCE R&D office to "equip Corps planners . . . to address relevant needs, to identify significant economic, environmental, regional development, and other social effects, and to evaluate benefits and costs."⁴⁴ The division was to translate its research into guidelines for field personnel, manage the IWR training program, and conduct special studies at the request of OCE or field offices.⁴⁵ The division consisted of a diverse professional mix: Michael Krouse and James Tang, economists; Mark Dunning and Charles Simpkins, sociologists; James Crews, Richard

McDonald, and Michael Walsh, civil engineers; Stuart Davis and Dana Grover, urban planners; and Darrell Nolton, a physical scientist.⁴⁶

The Corps' expanding water conservation work resulted in part from a natural disaster. During the 1970s, the severe drought in the West had prompted the Carter administration to create a White House task force to find solutions. The policy division of IWR had prepared drought, water supply, and conservation studies and had participated in the task force. Working through the office of policy, IWR developed a "Revised Plan of Action for Water Conservation" in May 1980. Examining both the demand and the supply components of water use, the plan directed Corps field personnel to assess conservation measures, use of existing water supplies, and the need for new supplies.⁴⁷ In a memorandum accompanying distribution of the plan to all Corps divisions and districts, Major General E.R. Heiberg, III, director of civil works, stated: "This [Plan of Action] retains the general framework for integrating water conservation into all aspects of the Civil Works program."⁴⁸

Heiberg's directive indicated that water supply and conservation had become an important Corps initiative. Shortly thereafter, IWR initiated a 5-year, agencywide water supply and conservation research program.⁴⁹ The program included developing methods for transferring technology and research and for training Corps planners. It promised to develop water forecasting methods, explore the conjunctive use of surface water and groundwater, and analyze the design of existing water facilities and recommend ways to improve them.⁵⁰

In the early 1980s, IWR completed several handbooks attempting to transfer water conservation technology. The handbooks stressed the principal objectives

of the program: to demonstrate that sound water conservation practices should accompany all Corps of Engineers planning and to provide field personnel with methods to implement those objectives. In 1981, IWR completed "An Assessment of Municipal and Industrial Water Use Forecasting Approaches," which evaluated the strengths and weaknesses of various forecasting methods.⁵¹ A year later, IWR produced two annotated bibliographies. One provided references to specific water conservation planning measures, and the second offered sources on additional forecasting techniques.⁵² To facilitate publication of the Institute's water supply research, IWR established the Information Transfer and Analysis Program (ITAP) in conjunction with HEC and the Waterways Experiment Station. After 1981, all publications of the water supply and conservation program were published and distributed through ITAP.⁵³

Although both policy studies and research were involved in water supply, implementation of the water conservation program by the early 1980s was more a research activity than a policy activity. As more R&D funding came to IWR, members of the research division took part in the water supply and conservation research program. Some, working on water conservation were actually in both divisions during 1981 and 1982. Among them was James Crews, who came to IWR in 1981 from the urban studies program in Baltimore District. By 1982, personnel from both divisions were assisting the field to implement the program. To do so they traveled around the nation to discuss IWR's water supply and conservation approach.⁵⁴

The Development of IWR-MAIN

As Institute researchers evaluated various forecasting programs, they searched for one that could be applied generally in the field. The application that best met their needs was a computer program called MAIN (Municipal and Industrial Needs). John Boland, a researcher at Johns Hopkins University, had developed the program under a grant from the U.S. Office of Water Resources Research during the late 1960s.⁵⁵ The MAIN system "disaggregated"; that is, it divided aggregate municipal and industrial water uses into separate data bases, such as residential, commercial/industrial, industrial, and public/unaccounted. Within those separations, MAIN had dozens of sub-uses, such as lawn watering, car washing, and industrial steam generation.⁵⁶

Researchers at IWR believed this system would improve the efficiency of water conservation. Yet it was impossible to implement MAIN in its current form. Boland had developed the program for use on a mainframe computer using punch cards. In computer parlance, MAIN was not user friendly. In 1981, the IWR research division secured a contract for Boland to update the data and modify the model to run on a modern, Corps-owned mainframe. A year later, in 1982, version 2.0 of IWR-MAIN was ready to assist Corps planners. By supplying the program with basic population, residential, and commercial information, planners could receive consistent and pertinent water usage data for communities in their districts.⁵⁷

Three years after completing version 2.0 of IWR-MAIN, Boland and other contractors developed version 2.4 for use on an IBM-PC or compatible computer. The next version, 4.0, released in 1986, added new growth models using standard metropolitan statistical area data from the

1960, 1970, and 1980 censuses. The 4.0 version also included new and more accurate water conservation variables. In late 1987, IWR released version 5.1, which included the capability to forecast seasonal adjustments and individual conservation measures, and an expanded list of overall variables.⁵⁸ By this time, IWR-MAIN was being used both inside and outside the Corps of Engineers. Municipal water districts and large regional water distributors found the program easy to use, flexible, and accurate, and IWR-MAIN had become one the best known Corps products among water suppliers.⁵⁹

Technology Transfer: Public Involvement and Noise Management on Military Installations

The public involvement techniques developed by the Institute for Water Resources found new applications during the 1980s. As the nation's urban areas expanded, development drew ever closer to armed services installations. Consequently, residents often complained about the noise generated from normal training and operational activities on the military bases. Recognizing that its training activities could be threatened by residential complaints, the U.S. Army Training and Doctrine Command (TRADOC) sought solutions. In 1982, TRADOC, a major Army command, enlisted the services of Mark Dunning and Darrell Nolton of the IWR research division to develop a plan for noise management on its installations.⁶⁰ Their program, Installation-Compatible Use Zone (ICUZ), relied on the basic tenets of the Corps' public involvement program. The program sought to engage members of the local community and installation planners in dialogue aimed at seeking solutions to noise and land-use problems. Through open

dialogue between military commanders accustomed to decisions being made unilaterally and local residents being angry at the government, the ICUZ program attempted to develop a political climate of cooperation in which meaningful compromises could take place.⁶¹ The ICUZ program involved a "change management process" designed both to protect the military mission of TRADOC installations from noise-sensitive development and to improve relations between the Army and neighboring communities. These goals could best be accomplished through planning with public concerns and needs in mind.⁶²

The program was so successful for TRADOC that other military organizations came to IWR for assistance. The Army National Guard asked IWR to develop an ICUZ program for its nationwide installations during the mid-1980s.⁶³ Shortly thereafter, the IWR research division conducted a noise management analysis of U.S. Army installations in Germany for U.S. Army, Europe (USAREUR). Dunning and Nolton prepared Development of a Noise Management Program for Headquarters, U.S. Army, Europe: Strawman Report. This report was expanded and refined into a handbook, which IWR published in June 1991, for reducing environmental noise impacts at Army installations in Germany. The report acknowledged that noise unavoidably resulted from USAREUR missions and regularly antagonized residents. In response, the report developed a management system that worked with the local communities. The system required USAREUR to schedule activities to minimize noise impact on nearby residents.⁶⁴ Through rescheduling and moving various activities farther from populated areas, USAREUR reduced the number of complaints and improved Army relations with the nearby communities. The technique of public involvement, one of

IWR's earliest products, proved to have wide applications more than twenty years after its development.

The Policy Division

While research division work expanded, the system established for developing and conducting policy studies brought IWR continuing and diverse work throughout the 1980s. In fiscal years 1981 and 1982, the office of policy assigned 12 new policy studies to IWR. The issues included use of dredged sand for beach nourishment, public use of Corps jetties, policy implications of recreational vehicles using Corps navigation facilities, the concept of "the federal interest," and the effects of inflation and the discount rate in civil works planning.⁶⁵ To address these diverse policy issues, IWR had assembled a diverse group in the policy division: Chief Kyle Schilling and James Dalton, civil engineers; Eugene Stakhiv, water resources planner; Thomas Ballentine and Mark Mugler, urban planners; Jerome Delli Priscoli, sociologist; Mary Vincent, physical scientist; Janet Wright, geographer; and Stephen Light, environmental planner.⁶⁶

Although implementation of water supply and conservation guidelines and computer modeling had become research activities, policy issues on those subjects continued to emerge. Policy study issues by 1982 served two objectives: improving the Corps' understanding of long-term water supply/conservation planning and drought contingency planning, and determining how the Corps could expand its cooperative efforts to work with state and local governments on water conservation technology.⁶⁷ While the transfer of IWR-MAIN technology to state and local governments eventually resulted in major benefits for localities around the

nation, the policy implications of working with state and local governments in water supply and, more generally, in water resources planning were potentially more far-reaching.

The Emergence of Risk and Uncertainty Analysis

Risk and uncertainty analysis, an evolving method of economic analysis, concerns a basic question: "What is an acceptable risk?" Most people accept the level of risk involved in riding in a car or an airplane, but victims of a recent flood may not be willing to accept the risk of remaining in the same place without some form of flood protection. Proponents of risk analysis ask, "How much protection is acceptable?" whereas traditional engineering designs a project to a standard level of protection. The differences in the two approaches are both philosophical and economic. While risk analysis strives to identify an acceptable level of risk, traditional methodology attempts to protect an area from floods that might happen once every 50, 100, or 500 years. Risk analysis challenged the traditional methodology as costly and unscientific.⁶⁸

On the national level, risk analysis began in the 1960s when scientists challenged the standard approach to water quality. During its evolution in the Corps, the Institute for Water Resources had worked on new economic, engineering, and sociological approaches to evaluating civil works projects that often challenged traditional ways. As early as 1971, IWR began preparing reports assessing the economic risk of water shortages caused by drought and developed methodologies to determine financial losses to industries in regions where water shortages occurred.⁶⁹ IWR's water supply and drought studies included alternative

planning for water needs without necessarily increasing supplies.⁷⁰

Elements of risk and uncertainty analysis were also developed through safety assessments of the nation's dams in the wake of the Teton Dam collapse in 1976. Following the collapse, President Carter called for an extensive review of dam safety practices and for creation of an interagency committee to coordinate the preparation of federal guidelines. Shortly thereafter, in November 1977, the Kelley Barnes Dam at Toccoa Falls, Georgia, collapsed, prompting President Carter to direct the Corps to carry out the provisions of the 1972 National Dam Inspection Act and inspect more than 9,000 nonfederal dams. (Prior to this event, Presidents Nixon, Ford, and Carter had not pursued the provisions of the act, believing the inspections to be a job for the states.) Assistant Secretary of the Army for Civil Works Michael Blumenfeld initiated the inspection program for Corps inspections of all dams in question by fiscal year 1981.⁷¹ The methodology used to inspect thousands of dams nationwide became a major concern by the early 1980s. With a huge number of dams to inspect and public fear of dam failure running at an all-time high, the Corps was hard pressed to do quick evaluations, a situation that often resulted in inconsistent findings.

As was the case with several other elements of the civil works program, Assistant Secretary William Gianelli sought to reform the Corps dam safety inspection program. As director of the California Department of Water Resources, Gianelli had developed a uniform methodology for dam inspections using risk analysis, and he believed the Corps should adopt a similar program. IWR's policy studies work on economic risk and on water conservation was ongoing as Gianelli expressed his views on dam safety

inspections.⁷² Staff members in ASA-CW who had worked with IWR on the Carter hit list response and water conservation, such as Stephen Dola and Edward Dickey, alerted Gianelli to the Institute's risk analysis work.⁷³

As it evolved among academic and professional water resource planners, risk analysis appeared to have broad application. Basically, "risk" is simply the threat of "a set of negative consequences" occurring. Assessment of risk usually involved loss of life and risks to health. Broader risk assessments included property loss and retarded economic activity. Known factors leading to the set of negative consequences, such as storms, are risks. Unknown factors, such as terrorist acts or factors without historical precedent, are "uncertainties."⁷⁴

For Gianelli and other proponents, risk analysis was a methodology that promised to bring uniformity to dam safety inspections. Forcefully, Gianelli informed the OCE that risk and uncertainty analysis should be incorporated agencywide into the dam safety program. Moreover, he argued that the approach should be considered in other Corps civil works activities, such as navigation planning.⁷⁵ Gianelli's action triggered a mixed response in OCE. His dam safety plan was only one of several activist measures coming from the Assistant Secretary's office, which together led to the powerful and enduring presence of the Assistant Secretary's office in water resources planning. Supported by the White House, Gianelli became the first assistant secretary to test the strength of his office with the Corps leadership.⁷⁶

Corps civilians and military personnel viewed Gianelli's actions suspiciously. Some of their suspicions concerned risk analysis. The controversial concept challenged some traditional engineering methods of the Corps. It called into question whether many Corps projects

needed to be designed to costly traditional engineering standards or whether there were acceptable risks in designing less protection. Gianelli challenged the idea that conservative engineering always resulted in less damage.

Initially, top civilians in OCE's engineering division refused to consider the new approach. Despite such recalcitrance, Gianelli persisted. In September 1983, his office, through OCE, enlisted IWR to "develop a uniform approach to evaluating dam safety" by using a "substantial program of research that addresses the issue of dam safety assurance for existing structures."⁷⁷ The risk analysis effort was to focus on spillway design and hydrological factors. As the IWR staff began to adapt risk analysis to dam safety, Gianelli continued to advocate an expansion of the approach into civil works planning. For Gianelli and the Reagan budget cutters, risk analysis promised to reduce the cost of design, construction, and operation and maintenance. Gianelli's successor, Robert K. Dawson, who became acting assistant secretary early in President Reagan's second term, continued his predecessor's activism by requesting in February 1985 that the Chief of Engineers develop a plan for implementing procedures for evaluating risks to all appropriate Corps programs.⁷⁸ In response to his request, Lieutenant General E.R. Heiberg, who had become Chief of Engineers in September 1984, approved a plan of action that resulted in the creation of the risk analysis research program directed by IWR. By the mid-1980s, the program, under the direction of Eugene Stakhiv, water resources planner in the policy division, and David Moser, economist in the research division, included navigation planning, risk perception and communication, environmental risk analysis, and hydrologic risk analysis. By the mid-1980s, risk analysis

had become a major research initiative, but it had yet to be incorporated significantly into Corps planning.⁷⁹

The Principles and Guidelines

The idea of incorporating risk analysis into water resources planning was more explicitly stated as another Reagan administration initiative coalesced. On March 10, 1983, President Reagan formally approved the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, better known as the Principles and Guidelines or P&G. Superseding the Principles and Standards, the P&G set the stage for a new era in federal water resources development.⁸⁰ Since taking office, Reagan and his assistants, including James Watt and William Gianelli, had believed that federal water projects were being delayed and halted by the "unnecessary and cumbersome regulations" contained in the Principles and Standards.⁸¹ The assertion derived from more than circumstantial evidence. Since the passage of the Omnibus Water Resources Development Act of 1970--the only major authorizing legislation of the decade--the decline in federal water projects had been precipitous. Federal expenditures had declined nearly 80 percent, from \$6 billion annually in 1968 to \$1.3 billion in fiscal year 1984. During the Carter years and up to 1983, fewer Corps civil works projects were approved than were canceled, and fiscal year 1984 was the first year in which the agency's operation and maintenance budget exceeded construction.⁸²

Many factors contributed to the reduction in construction, including increasing federal deficits, the environmental movement, and the fact that many projects were unjustified. Still, the Reagan administration assembled

a Cabinet Council Working Group on Water Resources to devise a simpler procedure than the Principles and Standards. The cabinet-council, which included Watt and Gianelli, was convinced that the process of authorizing and constructing water resources projects took too long. Gianelli and other members of the Council also believed that the Principles and Standards, with its emphasis on environmental alternatives, often resulted in plans that had little economic or political chance of being implemented. Gianelli's office contributed substantially to production of new procedures contained in the P&G, which was published in March 1983.⁸³

The provisions of the P&G reflected frustration with the present system and acceptance of new realities in federal water resources development. The P&G maintained four accounts to evaluate plans: national economic development (NED), environmental quality (EQ), regional economic development (RED), and other social effects (OSE). However, in contrast to the Principles and Standards that required development of a NED plan and an EQ plan, the P&G made NED the only "required account." This meant that the primary objective of any project would be to "maximize net national economic development benefits."⁸⁴ The new guidelines defined the "Federal objective" as "contribut[ing] to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements."⁸⁵ Environmental quality, regional development, and social objectives were important in the P&G, but the recommended plan would be the one that offered the greatest net economic benefit consistent with the other considerations.

Development of procedures to identify and evaluate the NED plan required a great deal of rethinking for the Corps of Engineers. Ten years of attempting to carry out the intent of the Principles and Standards had led to established procedures for the field in planning water resources projects. However, calculating the basic tradeoffs between environmental quality and national economic development was excessively complicated. While the P&G promised to be simpler and more straightforward, and afford greater accuracy in benefit-cost analyses than the Principles and Standards, the process was still complex. After the Principles and Standards was issued in 1973, IWR had been involved in developing manuals and training programs to help the field implement it. Following the issuance of the P&G, the civil works directorate needed new manuals and education and training programs. During the 1980s and into the 1990s, OCE turned increasingly to the Institute for policy studies and research and development programs regarding implementation of NED.

The tenth of thirteen major headings in the P&G concerned risk and uncertainty.⁸⁶ Three pages of the P&G concerned risk and uncertainty analysis. Reflecting Gianelli's interest in IWR's work, the P&G outlined applications of the methodology, directing planners "to characterize to the extent possible the different degrees of risk and uncertainty and to describe them clearly so that decisions can be based on the best available information."⁸⁷ The brief outline admonished planners to report risk and uncertainty "in a manner that makes clear to the decision maker the types and degrees of risk and uncertainty believed to characterize the benefits and costs of the alternative plans considered."⁸⁸ From this beginning of incorporating risk analysis into water resources planning, a long road of implementation lay ahead.

The eleventh heading in the P&G outline was cost allocation. A brief paragraph followed, stating that "cost sharing policies" would be addressed separately.⁸⁹ Indeed, new cost allocation proposals, including cost sharing (a percentage contribution on the part of nonfederal agencies to water resources construction and/or operation and maintenance) and cost recovery (the imposition of fees or tolls by federal and local interests on water resource users to recover construction and operation costs) were becoming some of the most controversial water resource issues in the 1980s. The history of cost sharing dates back to the beginnings of the Corps' civil works activities. Cost sharing was practiced to a degree by federal water resources agencies for most of this century. However, the procedures were inconsistent and often arbitrary. At the end of the Corps' "big dam era" of the 1930s through the early 1960s, economists and planners began to criticize federal dominance in flood control, navigation, and other water resources developments. Eager to reduce the role of the federal government and increase the power of the states, critics called for "local interests" to pay for a substantial part of the construction and the operation and maintenance of projects that benefited them. The Eisenhower administration agreed and advocated increased cost sharing. However, the congressional champions of large federal water projects prevailed throughout the 1950s and into the next decade.⁹⁰

As pressures increased on the federal budget, so did efforts to reduce water resources expenses. When Congress passed the Water Resources Development Act of 1974, it directed the Water Resources Council to reexamine the Principles and Standards of 1973 and to evaluate current cost-sharing practices.⁹¹ The study found no uniformity in

reimbursements, repayment schedules, interest rates, or operation and maintenance responsibilities. While outlining some potential cost-sharing formulas, the Water Resources Council deferred the issue to Congress.⁹²

For a variety of reasons, Congress took no immediate action on cost sharing. One of the main reasons was the opposition of users such as the Water Resources Congress, an umbrella lobbying organization of water-related interests. To such organizations, any talk of sharing, allocating, or recovering costs for federal water projects meant an end to the free use of national waterways and an end to federal operation and maintenance of the navigation system at no charge to the users. Opposition to cost sharing also came from members of Congress in whose districts flood control, shore protection, or other water resource projects were pending. However, an increasing number of budget-minded members of Congress began to endorse cost sharing as an excellent means to reduce the size of the federal government.⁹³ In October 1978, they successfully imposed the first user fee when President Carter signed a bill creating the Inland Waterways Trust Fund. The law established a 10-cents-per-gallon fuel tax and authorized construction of a new lock and dam 26 on the Mississippi River (an action that tow and barge operators had long wanted).⁹⁴

The 1978 legislation established a precedent in imposing user fees and in tying policy reform to project authorizations. However, it did not establish generic cost-sharing formulas for any type of water project. Carter had favored greater federal-state cooperation regarding water projects, including more local contributions such as a five-percent local cost share for construction. However, his approach--and the suspicion that he intended to eliminate the Corps civil works program--alienated both Congress and

the agency. Cost sharing and cost recoveries were top priorities for the succeeding Reagan administration, which aggressively pursued their implementation. As he assumed office, Assistant Secretary Gianelli viewed the current situation as another factor in the "stalemate in water project authorizations." Gianelli saw cost sharing as the key to end the stalemate.⁹⁵ Gianelli looked to cost sharing to fund needed projects. He also favored cost recovery over and above user charges and called for much higher fees than the 1978 law had imposed.⁹⁶

Secretary Gianelli found prevailing opposition to cost sharing and cost recovery in the user lobby and in Congress. Many feared his proposals would bankrupt the waterways industry, put farmers out of business, and raise the price of food for consumers. Yet Gianelli also found considerable opposition to cost sharing throughout the Corps of Engineers. Cost sharing meant not only lower federal expenditures but less federal influence over water projects. For many in the Corps, increased costsharing challenged traditional prerogatives of the agency. Some feared that cost sharing might make so many projects financially unfeasible that the whole civil works program would be imperiled.⁹⁷

Gianelli nevertheless had the support of the administration in his cost-sharing efforts. In 1982, President Reagan signed Executive Order 12372. The Intergovernmental Review of Federal Programs directed federal agencies to "strengthen Federalism" by seeking out ways to bring state and local government views into their activities. Thereafter, federal agencies would be required to accommodate the views of state and local governments and give reasons whenever they did not.⁹⁸

Proponents of cost sharing wished to increase the role of local sponsors in the planning process as a basic

objective. Shortly after becoming secretary, Gianelli had raised the issue of cost sharing with project studies to the Corps and Congress. His primary concern was the "excessive cost to the Federal Government for 'unsuccessful' studies."⁹⁹ Bringing local sponsors into the planning process was Gianelli's intention, and he believed doing so would provide "a market test to improve the study success rate."¹⁰⁰

In short, Gianelli wanted studies to lead to projects. He was highly critical of the amount of time the Corps spent on studies that had little chance of becoming projects. Gianelli thought the Corps' proclivity for studying whatever Congress requested was a weakness of the system and a holdover from the days when Congress controlled the civil works program.¹⁰¹ Such practices were an intolerable waste of money in Gianelli's view, and he intended to use the power of his office to change them.¹⁰²

The issues of cost sharing presented a dilemma to the Corps civil works program in the early 1980s. Regardless of agency prerogatives, federal funds for water resources projects were declining. Congress and the Reagan administration intended to cut federal spending and spend water resources dollars more efficiently. The civil works program no longer could depend on the authorization and funding system that had existed since the 1930s. The large projects that had sustained the program had mostly been built, and new ones faced environmental and fiscal constraints that made construction unlikely. With the entire civil works program in jeopardy, the agency began to recognize that a system providing for smaller, cost-shared projects might be its salvation.

IWR and Cost Sharing

While the essentials of cost sharing involved specific formulas for federal and nonfederal participation, cost sharing also included learning more about what people thought about a water resources development in their area. Through its studies of social impact assessment, public involvement, postconstruction economic analysis, and other local and regional evaluations, the Institute for Water Resources had experience in gauging local sentiment. Since its establishment, IWR had also sought to improve the Corps' economic analysis, and it had more recently developed financing strategies for inland navigation. Successful implementation of cost sharing would probably require each of these planning tools.

The Institute had actually examined cost-sharing concepts regarding the Corps shoreline erosion program as early as 1974. Cost Sharing for Shoreline Protection, published in August of that year, recommended new cost-sharing rules that would "probably result in higher local percentage cost shares on average per shoreline protection project, a shift of local demand away from engineering techniques in favor of management techniques, and more protection benefits per national dollar expended."¹⁰³ Shoreline erosion was tangential to the central issues of cost sharing as they emerged in the late 1970s. However, as increased cost sharing for navigation and flood control grew in importance, IWR continued to broaden its knowledge of the subject. The Institute's work included several policy studies on cost-sharing practices among federal water resources agencies, particularly in regard to environmental quality objectives.¹⁰⁴

Cost sharing remained a major initiative of the Reagan administration. To a greater extent than risk

analysis, increased cost sharing promised to reduce federal spending by demanding more nonfederal contributions to various water resources developments. With the intent of moving Congress forward on cost-sharing legislation, Secretary Gianelli looked for supporters in the Corps. In his own office there were proponents such as economist G. Edward Dickey, a staff assistant who believed that cost sharing was necessary "to keep the Corps' civil works program viable."¹⁰⁵ Gianelli also requested that the director of civil works enlist IWR for policy research on water project financing. In 1982, the Assistant Secretary's office directed a literature search of financing methods for water projects. "Cost Sharing Objectives and Approaches," completed in 1983, reviewed various cost-sharing formulas and concluded that increased cost sharing of water resources developments would drastically change federal and nonfederal relationships.¹⁰⁶

During the early 1980s, IWR's cost-sharing focus concerned water resources planning studies. Cost sharing in this activity was important to Gianelli, budget director Stockman, and Gianelli's successor, Robert K. Dawson. Dawson had been Gianelli's principal deputy, and before then had worked on the Republican staff of the House Public Works Transportation Committee. Having worked extensively with the ASA-CW staff on the administration's initiatives, Dawson brought both knowledge and political acumen to the position of acting assistant secretary at the end of 1984. He quickly reasserted the Reagan administration's determination to reshape the financing of water resources development.¹⁰⁷

Among many goals was establishing cost sharing for planning studies. This was a measure that Gianelli and Dawson had supported since 1981 but that Congress

opposed. Believing that congressional opposition was waning, Dawson in December 1985 ordered Chief of Engineers Heiberg to require cost sharing of feasibility studies initiated after 1 January 1986.¹⁰⁸ He also directed Heiberg to proceed with developing methods and guidelines to study cost sharing. In turn, Heiberg directed the OCE civil works planning division chief, Lewis Blakey, to assemble a committee to streamline project planning. The group consisted of William Holliday and Harry Kitch of the OCE planning division, Arthur Klingerman of BERH, and Eugene Stakhiv and urban planner Mark Mugler of IWR.¹⁰⁹

The result of their work was "A Plan for Planning in 1986," released in January 1986. The report spoke of the need for "nonfederal sponsor decision making equity" as an essential element in developing better water resources planning. Equity meant that nonfederal interests would often have equal influence over the planning process. The premise of "A Plan for Planning" was that equal sharing of study costs would bring about equity and that "the joint desire" of the federal government and the local sponsor to conduct a study would result in greater possibility that a project would be implemented.¹¹⁰ The major recommendations of the report included a model cost-sharing agreement between the Corps and local sponsors and a new study management regimen. The report recommended earlier initiation of Washington level review in issues of the study, a better definition of the scope and purpose of reconnaissance reports, and definite project reports to "facilitate the review process."¹¹¹ Later in the year, OCE released new regulations for cost-shared studies based on "A Plan for Planning."¹¹²

"A Plan for Planning" was significant in several aspects. The report was a collaborative effort among OCE,

BERH, and IWR that promoted the "partnering" approach of cost sharing. Major General Henry Hatch, director of civil works, gave his enthusiastic support to the document--and to cost sharing in general--even though the initiative came from OASA-CW. His endorsement of the new idea of treating local sponsors as "partners" instead of "customers" indicated that the military leadership was adjusting favorably to some views of an assertive ASA-CW, including cost sharing. For Hatch, the document heralded a new era for the Corps, and he advocated the preparation of similar reports for design and construction.¹¹³

Implementation of "A Plan for Planning" shortly after its release highlighted a new commitment in headquarters to making cost sharing agencywide policy. Headquarters was getting the field ready to accept and implement cost sharing of studies, and the field was beginning to ready local interests for the new realities of cost sharing.

The Issue of Navigation User Charges

The end of 1985 marked the fifteenth year since Congress had passed a major water resources funding measure. Without a funding bill, it would matter little that the Corps had developed new cost-sharing practices for planning studies; the agency was fast running out of work. The major funding legislation that many anxiously awaited had been the subject of bruising political battles between members of the Senate who favored cost sharing and cost recovery and members of the House of Representatives who opposed those measures but who also wanted projects to move forward.¹¹⁴

Although cost sharing of studies and projects remained the top priority of the Reagan administration, cost

recovery issues were important as well. Navigation user charges were contentious. Lobbyists for the navigation users found more support in the House than in the Republican Senate, and they relied on individuals like Illinois Representative Dan Rostenkowski to champion their battle against any increase in the 10-cents-per-gallon fuel tax already imposed. But proponents of higher user fees, including Stockman, Gianelli, and Dawson, also had strong congressional support, and their message was clear: higher user costs were coming to direct beneficiaries of navigation improvements.¹¹⁵

Partly in response to the congressional debate over imposing a higher user fuel tax, the Office of the Chief of Engineers in 1982 gave IWR's Navigation Analysis Center the task of providing data and analytical support to the office of policy in its efforts to assess various legislative proposals by Congress and OMB. When the center became part of the newly created navigation division in 1983, that work continued and expanded. As debate on higher user charges intensified during the mid-1980s, the navigation division provided statistics on current carrier revenues and forecasts of revenues with the imposition of 65 various user charges.¹¹⁶

Toward WRDA-86

All the issues of funding and planning water projects were on the bargaining table as Congress debated water resources funding in the early 1980s. The Reagan administration's main points were that planning and projects must be cost shared and higher user fees must be imposed. Some congressional proponents of federal water resources development feared the challenge to their traditional

authority and resisted them. The Reagan agenda, however, strongly appealed to many other legislators who favored a strong civil works construction program. Initially, the Corps reacted skeptically to user charges because of its close ties with navigation interests. Gradually, however, the Corps recognized that cost recovery measures, like cost sharing itself, might be the only way to stay in business. By the mid-1980s, the Corps was preparing itself--and navigation users and local interests--for the coming of new water resources legislation.

The new legislation came when President Reagan signed the Water Resources Development Act (WRDA-86) into law on 17 November 1986. This landmark law was the culmination of years of hearings, proposed bills, compromises, and acrimony. Ultimately, it marked the first significant funding of water resources development since 1970. Compromises characterize WRDA-86, but those who insisted on cost sharing and higher user charges prevailed. A major provision of the law established a minimum 25-percent nonfederal contribution for constructing flood control projects, nullifying the 100-percent federal responsibility for reservoir construction delineated in the 1938 Flood Control Act. The law applied cost sharing to separable elements, such as the Mississippi River and Tributaries project, and required ports to pay part of the cost of new construction. To recover costs, the law allowed port authorities to collect tonnage fees on users.¹¹⁷

The inland navigation provisions of the law were significant as well. WRDA-86 imposed a gradually escalating fuel tax that, by 1994, would rise to 20 cents per gallon. The taxes were to be used to pay half the cost of replacing seven inland locks. The law also authorized the establishment of an 11-member Inland Waterways Users

Board consisting partly of barge and tow operators. Through the board, users would have a voice in spending the fuel taxes. Perhaps most important, WRDA-86 broke the impasse on water project approvals as dozens of flood control, navigation, harbor development, and shoreline protection projects gained authorization.¹¹⁸

The long-term impact of the provisions of WRDA-86 remain to be determined, but the short-term impact was a major redirection for the Corps of Engineers. The agency thereafter had to cope with cost sharing, partnering with local sponsors, and more formalized relations with navigation interests. From the day WRDA-86 was passed, the Corps' civil works program has struggled to respond to the new way of doing business the law mandates.

The Institute's workload had diversified and expanded steadily since the late 1970s, with the exception of the dropoff after completion of the national studies. However, this dropoff was more than made up with the addition of risk and uncertainty analysis, expanding water conservation work, responses to the Principles and Guidelines, and cost-sharing provisions leading to WRDA-86. The incorporation of the Navigation Analysis Center gave the navigation division greater responsibilities and tasks. Additional personnel further diversified the interdisciplinary mix of skills in IWR and increased the customer base. IWR continued to assist OCE, the field, ASA-CW, navigation interests, and other federal and state agencies.

By the end of 1986, IWR had unprecedented visibility, and it successfully served specific needs of the Corps as never before. The tradeoff, if there was one, was an increased level of compartmentalization. In the wake of the 1983 reorganization, it was much more difficult to draw

on the Institute's collective knowledge. There were more people in the Institute, and more specific tasks within each division, which inevitably led to more formality and less interaction among the divisions. The Institute had changed a great deal since the late 1970s, and the changes from its early days were still more striking, but many more changes were to come.

¹ See Reuss, Reshaping National Water Politics, pp. 47-64, for a discussion of the Carter administration and water resources development.

² *Ibid.*; Dickey interview.

³ See Gary Wills, Reagan's America (New York: Penguin Books, 1987), for a discussion of the early Reagan years; Reuss, Reshaping National Water Politics, pp. 64-79.

⁴ *Ibid.*, pp. 65-66.

⁵ *Ibid.*; Nelson, "A History of the Office of the Assistant Secretary of the Army for Civil Works," pp. 367-368; Martin Reuss, interviewer, Water Resources People and Issues, An Interview with William R. Gianelli (Fort Belvoir, VA: Office of the Chief of Engineers, 1985), pp. v-viii.

⁶ *Ibid.*, pp. 1-3; Dickey interview.

⁷ IWR Annual Report, 1980-1981, pp. 28-29; IWR Annual Report, 1982, p. 25; Interview, author with John M. Lane, 9 Sept. 1993. Hereafter cited as Lane interview.

⁸ IWR Annual Report, 1980-1981, p. 29; Interview, author with Homer Gardner, Jesse McDonald, and Charles Hill, Lower Mississippi Valley Division, 8 Jan. 1994.

⁹ IWR Annual Report, 1980-1981, pp. 30-31.

¹⁰ IWR Annual Report, 1982, pp. 26-27.

¹¹ Ibid., pp. 33-36.

¹² Ibid., pp. 35-38; IWR Annual Report, 1980-1981, pp. 25-27.

¹³ Dietz interview; National Waterways Study, Overview of the Transportation Industry, Final Report, Aug. 1981, front cover, pp. i-ii.

¹⁴ Ibid.; IWR Annual Report, 1982, p. 32.

¹⁵ Ibid.; Dietz interview; Morris interview.

¹⁶ IWR Annual Report, 1982, pp. 31-32; Dietz interview; U.S. Army Engineer Institute for Water Resources, The 1988 Inland Waterway Review, IWR Report 88-R-7 (Nov. 1988), pp. 1-3.

¹⁷ IWR Annual Report, 1980-1981, pp. 21-23; U.S. Army Engineer Institute for Water Resources, National Hydroelectric Power Resources Study: National Report Vol. II (May 1983), p. 1-5.

¹⁸ IWR Annual Report, 1982, p. 33; Institute for Water Resources, National Report, pp. 2-1-2-4.

¹⁹ Ibid., p. 7-2.

²⁰ Ibid., p. 7-3.

²¹ Ibid., pp. 7-3-7-4.

²² Ibid., pp. 6-1-6-2; Antle interview, 26 Mar. 1994.

²³ Antle interview, 11 Jan. 1994; Dietz interview.

²⁴ Dietz interview; IWR Annual Report, 1982, p. 32.

²⁵ U.S. Army Engineer Institute for Water Resources, Program and Study Team Directory (July 1993), pp. 97-98.

²⁶ Ibid., p. 99.

²⁷ See Richard H. Leach, American Federalism (New York: W.W. Norton and Co., 1970), Chapter One, for a discussion of the federal, state, and local government role in American life.

²⁸ Harrison interview; Hanchey interview; IWR Annual Report, 1982, pp. 7-8.

²⁹ DF, Dir., IWR to Commander/Dir. WRSC, 12 Oct. 1983, subj: Revision of WRSC Regulation 10-1-23 "Organization and Functions," IWR DO files.

³⁰ Ibid.

³¹ Ibid.

³² DF, Dir., IWR to IWR Staff, 24 Oct. 1983, subj: Formation of Navigation Division, IWR DO files.

³³ Ibid.

³⁴ Annual Report FY 1983 of the Chief of Engineers on Civil Works Activities, p. 53-4.

³⁵ Annual Report FY 1985 of the Chief of Engineers on Civil Works Activities, p. 53-2.

³⁶ "Procedure Adopted for Establishment of Corps Policy on Civil Works Issues," undated typescript, ca. 1980, HQUSACE Office of Policy files.

³⁷ MFR from Donald Duncan, 23 June 1982, subj: Policy Issue Program, HQUSACE Office of Policy files.

³⁸ Ibid.

³⁹ Ibid.

⁴⁰ See, for example, MFR from Duncan, 24 June 1981, subj: IWR Policy Studies in Support of CWR-P, HQUSACE Office of Policy files, for a listing of FY 1981 studies.

⁴¹ Memorandum for Chief, Office of Policy, from Duncan, 23 June 1982, subj: CWR-P Activities, HQUSACE Office of Policy files.

⁴² Interview, author with Eugene Z. Stakhiv, 12 June 1994. Hereafter cited as Stakhiv interview, 12 June 1994; Schilling interview.

⁴³ Interview, author with Michael Krouse, 23 July 1993. Hereafter cited as Krouse interview, 23 July 1993.

⁴⁴ ER 10-1-23, 24 Oct. 1994, IWR DO files.

⁴⁵ Ibid.

⁴⁶ DF, Dir., IWR to IWR Staff, 24 Oct. 1983, subj: Formation of Navigation Division, IWR DO files; IWR Annual Report, 1982, p. 11.

⁴⁷ Schilling interview; Memorandum to Corps divisions and districts from Maj. Gen. E.R. Heiberg, III, May 1980, subj: Revised Plan of Action for Water Conservation, IWR DO files.

⁴⁸ Ibid.

⁴⁹ Interview, author with James Crews, 10 June 1994. Hereafter cited as Crews interview; Schilling interview; IWR Annual Report, 1982, p. 11.

⁵⁰ Ibid., pp. 16-17.

⁵¹ Ibid, pp. 15-16; U.S. Army Engineer Institute for Water Resources, An Assessment of Municipal and Industrial Water Use Forecasting Approaches, IWR Contract Report 81-C05 (May 1981), passim.

⁵² See U.S. Army Engineer Institute for Water Resources, The Evaluation of Water Conservation for Municipal and Industrial Water Supply: Illustrative Example, IWR Report 82-C01 Vol. II (Feb. 1981), and U.S. Army Engineer Institute for Water Resources, Analytical Bibliography for Water Supply and Conservation Techniques, IWR Report 82-C07 (Jan. 1982), for examples of this R&D work.

⁵³ IWR Annual Report, 1981, p. 10.

⁵⁴ Crews interview.

⁵⁵ Ibid.; Michael R. Krouse, "The History and Development of the IWR-MAIN Water Use Forecasting System," undated typescript, IWR files.

⁵⁶ Ibid.; Crews interview; Krouse interview.

⁵⁷ Krouse, "The History and Development of the IWR-MAIN Water Use Forecasting System"; Planning and Management Consultants, Ltd., "The IWR-MAIN Water Use Forecasting System," undated typescript, p. 6, IWR files.

⁵⁸ Krouse, "The History and Development of the IWR-MAIN Water Use Forecasting System."

⁵⁹ Krouse interview.

⁶⁰ U.S. Army Training and Doctrine Command, Installation Compatible Use Zone (ICUZ), Executive Briefing, 1983, p. iii.

⁶¹ C. Mark Dunning, J. Phillip Huber, and Darrell C. Nolton, "Developing a Collaborative Planning Approach for Managing Noise and Land Use Issues Around U.S. Army Installations," Paper presented at NATO CCMS Conference on Aircraft Noise, Mittenwald, Germany, 1986.

⁶² Ibid.

⁶³ U.S. Army National Guard, Installation Compatible Use Zone (ICUZ), Executive Briefing," Oct. 1988.

⁶⁴ U.S. Army Engineer Institute for Water Resources, Reducing Environmental Noise Impacts: A USAREUR Noise Management Program Handbook, IWR Report 91-R-5 (June 1991), p. 2.

⁶⁵ Unsigned memorandum, 24 June 1981, subj: IWR Policy Studies in Support of CRW-P, HQUSACE Office of Policy files; Unsigned and undated memorandum, subj: FY 1982 IWR Policy Studies in Support of CWR, HQUSACE Office of Policy files.

⁶⁶ Hanchey to IWR Staff, 24 Oct. 1983; IWR Annual Report, 1982, p. 19.

⁶⁷ DF, Kyle Schilling to Donald Duncan, 8 March 1982, subj: Water Supply/Conservation Policy Studies, IWR DO files.

⁶⁸ Krouse interview; Telephone interview, author with Leonard Shabman, Virginia Polytechnic University, 16 June 1994. Hereafter cited as Shabman interview.

⁶⁹ Telephone interview, author with Martin Reuss, HQUSACE Office of History, 17 Aug. 1994; See U.S. Army Engineer Institute for Water Resources, A Methodology for Assessing Economic Risk of Water Supply Shortages IWR Report 72-6 (May 1972), for early IWR concepts of risk analysis; IWR Annual Report, 1971, p. 18; IWR Annual Report, 1972, p. 9.

⁷⁰ Schilling interview.

⁷¹ Nelson, "A History of the Office of the Assistant Secretary of the Army for Civil Works," pp. 186-189.

⁷² Interview, author with Eugene Stakhiv, 15 June 1994. Hereafter referred to as Stakhiv interview, 15 June 1994; Y.Y. Haimes, R. Petrakian, P.O. Karlsson, and J. Mitsiopoulos, Multiobjective Risk-Partitioning: An Application to Dam Safety Risk Analysis, IWR Report 88-R-4 (Apr. 1988), p. v.

⁷³ Ibid; Dickey interview.

⁷⁴ H.C. Cochrane, R. Ferrell-Dillard, and D.D. Bauman, Socioeconomic Considerations in Dam Safety Risk Analysis, IWR Report 87-R-7 (Aug. 1987), p. 3.

⁷⁵ Dickey interview; Stakhiv interview, 15 June 1994.

⁷⁶ Nelson, "The Office of the Assistant Secretary of the Army for Civil Works," pp. 367-368; Stakhiv interview, 15 June 1994; Shabman interview.

⁷⁷ Quoted in Haimes et al., Multiobjective Risk-Partitioning, p. v.

⁷⁸ Quoted in Ibid.

⁷⁹ Ibid., pp. v-vi; Stakhiv interview, 15 June 1994.

⁸⁰ "Water and Related Land Resources Planning: Extension of Comment Period on Proposed Repeal of Regulations and Request for Comment on New Principles and Guidelines," Water Resources Council, Federal Register 47, No. 55, March 1982; U.S. Water Resources Council, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (10 March 1983).

⁸¹ Quoted in Reuss, Reshaping National Water Resource Politics, p. 88.

⁸² Moore and Moore, The Evolution of Federal Flood Plain Management Policy, p. 132.

⁸³ *Ibid.*, pp. 133-134; Reuss, Interview with William R. Gianelli, p. 55; Reuss, Reshaping National Water Resource Politics, pp. 87-88.

⁸⁴ U.S. Water Resources Council, Economic and Environmental Principles and Guidelines, pp. iv-v.

⁸⁵ *Ibid.*

⁸⁶ Shabman interview.

⁸⁷ U.S. Water Resources Council, Economic and Environmental Principles and Guidelines, p. 16.

⁸⁸ *Ibid.*, p. 17.

⁸⁹ Ibid., p. v.

⁹⁰ See Ferrell, Big Dam Era, Chapter III; Also see Maass, Muddy Waters, for criticism of the Corps' civil works program of the 1950s.

⁹¹ Reuss, Reshaping National Water Resource Politics, pp. 32-33 See this work for a full discussion of cost sharing and user fees leading to WRDA-86.

⁹² Ibid., p. 33.

⁹³ Ibid.

⁹⁴ Ibid., pp. 56-57.

⁹⁵ Reuss, Interview with William R. Gianelli, p. 19; Dickey interview.

⁹⁶ Ibid.; Reuss, Reshaping National Water Politics, pp. 72-73.

⁹⁷ Reuss, Interview with William R. Gianelli, pp. 16-19; Dickey interview.

⁹⁸ U.S. Army Corps of Engineers, Office of the Chief of Engineers, Directorate of Civil Works, Planning Division, Committee on Streamlining and Making More Efficient the Planning of Specific Projects, "A Plan for Planning in 1986" (January 1986), p. 4.

⁹⁹ Ibid., p. 2.

¹⁰⁰ Ibid., p. iv.

¹⁰¹ Dickey interview.

¹⁰² Ibid., Reuss, Reshaping National Water Politics, pp. 86-87; Reuss, Interview with William R. Gianelli, pp., 18-19.

¹⁰³ U.S. Army Engineer Institute for Water Resources, Cost Sharing for Shoreline Protection, IWR Contract Report 74-7 (Aug. 1974), p. i.

¹⁰⁴ Anne M. Lynne, "Interpretation and Implementation of EQ," (IWR Policy Studies Report) June 1980, located in HQUSACE Office of Policy files.

¹⁰⁵ Dickey interview.

¹⁰⁶ IWR Annual Report, 1982, p. 21.

¹⁰⁷ Reuss, Reshaping National Water Politics, p. 120.

¹⁰⁸ Ibid., p. 184.

¹⁰⁹ IWR first produced a study for the Office of Policy on cost sharing planning studies with Eugene Z. Stakhiv and Janet Wright, "An Overview of Issue Related to Cost-Sharing of Planning Studies," Feb. 1985 (draft), IWR Historical files; Stakhiv interview, 15 June 1994.

¹¹⁰ U.S. Army Corps of Engineers, "A Plan for Planning," p. iv.

¹¹¹ Ibid.

¹¹² Reuss, Reshaping National Water Politics, p. 185.

¹¹³ Stakhiv interview, 15 June 1994; Reuss, Reshaping National Water Politics, p. 185.

¹¹⁴ See Reuss, Reshaping National Water Politics, for a detailed analysis of the events leading to passage of the Water Resources Development Act of 1986.

¹¹⁵ Ibid., pp. 187-190.

¹¹⁶ IWR Annual Report, 1982, p. 27.

¹¹⁷ Water Resources Development Act of 1986, Public Law 99-662, p. 3; Reuss, Reshaping National Water Politics, pp. 196-198.

¹¹⁸ Ibid.; U.S. Army Engineer Institute for Water Resources, The 1988 Inland Waterway Review (Nov. 1988), p. 1.



CHAPTER FIVE: RESPONDING TO NEW CHALLENGES, 1986-1993

During the years 1986 through 1993, the Corps of Engineers' civil works program struggled to adapt to a new era in federal water resources development. The Institute for Water Resources played an increasingly influential role in helping the Corps cope with new ways of doing business. The cost-sharing provisions of the Water Resources Development Act of 1986 represented a trend of increasing nonfederal influence. Shortly after its passage, Assistant Secretary of the Army for Civil Works Robert Dawson declared, "This is a new era for water resources development."¹ Echoing Dawson was Representative Robert Roe, a strong proponent of WRDA-86, who stated enthusiastically, "The Corps is back in business."² Nonetheless, WRDA-86 also changed the Corps' way of doing business, especially in regard to planning. After WRDA-86, the Corps had an unprecedented mandate to bring nonfederal sponsors into its planning process and to work more closely with the commercial interests that used Corps-built water developments. Such mandates forced internal change just as the rising influence of ASA-CW had, but they also portended more intergovernmental cooperation in infrastructure, water supply, recreation, and drought studies.

Uniform implementation of the Principles and Guidelines continued to be the top priority of the civil works program. The P&G, which emphasized national economic development, seemed less complicated on the surface than the two-account Principles and Standards. However, actual implementation required governmentwide coordination, as did development of risk analysis methods. Regulatory and wetland protection continued to evolve as significant Corps responsibilities requiring multidisciplinary expertise. Meanwhile, alternative methods of resolving contractor disputes gathered strength in the agency.

Budgeting and personnel constraints challenged the Corps even as its responsibilities diversified. Pressures were great to improve the performance of all federal government agencies in the early 1990s. The Corps responded with evaluations of its civil works activities, including the operation and maintenance program. Achieving a better performing government required new approaches and new strategies, many of which the Institute for Water Resources had been developing for more than two decades. Collectively, these issues challenged the civil works directorate and, consequently, the Institute for Water Resources.

Programmatic Changes in IWR

After the promulgation of the P&G in March 1983, the Corps of Engineers and other federal water resources agencies were required to develop implementation studies by July of that year. Since IWR had conducted economic analysis since its beginnings, the civil works directorate assigned the NED implementation program to the research division. That work continued into the 1990s. As risk and

uncertainty analysis grew in importance in the Assistant Secretary's office and among many Corps planners, IWR's ongoing research activities increased in this area as well. Navigation analysis expanded as IWR became increasingly involved in preparing statistical studies and economic forecasts for the Inland Waterway Users Board. The navigation division also maintained statistical data bases of navigation for Corps divisions and districts and provided analysis for the major rehabilitation program for locks and dams delineated in WRDA-86. Meanwhile, the policy analysis division responded to policy issues ranging from cost-sharing strategies and project financing to developing issues regarding the Corps' regulatory program.

The Institute added a facilitation capability when, on 1 October 1986, it acquired the Fusion Center. Transferred from Fort Belvoir, the Fusion Center was designed to allow strategic planners, task forces, and project teams to work with facilitators to solve problems in open, collaborative and synergetic efforts. In the center's facilities were walls covered with writing boards, and smaller conference rooms to accommodate smaller working groups. The Fusion Center staff coordinated and facilitated these meetings, which until transfer to IWR had largely served military functions at Fort Belvoir. Once established in IWR, the staff provided its services not only to civil works but also to other Corps elements in headquarters and the Pentagon.³

The pace of change in the late 1980s compelled the civil works directorate to rethink the structure of the Water Resources Support Center. Reorganizing navigation data collection and analysis topped the list. Since the creation of WRSC in 1979, data collection organizations had come into the umbrella water resources organization in a somewhat haphazard manner. By the mid-1980s, several data

collection and statistics groups were in WRSC's data collection and management division, including remote sensing research, water control data systems, telecommunications planning, the Waterborne Commerce Statistics Center in New Orleans, and various computer, radio, and data base collection groups. The dredging statistics program and the port facilities division were separate information-gathering elements in WRSC as well.⁴

To coordinate navigation and the other statistical elements, a WRSC task force examined various options during early 1987. Consisting of OCE and WRSC personnel, the task force recommended that most of the WRSC navigation statistics groups be incorporated into a single organization. The task force also recommended that the Lock Performance Monitoring System, at that time under the direction of the IWR navigation division, be transferred to the new organization. In June 1987, the civil works directorate created the Navigation Data Center within WRSC.⁵ With this action, a single organization of WRSC now controlled navigation data and coordinated a variety of formerly disparate functions.⁶

The Users Board and IWR

Creation of the Navigation Data Center significantly affected IWR. Removal of the PMS function from the navigation division allowed its personnel to focus on the analytical aspects of navigation and provide service to the field and the Inland Waterways Users Board. WRDA-86 established the 11-member users board, whose members were nominated to revolving terms by the Secretary of the Army. The board consisted of shippers and barge operators who made recommendations to Congress and ASA-CW on priorities for

spending the money accumulating in the Inland Waterways Trust Fund.⁷ The trust fund, authorized in the Inland Waterways Revenue Act of 1978, consisted of the fuel tax collected on tows operating on 27 segments of the inland waterway system. In fiscal year 1981, the first year of the tax, the Internal Revenue Service collected \$21.2 million at a rate of 4 cents per gallon.⁸ Through provisions of WRDA-86, the rate increased to 10 cents per gallon by fiscal year 1989. By fiscal 1995, the rate was to rise to 20 cents per gallon. While the fund increased steadily during the early 1980s, it was due more to an increasing tax rate and accumulating interest than to any expansion of waterway activity. With no new construction, the fund remained untapped. After WRDA-86 and another funding act in 1985, construction and rehabilitation work accelerated, as did use of the fund. By the end of fiscal year 1987, the trust fund balance was about \$280 million.⁹

The users board was another aspect of the "partnering" idea set forth in WRDA-86. Section 102(a) of the act stated that half the construction costs for navigation improvements were to be paid "only from amounts appropriated from the Inland Waterways Trust Fund."¹⁰ As a cost-sharing partner, the shipping and towing industry, through the Users Board, had unprecedented contact with and influence over the federal decisionmaking process and the Corps navigation program. However, the board had no effective internal means of gathering and analyzing waterway statistics. To streamline project implementation, in 1987 the Corps established an agencywide task force that assigned IWR the task of providing information to the board. This was done primarily because the navigation division had recently developed a cash flow model to calculate the trust fund's ability to finance construction. The model

demonstrated that projected revenues would allow only a moderate, well-planned, prioritized improvement program for the inland waterways.¹¹ As time passed, IWR's navigation division became the coordinator for many major items on the board's yearly agenda, including providing staff support, recording minutes of the three annual meetings, and preparing drafts of the annual report.¹²

The Institute's work became the User Board's basis for making waterway improvement recommendations. By analyzing data produced in the Navigation Data Center, IWR facilitated an understanding of the relationship of revenues and outlays in the trust fund. WRDA-86 authorized nine navigation projects totaling more than \$2.6 billion, 50 percent of which had to come from the trust fund during the planning and construction of each project. IWR concluded in 1988 that the trust fund could provide 50-percent funding for the nine projects and a modest rehabilitation program, but it could not fund additional projects.¹³ Moreover, 12 rehabilitation projects then being planned on the Ohio River waterway would overtax the trust fund if they were implemented too soon.¹⁴

The task force to streamline project implementation also began production of a periodic inland waterway review for the users board and Corps planners. The periodic review, which presented a concise overall analysis of the inland waterway system following WRDA-86, was modeled after the National Waterways Study. Because of the Institute's experience with the national studies and its longer experience in examining navigation on a systems basis, the navigation division received the task of producing the review.¹⁵

After producing a preliminary study called Status of the Inland Waterways in July 1987, the IWR navigation staff

expanded and updated the work into The 1988 Inland Waterway Review. The study focused on traffic levels, system performance, transportation savings, investment needs, and financial resource availability for waterways investment. The report included a summary of the system of "fuel-taxed waterways" and described the fleet of towboats and barges that used each waterway segment. The segments were the Upper Mississippi, Middle Mississippi, Lower Mississippi, Illinois, Ohio River, Gulf Intracoastal, Mobile River and Tributaries, Atlantic Intracoastal, and Columbia-Snake. The report discussed trends and projections from historical statistics and more recent data from the Waterborne Commerce Statistics Center, analyzed the types of commodities shipped on the various waterways, and forecasted future shipments.¹⁶

The Inland Waterway Review relied heavily on computerized statistics from the Lock Performance Monitoring System. The resulting performance analysis emphasized the impact of "bottlenecks" (undersized or poorly operating locks) on the nine waterway segments and the entire inland navigation system.¹⁷ The review outlined the new realities of inland waterways funding, including study and project cost sharing for construction, the limitations of the trust fund, and the need for extensive lock and dam rehabilitation. By fiscal year 1988, the Corps' overall operation and maintenance budget accounted for 31 percent of the total, while construction represented 26 percent. However, WRDA-86 made no provisions for cost sharing of rehabilitation, nor did it define what constituted rehabilitation versus "major maintenance." With limited federal funds for rehabilitation--then funded at 100 percent--pressure for cost-sharing rehabilitation from the trust fund would undoubtedly increase.¹⁸ The issue was

resolved in fiscal year 1992, when the user board and the Corps agreed on a policy for major rehabilitation in which 50 percent funding came from the trust fund.¹⁹

The 1988 Inland Waterway Review posed several questions to Corps planners and inland navigation users. Given limited funds, aging locks and dams, and the many political, economic, and environmental issues associated with water resources development, what planning strategies would benefit the system most? What were the most advantageous major rehabilitations, and how would their planning and construction be funded? How much should the market economy affect investment decisions, and how important was regional development? "A prerequisite to the definitive assessment of future waterway system needs," the review stated, "is comprehensive analysis using consistent assumptions as to traffic growth and system capacity."²⁰ In other words, investment decisions should be based on standardized data and systems analysis for maintenance and improvement of the present waterways, and for any expansion. By the end of 1988, the Institute for Water Resources was deeply involved in navigation planning and analysis for both the users board and Corps divisions.

Issues of Wetlands and the Regulatory Program

Since passage of NEPA in 1969, public awareness of the importance of wetlands to the ecosystem had steadily increased. Since environmental groups prevailed in assigning a broadened regulatory program to the Corps of Engineers in 1975, the agency had grappled with a nationwide permit process over the nation's waters and wetlands. During the late 1970s, the expanded regulatory program received Presidential support. Jimmy Carter signed

Executive Order 11990 on 24 May 1977, which focused on the issue of wetlands preservation.²¹ Less than 2 months later, the Corps developed guidelines for the Department of the Army permit program and published them in the Federal Register of 19 July 1977. The guidelines were clear regarding wetlands protection: "Wetlands are vital areas that constitute a productive and valuable public resource, the unnecessary alteration of which should be discouraged as contrary to the public interest."²² Wetlands were integral components of the food chain. They provided wildlife habitat for birds, marine mammals, and aquatic species. With administration support and great public interest in environmental quality, the Corps carried out its regulatory mandate and expanded and refined wetlands protection.

As a policy agent for the operations branch of the civil works directorate, IWR had been actively involved in the Corps' regulatory program. In February 1979, IWR published Wetland Values: Concepts and Methods for Wetlands Evaluation to assist the field in complying with the directives of the section 404 program and Carter's executive order. In July 1980, the Institute published Investigation of the Relationship Between Land Use and Wildlife Abundance, which explored the impact of human development on animal habitat. In March 1982, IWR provided the operations branch with a plan for a permit applications data base to help streamline the regulatory program.²³ However, as with many aspects of water resources development, the election of Ronald Reagan to the Presidency in 1980 significantly affected the direction of the Corps' regulatory program--especially regarding wetlands. On 17 February 1981, Reagan issued Executive Order 12291, one of the first of his administration. The President sought the reduction of the Corps' regulatory activity. The

Republican administration defined regulatory objectives as those that "maximize[d] the net benefits to society."²⁴ Obviously focused on economic benefits, the order also accelerated the permit process.²⁵

The expanded regulatory program with its emphasis on protecting wetlands remained controversial in the Corps. Still, the agency expended considerable effort to carry out the law and balance development with environmental protection in the permit process. The operations branch of headquarters continued to rely on IWR for technical assistance in running the program.

Wetland Mitigation Banking

With a development-minded President in the White House and William Gianelli as Assistant Secretary, interpreting the proper course of action regarding wetlands regulation became more complex for the Corps. Gianelli agreed with Reagan that the permit process took too long, intruded on small development, and defined wetlands too broadly.²⁶ While the Reagan administration asserted its viewpoint on the regulatory program, the civil works directorate began to discuss a new approach to regulating wetlands. At a September 1982 meeting of the Corps' Environmental Advisory Board (EAB), Michael Zagata of Tenneco Corporation presented a paper on "mitigation banks" (the practice of creating wetlands through deposition of dredged or fill material, or of reserving large sections of wetlands to offset wetland losses in other areas). Acting Director of Civil Works Brigadier General Forrest T. Gay, III, placed the subject of mitigation banking on the top of the agenda for the next EAB meeting and directed IWR to prepare a paper on the subject.²⁷

Gay's directive offered IWR policy analysts an opportunity not only to look at mitigation banking but also to evaluate the overall regulatory program. By 1983, the Corps was processing about 16,000 individual permit applications annually. About 37 percent (6,000) of those required conditions to be met before issuing permits. In about 4,000 cases, the conditions could be mitigated onsite by minimizing or avoiding certain impacts. In the remaining cases, about 2,000 per year, significant unavoidable impacts existed that could lead to a denial of the permit. IWR's policy analysis argued that in some cases, where onsite mitigation was impossible, wetland mitigation banks could be used to "offset" the unavoidable losses.²⁸

The historical examples of wetland "banks" included several federal, state, and private endeavors. State and federal purchase programs had reserved almost 33 million acres of wetlands by 1983, 29 million of which were in Alaska. The federal Duck Stamp Program, with the support of the private organization Ducks Unlimited, had purchased 2.5 million acres of duck habitat since 1934.²⁹ Although these were not "mitigation banks" in the purest sense of a developer purchasing acreage in banks to offset losses elsewhere, the existence of Duck Stamp lands provided conceptual strength to the idea, as did a debit and credit system developed by the Fish and Wildlife Service.³⁰

Through 1983 and 1984, the IWR policy studies division continued to work on wetlands mitigation banking. Research revealed that there had been a net loss of more than 11 million acres of wetlands in the United States since 1950, of which 97 percent were freshwater wetlands drained primarily for agricultural uses. Given such losses, wetlands mitigation banking appeared to be a viable approach. Creation of new wetlands with dredge or fill material could

establish additional fish and wildlife habitat. Wetlands mitigation banking could also improve the relationship among the Corps, EPA, and the Fish and Wildlife Service if all agencies agreed to implement wetland mitigation banking and accept standard values and exchange rates for the banking system.³¹ However, IWR researchers found that Corps regulatory personnel generally believed that "compensation for unavoidable losses of wetlands," the basic premise for mitigation banking, was incompatible with the purpose of the regulatory program.³²

The Office of the Assistant Secretary also opposed wetland mitigation banking. In a broader sense, Gianelli; his successor, Robert K. Dawson; and the Reagan administration opposed the Corps' 404 program. Rather than charge a federal agency with all regulatory responsibilities, the Reagan administration wanted to delegate some 404 activities to state governments. Early in his first term, Reagan established the Task Force on Regulatory Reform, chaired by Gianelli. Principal on a list of reforms was the Corps' 404 program, which, in Gianelli's viewpoint, "was simply not working."³³ The task force concentrated its early efforts on streamlining the review process, and in 1983 developed a memorandum of understanding (MOU) signed by the Corps, EPA, and the departments of Commerce, Agriculture and the Interior. The MOU reduced the successive levels of review in permitting and allowed simultaneous coordination with Corps field offices, headquarters, ASA-CW, and the other interested agencies.³⁴

As chairman of the task force, Gianelli skeptically viewed bringing wetlands mitigation banking into the 404 program. Undoubtedly he believed it would broaden Corps regulatory responsibilities and strengthen a federal program he wanted to divest to the states. However, Gianelli also

believed that the 404 program was not intended to be "a wetlands protection measure."³⁵ Creating mitigation banks far from the sites appeared to find favor with environment-minded proponents of the expanded 404 program--something Gianelli strongly opposed. When IWR's favorable initial policy studies appeared before Gianelli in 1983, he dismissed them.³⁶

Without the support of OASA, the OCE policy division gradually curtailed funding for IWR's work on wetlands mitigation banking. Members of the Institute's policy studies division went on to other tasks after 1984 but kept apprised of research and scholarship on the banking idea. Late in 1987, Vice-President George Bush announced his candidacy for the Presidency in 1988. Emerging from the shadow of the Reagan budget cutters, Bush promised a new agenda, including a pledge to be the "environmental President" who would protect wetlands. A few days after Bush's November 1988 victory, the National Wetlands Policy Forum, a working group of environmental organizations and government officials, issued a report entitled Protecting America's Wetlands: An Action Agenda. The forum proposed a national goal of "no net loss of wetlands" and advocated the establishment of mitigation banks. President Bush quickly endorsed the report and made it an administrative goal to achieve no net loss of wetlands.³⁷

President Bush's pledge left federal resource agencies scrambling to implement new wetlands regulations. As the federal agency charged with regulating national waters and wetlands, the Corps of Engineers sought out ways to balance development and environmental quality, promote the concept of environmentally sustainable development, and at the same time bring about nationwide conditions

resulting in no net loss of wetlands. In February 1989, the civil works directorate published revised policy guidelines regarding wetlands conservation. The definition of wetlands was broad:

*Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.*³⁸

The emphasis on wetlands protection compelled federal agencies to reexamine the merits of banking. Chief of Engineers Lieutenant General Henry J. Hatch (director of civil works until May 1988) approached incoming Assistant Secretary of the Army for Civil Works Robert Page with a strategy for achieving the national wetlands goal. Part of the strategy included further investigation of wetlands mitigation banking. With Presidential support, the OASA-CW recognized that mitigation of some kind was inevitable and that the banking concept deserved consideration. The reexamination was fully under way when the Corps and EPA signed a memorandum of agreement (MOA) on 6 February 1990. The MOA outlined specific procedures for meeting the mitigation requirement under section 404 guidelines and recognized that wetland mitigation banking "might be an acceptable form of compensatory mitigation under specific criteria designed to assure that the banks meet environmental objectives."³⁹

The Water Resources Development Act of 1990 accelerated the examination of mitigation banking. Section 307(d) directed the Secretary of the Army to establish a wetlands restoration and enhancement demonstration program, and he assigned IWR as administrator. The goal of the program was to establish a limited number of demonstration wetlands, to make an inventory of all mitigation banks around the nation, and to report the findings to Congress no later than 3 years after passage of the 1990 act.⁴⁰ Robert Brumbaugh, a geographer who came from the Los Angeles District and graduated from the planning associates program, was the IWR study manager. Brumbaugh was assisted in the policy and special studies division by Richard Reppert, an environmental planner who had worked on wetlands issues for IWR in the 1970s. After making a preliminary inventory of 37 banks in active operation and 64 others being planned, IWR published a conceptual report in July 1992 entitled Wetland Mitigation Banking Concepts. The report outlined the progress of the demonstration study as well as the history of wetland mitigation banking. One of the earliest banks was Tenneco LaTerre in the bayou country of Louisiana. Tenneco Corporation, an oil and gas developer, established this industrial bank to offset losses of wetlands resulting from its operations.⁴¹ Other operating banks were created primarily to offset losses associated with highway and port construction. State transportation agencies usually sponsored operation of the highway-related banks, but with passage of the federal Intermodal Surface Transportation Efficiency Act of 1991, federal funds became available for establishing mitigation banks to offset wetland losses caused by highway construction. Port authorities usually sponsored port-related mitigation banks and financed their acquisition and

operation through user fees and rents.⁴² The report identified three additional types of banks: single-user banks, commercial banks, and wetland mitigation trusts. Examples of single-user banks are the highway and port-related banks. Commercial banks and wetlands mitigation trusts were both operated on the basis of "market-oriented" mitigation. Commercial banks offset wetland losses owing to a variety of users and could be sponsored by either a public agency or a private company. Private companies, motivated by profit, had begun establishing commercial banks from which developers could buy credits to offset onsite wetland losses. Mitigation trusts in Maryland, Louisiana, California, Oregon, and Hawaii permitted developers to make cash contributions to a trust fund maintained by public or private enterprise.⁴³

There were very few federal project banks, but one being planned in 1992 involved the Corps of Engineers. Authorized in WRDA-90, the Passaic River flood control project in New Jersey employed a nonstructural approach requiring acquisition of large sections of freshwater wetlands. The authorizing legislation designated those lands as a "wetlands bank" designed to offset losses incurred not only by the structural components of the project but also by other nonfederal development activities in New Jersey.⁴⁴

As one of the initial products of the Wetlands Mitigation Banking Demonstration Study, the July 1992 report outlined current knowledge about the concept and how banks were being implemented in various regions of the United States. Further phases of the demonstration study included conducting demonstration studies, planning and designing actual demonstration sites, exploring the applicability of banking for the Corps regulatory program, preparing an implementation manual, and producing the final report to Congress.⁴⁵ By 1993, it appeared that

wetlands mitigation banking was a concept whose time had come, and the Corps was a leading proponent of a concept.

Drought Studies

Droughts are a normal part of the climatological cycle, but their consequences can be economically devastating. The Corps of Engineers, hoping to expand understanding of drought effects, began several studies in the 1950s. The agency expanded drought examinations in the regional Northeastern U.S. Water Supply Study of the 1960s, and expanded into national studies following President Carter's drought initiatives of the late 1970s. Involvement in the Presidential Drought Study substantially increased IWR's knowledge about water supply, conservation, and drought.

In 1980, a Chief of Engineers' policy directive stated that Corps projects should "respond to public needs during droughts to the extent possible under administrative and legislative authorities."⁴⁶ Partly in response, IWR expanded its policy studies in the early 1980s to include research into pre-drought planning policies. During the mid-1980s, an extended drought gripped the southeastern United States. Under the direction of the OCE policy division, IWR undertook a study to assess how the Corps and other federal and state agencies had responded. In 1988 and 1989, IWR published two policy studies: Lessons Learned from the 1986 Drought, and a study of the 1988 drought along the lower Mississippi River. Both reports concluded that local governments had done little or nothing to prepare for drought. Although the federal government, particularly the Corps, had conducted studies of drought planning and possible responses, most water distribution agencies had taken no preventive action. The researchers concluded that

state and local governments acted only when drought conditions forced action, and once the crisis ended they initiated no planning for future droughts. The federal government pursued a systematic approach to drought planning but had not yet had significant impact.⁴⁷

The Water Resources Development Act of 1986 provided authority for more extensive drought examinations. Section 707 of the act authorized the Secretary of the Army to estimate long term capital investment needs for a variety of improvements, including municipal and industrial water supply. Section 729 required the Secretary in coordination with the Secretary of the Interior to study the water resources needs for river basins and regions. This section required coordination with all concerned government agencies. In response to the droughts of the late 1980s, Congress and state and federal water agencies shaped these provisions into the guidelines for a national study.⁴⁸

Because of its continuing drought studies and its experience in national studies, the Institute for Water Resources became the lead agent for the National Study of Water Management During Drought. IWR's third national water resources development study called for extensive coordination with Corps divisions and districts, state water resource agencies, the Advisory Council on Intergovernmental Relations, various consultants, and the Resources for the Future Foundation. To encourage a nationwide response, Assistant Secretary Robert Page wrote the governors of all 50 states and asked them to provide information on state- or local-level responses to drought. IWR's study manager was William Werick, a civil engineer who had come from the Buffalo District. The objective of the early phase of the study was to examine the way water had been managed during the droughts of the late 1980s

and then develop a national strategy for improving management.⁴⁹

After the first year of the study, IWR published an extensive progress report. The report predicted that future droughts would probably cause more strife and damage than those in the recent past, whose impacts had been mitigated by unusually high reserves of water and food. The report acknowledged that no single agency could manage water during drought. There was no consensus among water resource agencies on the best approaches to managing water during droughts. The overall conclusion of the first-year report was that "most places in the country are chronically ill prepared for drought."⁵⁰ The report outlined a recommended approach to drought planning and proposed that it be tested in case studies.

As the national drought study team delved further into the 4-year project, a systematic, multiobjective approach was tested in case studies around the country. The difficulty of preparing those sorts of plans was reinforced in the findings of Lessons Learned from the California Drought (1987-1992), published in September 1993. California's severe 6-year drought showed that competing users were unable to negotiate reallocations of water until new laws were passed creating water markets while at the same time preserving long-term water rights. The conflict among users during this drought affected 1992 Presidential and Senatorial campaigns, and led to passage of the Central Valley Improvement Act of 1992. This act has been called one of the most important pieces of environmental legislation yet passed.⁵¹

As the drought study progressed, some participants began to apply interactive computer technology to the process. One study member, Dr. Richard Palmer of the civil

engineering department of the University of Washington, developed a concept called the "shared vision." Palmer had received an American Society of Civil Engineers award for his use of interactive computer modeling in Washington, D.C. water supply issues. Introduced in early 1992, the shared vision models allowed water managers and competing stakeholders to build an accurate, dynamic, and interactive representation of the water system they all shared. This computerized "single text negotiating document" helped break down barriers to problem solving among competing users.⁵²

The four-year drought study was completed in 1993. The study results combine drought management research, hydrological studies, water use forecasting, public involvement, and multiple objective planning methods into an internally consistent and practical guide to improved water management.⁵³ Even before the study ended, water managers in Pennsylvania, Maryland, Florida, Virginia, and Washington state began to employ these methods. Negotiation with Georgia, Florida, and Alabama for use of the Drought Study methods on a \$13.5 million river basin study were also underway. Thus, the Drought Study had already begun to address its primary objective: To improve water management in the United States.⁵⁴

Water Supply and Conservation--IWR MAIN

By the late 1980s, planning methodologies and water supply and conservation were the central work units of IWR's Research Division. Included in water supply and conservation was the ongoing refinement of the IWR-MAIN water use forecasting program. First developed by IWR consultants in the early 1980s, the computer program had

undergone several revisions and expansions. Each new version increased IWR-MAIN's flexibility and applicability for many water distribution agencies.⁵⁵

The developers of IWR-MAIN, responding to user demands and supported by the American Public Works Association, continued to revise and improve the system. In late 1987, IWR released version 5.1 of IWR-MAIN, able to forecast seasonal adjustments, calculate individual conservation measures, and isolate as many as 284 individual water uses.⁵⁶ In each category, residential, commercial/industrial, industrial, and public/unaccounted, the new version provided for additional flexibility. In separating residential data, users could discern among four residential housing types, including flat rate and metered. IWR-MAIN had 23 built-in commercial/industrial categories to which users could define up to 27 additional uses. The system could estimate water use for as many as 198 industrial categories. By supplying current population figures for the service area, users could acquire estimates of unaccounted water consumption.⁵⁷

On the basis of responses from version 5.1 users, IWR, through its contractor, Planning and Management Consultants, Ltd., continued to modify IWR-MAIN in the 1990s. New features included a "conservation evaluation routine" that calculated benefit-cost figures with each new conservation measure included. Another addition was a "drought contingency routine," which enabled users to learn the cost of various water system improvements during the planning phases of potential water supply projects. The Institute built a subroutine program for risk assessment analysis for planned water systems into the drought contingency routine. IWR-MAIN also evaluated the comparative costs of emergency water supplies and other

individual short-term drought management options. Finally, IWR-MAIN programmers incorporated a system manager into the most recent distributions. This enabled water resource planners to use IWR-MAIN to evaluate and forecast water needs over a much broader geographic area than was formerly possible. The system manager compiled and analyzed series of forecasts within political or water district boundaries, aggregated them, and provided forecasts for large water use areas.⁵⁸

Planning Methodologies: National Economic Development

When the Principles and Guidelines of 1983 elevated the NED account to the primary federal objective in planning water resources developments, additional simplification came to the process. Since the NED plan was the one that increased the net value of national output of goods and services while also being consistent with environmental and societal objectives, selection would presumably be easier than under the multiple-criteria Principles and Standards. In theory, this may have been true, but Corps field planners nonetheless required specific procedures for consistent application of NED planning, including flood control, navigation, shore protection, and recreation. Beyond these requirements, they also needed methodologies for evaluating public attitudes and socio-economic factors. The P&G may have simplified the accounting, but it only identified improved approaches to the exceedingly complex process of water resources planning.

To provide Corps planners with consistent guidelines, the civil works R&D committee, composed of headquarters civil works division chiefs and chaired by the

deputy director of civil works, began an ongoing NED research program after promulgation of the P&G. Because of its experience in interpreting and implementing the Principles and Standards, the committee assigned the program to the IWR research division. Following the WRDA-86 cost-sharing provisions, clear definitions and guidelines for NED planning grew in importance not only for Corps planners but also for local sponsors. In a series of manuals published periodically in the late 1980s and early 1990s, IWR established procedures for implementing NED into preauthorization planning. The manuals became additions to division and district planning guidance notebooks for adhering to the P&G.⁵⁹

NED and Recreation

IWR's first NED manual concerned evaluation procedures for recreation, the first volume of which appeared in March 1986. "One of the alternative plans," the report stated, "to address the needs and opportunities in water and land related planning must be the NED plan."⁶⁰ Since NED plans had to be in monetary units, planning studies had to estimate the extent to which a potential project would enhance or diminish recreational use. Planners needed to assess competition from other nearby recreational opportunities, estimate future recreational use and value on the basis of population and economic trends, and ultimately calculate benefits of the "with-plan" and "without-plan" values.⁶¹

Federal water resources projects often both created and displaced recreational opportunities. If the Corps of Engineers built a dam that created a lake, the public gained reservoir-related recreation but lost "associated stream and

terrestrial recreation" in the inundated land behind the dam. Therefore, the net NED benefit for recreation was the difference between the value of the opportunities lost and those gained. The measure by which recreation opportunities should be figured was called "aggregate willingness to pay." This figure was the sum of two components: actual fees and user charges plus any excess amount users would be willing to pay but did not have to.⁶²

Estimating total willingness to pay, or user demand, presented challenges for a variety of reasons. The most basic was that public agencies rarely charged users at rates that reflected their willingness to pay. Therefore, NED benefit evaluation usually had to employ demand models for private goods as analogies for public goods. Three methods of estimating recreational demand and the value of recreation use on this basis listed in the P&G were the unit day method, the travel cost method, and the contingent value method. The unit day method used values agreed on in a national schedule developed in the 1962 Senate Document 97 and revised and updated in the P&G. The travel cost method used formulas to estimate use on the basis of the distance of the project from population centers. The contingent value method, adapted to Corps needs by Mark Dunning and David Moser of IWR, used questionnaires, surveys, and interviews to estimate willingness to pay by creating a simulated market. The IWR manual gave examples of each of these methods and listed step-by-step guidelines for choosing which method was most applicable for planning specific projects.⁶³

The Institute for Water Resources also published an accompanying volume to the NED recreation manual in March 1986. This volume presented detailed guidelines for using the contingent value method of estimating recreational

demand. Four years later, in November 1990, the Institute published a third volume: National Economic Development Procedures Manual, Recreation: A Case Study Application of Contingent Value Method for Estimating Urban Recreation Use and Benefits. The case study involved the proposed Buffalo Bayou flood control project in Houston, Texas. The Galveston District used the contingent value method to estimate recreational use for the project in the Houston urban area. During the planning study, IWR directed a coordinated effort sponsored by the Corps of Engineers, the National Park Service, and a National Park Service cooperative park studies unit at Texas A&M University.⁶⁴ William Hansen, an economist who joined IWR's Research Division in 1985, coordinated the planning study and then assembled a five-person team to produce the case study. The study provided a practical guide for using the contingent value method in an actual recreation planning study.⁶⁵

IWR's fourth recreation manual appeared in July 1991. In contrast to the first three, which focused on the evaluation of providing new facilities (the supply side), the fourth manual focused on the demand side of recreation. The manual's primary purpose was to describe procedures and methodologies for evaluating changes in recreation use and value resulting from management decisions affecting recreation facilities and services. Secondly, the manual explored the ways such management decisions affected the environmental resources within a recreational development.⁶⁶

NED: Agricultural and Urban Flood Damage Reduction

Another part of IWR's NED work concerned agricultural and urban flood damage. The Institute had much

experience responding to both types of flood damage. Since the early 1970s, IWR had developed methods for evaluating nonstructural benefits. Working with Baltimore District, IWR evaluated specific residential methods of nonstructural protection, including relocation, placing structures on stilts, and floodproofing.⁶⁷ Later, IWR examined the human impact and "flood trauma benefits" in a 1980 study of floods in the Tug Fork Valley of West Virginia and Kentucky during 1977, and with examinations of flooding in Jackson, Mississippi during 1979 and 1983.⁶⁸ During the early 1980s, a visiting scholar in residence at IWR, Annabelle Motz of the American University, wrote Nonstructural Flood Control Measures: A Sociology of Innovation. The study evaluated various nonstructural practices such as flood insurance, zoning ordinances, floodproofing, and flood warning systems.⁶⁹

IWR's experience in flood control work facilitated its NED tasks. Production of guidelines and procedures for calculating NED benefits for agricultural flood damage prevention involved Corps personnel from headquarters and the field. William Hansen, who chaired the committee, was joined by Stuart Davis, a community planner with IWR. Other members were from the Southwestern, Missouri River, and Lower Mississippi Valley divisions, the St. Paul District, HEC, and the OCE planning division.⁷⁰

In October 1987, the Institute published National Economic Development Procedures Manual: Agricultural Flood Damage. The manual provided a comprehensive guide for calculating NED benefits for potential agricultural flood control projects and described basic considerations such as food and raw material values and urban encroachments on agricultural land. As with recreation, the agricultural manual described the steps required to estimate

the NED benefits for water resources developments protecting agricultural land.⁷¹

In March 1988, the Institute released National Economic Development Procedures Manual: Urban Flood Damage. Like the manuals for recreation benefits, the flood damage manual provided a practical guide for planners considering flood protection projects. To produce the manual, IWR assembled a team from OCE, the Omaha and Wilimington districts, the North Atlantic and Lower Mississippi Valley divisions, and the Bureau of Reclamation. The manual outlined the conceptual framework for developing NED plans for urban flood damage reduction, including willingness to pay. If planners could know what the public was willing to pay for various levels of flood protection, they could more readily determine net benefits and costs and therefore the NED plan. Determining the cost of a flood meant estimating emergency costs, temporary relocation, loss of employment, and loss of economic activity in urban flood zones. With-project and without-project conditions also were important NED planning tools, as was an estimate of the period of analysis or life of the project.⁷²

Among several planning concepts was risk and uncertainty analysis.⁷³ By the time the manual was published, risk and uncertainty analysis had become an important tool in the flood protection planning process. What was not known was as important as what was known, and risk and uncertainty became an important element of the NED planning process for urban flood protection.⁷⁴

Three years later, IWR produced the second NED manual on urban flood damage. The Primer for Surveying Flood Damage for Residential Structures and Contents, released in October 1991, explained how the basic principles of survey research could be applied to data

collection for flood damage studies. The urban flood damage manuals focused on planning approaches, methods for evaluating flood damage, recent hydrologic and hydraulic scholarship, and the best ways to estimate NED benefits for structural and nonstructural measures.⁷⁵

NED and Deep-Draft Navigation

A cooperative effort between the research and navigation divisions of IWR produced the National Economic Development Procedures Manual: Deep Draft Navigation in November 1991. Written jointly by IWR and outside consultants, the manual was a practical guide to NED planning for commercial deep-draft navigation projects that would yield correct and uniform determinations. Accurate costs, transfers of benefits to improved ports from unimproved ones, fleet and commodity forecasting, and engineering analyses were all integral elements of NED planning for deep draft navigation. The planning of deep-draft facilities was complicated, for planners had to address both international and national waterway movements. The report recommended several forecasting methods, one or more of which might be used to achieve the most accurate figures. The 1991 report was the seventh one produced by IWR since 1986.⁷⁶

An Overview of NED

By the beginning of the 1990s, the Institute had assembled and disseminated a great deal of information on NED planning. To provide a summary of the first seven years of water resources planning under the P&G, the Institute produced a general work on NED. The result was National Economic Development Procedures Manual--Overview

Manual for Conducting National Economic Development Analysis, released in October 1991. The intent of the manual was "to unravel some of the mystery of the NED principle for laymen and to provide new and reignite old insights for Corps' economists and planners."⁷⁷ To conduct the study, IWR assembled a thirteen-member field review group coordinated by Mark Dunning of the IWR research division. Other members of the group were economists and planners from headquarters and the field. The contractor for the study, the Greeley Polhemus Group, Inc., conducted interviews with each member of the group and later interviewed twelve more Corps personnel with knowledge and experience in NED planning.⁷⁸

The manual placed NED planning in the broader context of macroeconomic theory. The authors attempted to explain the NED principle in its historical context with regard to Corps planners who had used it, and through the collective experience of IWR and headquarters. The manual delved into the complexities of supply and demand economics regarding public works and also contained clarifying vignettes and passages, such as the following:

*The NED principle is not fundamentally an economic principle. It is fundamentally a normative economic policy, i.e., one that addresses what decision makers feel ought to be the Corps's economic priorities. As such, it is a matter of law, policy and interpretation rather than one of economic fact or theory, although it is a policy firmly rooted in economic theory.*⁷⁹

Expanding on the NED overview was the June 1993 National Economic Development Cost Manual. This manual provided a framework for thinking about NED costs

and their various uses by the Corps of Engineers. Its intent was to furnish readers with explanations of NED costs, how they differ from other costs, and how Corps planners properly use them in evaluating projects.⁸⁰

The evolving viewpoint of those working with NED planning was a positive one. Chiefs of planning in all field agencies received drafts of each manual for review, which heightened their field applicability. Although NED planning was complex and often difficult to implement in a standardized fashion, it was simpler than prior procedures for water resources planning. Implemented correctly, the procedures mandated in the P&G brought about efficient planning with proper consideration for social well-being and environmental quality. Through its efforts in the NED procedures manual work unit, the Institute for Water Resources had made substantial strides in uniformly applying NED planning throughout the civil works program. IWR's 12 NED manuals provided field planners with a blueprint for implementing the P&G.

Greater Integration of Risk Analysis

Risk and uncertainty analysis gained increasing acceptance among water resources planners, but this is not to suggest that the idea did not remain controversial in the Corps of Engineers. Many engineers were uncomfortable with accepting risk and uncertainty as part of the planning process, opting instead for conservative safety and reliability standards regardless of cost. Their views reflected a long-term proclivity of the Corps for building large structural projects for maximum flood protection. However, an increasing number of factors weighed against that view. Foremost was cost. Large projects were expensive, and new

cost-sharing provisions put many desired projects beyond the means of local sponsors. Consequently, local sponsors began to favor risk and uncertainty analysis as an acceptable approach to planning smaller, less costly projects.

Another factor promoting risk analysis was its increasing popularity as a tool of public policy. Risk analysis called into question many accepted methods of ensuring public health and safety, such as the standards approach for clean air, water, and soil. Imposing exceptionally high standards for pollutants and chemicals often proved prohibitively expensive and left local governments unable to comply. Proponents of risk analysis instead favored an approach that analyzed the level of risk to public health of reducing pollutants to lesser standards. By the late 1980s and early 1990s, similar risk analyses were being conducted on issues ranging from the safety of nuclear power plants to carcinogenic risks of using the chemical Alar in apples.⁸¹ In November 1987, the Engineering Foundation of the American Society of Civil Engineers held its third conference on risk analysis in Santa Barbara, California. The conference reflected a steady increase in information exchange among academicians, water resource planners, and scientists since the first conference in 1980. The range of topics included perceptions of risk regarding marine pollution, health risks involving agricultural production, the risks of climate change, and necessary safety levels for the size of navigation channels. The Institute for Water Resources cosponsored the conference.⁸²

For the water resources developments of the Corps of Engineers, risk analysis normally involved "low-probability, high-consequence events."⁸³ Projects that controlled water for various purposes could devastate life and property if they failed. Yet risk analysis asked how safe

such projects needed to be? Dams were the primary concern, but other works, including flood control channels and navigation works, fell under such consideration. As manager of the Corps' risk analysis research program, the Institute for Water Resources continued its work in dam safety and other related issues. Socioeconomic Considerations in Dam Safety Risk Analysis, published by IWR in August 1987, outlined the many variables associated with dam failure, basing risk analysis on a sequence of events: the probability of a large flood, the probability of a dam failure because of the flood, the probability of detecting high-risk dams, and the probability that warnings and evacuations would be successful. Without consideration of all such factors, the report concluded, the overall analysis of risk would be incomplete.⁸⁴

Subsequent IWR publications reflected the increasing refinement of risk analysis. In April 1988, IWR published Multiobjective Risk Partitioning: An Application to Dam Safety Risk Analysis. The report argued that while risk analysis was an important step forward in evaluating dam safety, its present focus on "low-probability/high-consequence risk" was inadequate. Instead, risk analysis for dam safety should include a range of risks, specifically called the "partitioned multiobjective risk method." The partitioned method "collapses the risk curve into a set of points, each of which represents a conditional expected value of damage falling within a particular probability range."⁸⁵ Through partitioned risk analysis, the Institute made the argument that the method was more sensitive to incremental improvements in dam safety features, such as a higher dam or larger spillway, and the ability of those features to reduce social and economic damage.⁸⁶

The report then applied a multiobjective risk partitioning model to a case study example based on the features of an actual operating dam. The model generally confirmed the arguments about using unconditional versus conditional expected values. The conditional approach yielded sensitivity to modifications, whereas the unconditional expected values yielded little. An approach that assessed risk at several levels and assessed several modification plans in light of the risks gave more responsive results.⁸⁷

As the dam safety risk research program conducted by IWR and HEC neared completion in 1987, Assistant Secretary Dawson assigned a new five-year research program to the Institute through the civil works directorate. Anticipating that nonfederal partners would favor the approach in cost-shared studies and construction, Dawson directed IWR to integrate risk analysis into the Corps' planning and design work. Dawson wanted risk analysis to appear in the earliest stages of the planning process and in all types of water resources developments, including flood control and navigation. Moreover, the new research program also encompassed "more generic cross-cutting evaluation needs associated with measuring risk perception and risk-taking; formal methods for communication; and topics related to environmental risk assessment, such as dredged material disposal, worst case analysis and ecological stability and resiliency."⁸⁸

To keep district and division personnel apprised of the evolving concepts of risk analysis, IWR sponsored an ongoing series of workshops beginning in the summer of 1987.⁸⁹ At a day-long workshop in July 1990, participants from headquarters and field offices praised risk analysis as a useful planning tool but argued that other elements in the

Corps' civil works program should also be employing the ideas and methods. Risk and uncertainty existed in planning, but they also existed during planning, preauthorization engineering and design, construction, and operation.⁹⁰

In light of this expanded view of the applicability of risk analysis, in 1991 IWR recommended broadening the research program. The result was the ongoing multilaboratory Risk Analysis for Water Resources Investments research program jointly undertaken by IWR, the Waterways Experiment Station (WES), and HEC. Program management passed from Eugene Stakhiv, who became chief of the policy and special studies division, to David Moser of the IWR research division. Initiation of the program made risk assessment and analysis a new major research and development program area. The program's intent was to develop applications of risk analysis techniques to a variety of issues faced in Corps water resources planning, engineering, and operations. Throughout the lifecycle of a project, the Corps had to make various investment decisions. The basis for incorporating risk analysis into decisionmaking was that it explored the most cost-effective procedures and provided local sponsors with less expensive options.⁹¹

The ongoing risk analysis research program continued to expand and refine the approach for the Corps' civil works activities into the 1990s. In March 1992, IWR published the first volume of Guidelines for Risk and Uncertainty Analysis in Water Resources Planning. The purpose of the guidelines was to describe the process of using risk analysis in planning evaluation through project characterization and quantification, evaluation, and management of risks. The broader intent was to persuade

federal and nonfederal planners to look at virtually all aspects of water resources development in terms of the risks involved. "The aim," stated the guidelines, "is to produce better decisions and to foster the development of informed consent by all parties to an investment decision."⁹²

The authors of the guidelines outlined risk analysis procedures for a variety of plans and offered approaches to incorporating it into the Corps' planning process. In each stage of the process, planners needed to identify risk and uncertainty and incorporate risk management plans.⁹³ The guidelines defined potential sources of risk and uncertainty by project type, including municipal, industrial, and agricultural water supply, flood control, hydropower, inland navigation, deep draft navigation, and commercial fishing. Each purpose had unique risks and uncertainties relating to future requirements and engineering design. Identification of the risks, however, remained an important activity from the beginning of planning.⁹⁴

Through these guidelines, the proponents of risk analysis in the Corps hoped to assist agency planners in addressing risk from the beginning of planning. They also hoped that planners would "modify and improve [the risk analysis guidelines] to fit the unique requirements of specific projects, while . . . producing a greater quantity and quality of information for improved planning and decision making."⁹⁵

In essence, risk analysis was another tool in the evolving planning methodology for water resources projects. Incorporated with benefit-cost analysis, environmental quality, and social impact analysis, risk analysis was intended to produce the best NED plan. Moreover, applying risk analysis throughout the lifecycle of a project would bring about the most cost-effective and informed investment

decisions during the engineering, construction, and operation phases.

The Development of Alternative Dispute Resolution

In the early 1980s, the Institute for Water Resources began playing a significant role in a program called alternative dispute resolution (ADR). The essence of the program was mediation. Rather than bring legal disputes into costly and lengthy litigation, the parties could use one of several nonlitigious approaches to reach a settlement. The origins of ADR date back to the late 1970s and the early 1980s, when academic and popular authors began to propose alternative measures of resolving disputes without lawyers, including the use of mediators.⁹⁶ Among the first proponents of using mediation to resolve disputes involving the Corps of Engineers was Jerome Delli Priscoli of IWR's policy division. The Institute's long involvement in public participation was in a sense a form of mediation, as the Corps negotiated with the public on project planning. With the success in the early 1980s of using ADR in a dispute between the National Space and Aeronautics Administration and the contractor TRW, some people in the federal government became aware of the method. In 1984, Delli Priscoli proposed a study to explore the use of ADR to the Corps' chief legal counsel, Lester Edelman. Edelman, who also had been examining ADR, agreed, and IWR began policy studies.⁹⁷

Shortly thereafter, proponents in the Corps began to look for suitable cases for pilot projects in ADR. Specifically, they looked for a chance to test the "minitrial." The opportunity came soon. Tenn-Tom Constructors, a subsidiary company of Morrison Knudsen, had a longstanding claim against the Corps for work it had done

on the Tennessee-Tombigbee Waterway. Company officials claimed that the initial Corps soil surveys on which they had based their bid did not reflect the high moisture content of the soil to be excavated from an eleven-mile stretch of river. The company first notified the Corps of differing site conditions in August 1980. Eventually, company officials claimed the government owed the firm an additional \$42.8 million. By 1985, the claim totaled \$55.6 million with interest. The Nashville District argued that the company's claims were groundless, and in August 1984 the Corps issued a Contracting Officer's Decision denying Tenn-Tom's claim. In October, the company filed an appeal.⁹⁸

At this impasse, the issue of using ADR arose. Stanley Johnson, a partner in the law firm representing Tenn-Tom, knew that the Corps was interested in ADR. He approached Edelman with a proposal to use a minitrial to settle the case. The minitrial, as designed by the Corps' chief trial attorney, Frank Carr, provided an informal format for both sides to present their cases to two decision makers (one person from each side), and a neutral (a person with no vested interest in the case and agreed to by both sides). The entire process was to take no more than 2 to 3 days.⁹⁹

Both sides reviewed various aspects of a minitrial. The contractor knew that even if a legal decision granted the entire claim to the company, the process involved would be lengthy and costly. The Corps had a broader spectrum of considerations. Even though Nashville District officials believed they had ample evidence to disprove the claim, a trial would require substantial time and expense. The dispute involved factual issues, and although the Corps could amass a technical case, doing so might obscure rather than clarify the issues by introducing volumes of complex data. Moreover, the Corps' legal counsel believed that an

adversarial trial with a large company could set a negative precedent and seriously damage relations with other contractors.¹⁰⁰

In May 1985, the minitrial began. Decision makers were Brigadier General Peter J. Offringa, then commander of the Missouri River Division, and Jack Lemley, group vice-president of Morrison Knudsen. Both sides had agreed to select a legal rather than a technical expert to serve in the pivotal position of neutral. Their choice was Professor Ralph Nash, an expert in government contract law from the George Washington University Law School. Each counsel presented arguments to the three-member group in an informal and expedient manner. Although the case took two more 3-day sessions beyond the first, the decision makers and the neutral arrived at a settlement in late June--less than 2 months after the process had begun.¹⁰¹

The outcome of the minitrial gave credibility to the ADR process. The settlement figure was \$17.2 million plus \$1.25 million in subcontractor claims. This was roughly one-third of the original claim. The contractors believed they could have obtained a larger amount in a regular legal proceeding, but they were satisfied with the quickness and amicability of the minitrial. General Offringa was satisfied as well. In a legal assessment of the government's chances against Tenn-Tom Constructors the Corps had "determined that a settlement was in the government's best interests."¹⁰² The technical staff of the Nashville District, however, was unhappy with the settlement and called for a review of the entire ADR process. In response, the Inspector General of the Department of Defense reviewed the case. He concluded that the settlement was reasonable and praised the use of the minitrial as "an efficient and cost-effective means for settling contract disputes."¹⁰³

The success of this pilot case led to an expanded ADR program in the Corps of Engineers. The Office of Counsel worked with IWR to develop the framework for the minitrial as well as the techniques of nonbinding arbitration, mediation, and partnering. With passage of WRDA-86 and its cost-sharing requirements and formation of local cooperation agreements, the agency anticipated an increasing number of legal disputes. After conducting policy studies on ADR in regard to local cooperation agreements, IWR recommended the creation of a long-term ADR program. The Office of Counsel agreed that ADR techniques, like public involvement, could "prevent disputes, resolve them at earlier stages, or settle them prior to formal litigation."¹⁰⁴

In 1988, the ADR program was established under the management of the IWR policy studies division. Managed within the division by Delli Priscoli, the ADR program encouraged Corps personnel to use the techniques of ADR to resolve disputes. A series of brief publications began in 1989, four of which reviewed the primary techniques of ADR: the minitrial, nonbinding arbitration, mediation, and partnering. Nine other documents released between 1989 and 1991 were case study accounts of ADR techniques in practice, including the Tenn-Tom settlement.

By the early 1990s, the series turned to lessons learned in the few years of the Corps' experience in ADR. IWR coordinated roundtable discussions, explored methods of bringing disputes to mediation, and analyzed the relationship of public involvement, conflict management, and dispute resolution in water resources development.¹⁰⁵ For the Corps of Engineers, the ADR program had impressive results. Between 1987 and 1993, the number of pending contract claims dropped from more than 1,000 to about 300. The agency also estimated that using ADR

techniques had avoided litigation on more than 400 major contracts.¹⁰⁶ The techniques of ADR had increasing acceptance in the Corps, and the ADR program directed by the Institute was providing information to other federal agencies and international organizations. The concepts of mediation and dispute resolution, with their close relationship to public involvement, were proving to be useful tools for the civil works program and for other federal agencies.

Infrastructure and IWR

One of the closest collaborative intergovernmental efforts during the late 1980s and early 1990s concerned the nation's infrastructure. Crumbling bridges and overpasses, poorly performing navigation locks, unsafe dams, potholed highways, inadequate water supply systems, and outmoded sewage treatment facilities were among many problems that besieged the United States. To examine strategies for maintaining and improving the nation's infrastructure, Congress passed the Public Works Improvement Act in 1984. This legislation created the National Council on Public Works Improvement. The council and its advisory group consisted of business people, consultants, government employees, and elected officials at the federal, state, and local levels. The council was to report to Congress on the condition of the nation's airports and airways; highways, streets, roads, and bridges; mass transit; intermodal transportation; wastewater management; water resources; water supply; hazardous waste management; and solid waste.¹⁰⁷

The council staff, familiar with IWR's work on previous national studies, began informal consultations with

Kyle Schilling, then chief of the IWR policy studies division. The consultations led to several roundtables on study approaches with the IWR staff and other experts regarding study approaches. The result was a performance and services-provided study approach that significantly departed from the traditional engineering standards-based methods. The council then asked the Corps to have IWR prepare the water resources portions of the study. The Corps was the only federal agency asked to provide such assistance, and it detailed Schilling to the council. He assembled a five-member consulting team consisting of Claudia Copeland, an environmental policy specialist with the Congressional Research Service; Joseph Dixon, a planner with the Phoenix Field Office of the Los Angeles District; James Smyth, a project manager in BERH; Mary Vincent, a physical scientist at WES and formerly with IWR; and Jan Peterson, an administrative specialist at IWR. The team drew extensively from IWR's past work on waterways, hydropower, water supply, and urban studies, and used the work of academicians to produce the groundwater and international aspects of water resources.

In May 1987, the council published The Nation's Public Works: Report on Water Resources. The report outlined the overall condition of the national water resources infrastructure. The findings of the report reflected a central theme: "Water resources programs have matured, and their focus is changing from development to operating and maintaining existing facilities, while responsibilities simultaneously are shifting from the Federal to non-Federal sectors to fund, operate, innovate, and manage on a proportionately larger basis than in the past."¹⁰⁸ On the basis of that assumption, the report assessed present and future needs for inland navigation, flood control, urban stormwater

management, dam safety, and shoreline protection. These assessments were followed by an appraisal of the various governmental roles in water resources management, an analysis of financing methods for constructing and maintaining projects, and a summary of international water resources development methods.¹⁰⁹

One of the report's principal recommendations was the establishment of an "intergovernmental coordinating forum" at the federal level. The authors believed that water resources challenges and problems "cross-cut" through all levels of government. Federal water resources technologies and information on planning, engineering, and operation could be useful to state and local governments. However, there had been little actual technology transfer. This situation held true for other parts of the infrastructure review. The water resources report also suggested the enormity of national infrastructure problems and concluded that solving them in an unplanned, uncooperative manner would vastly exceed federal, state, and local budgets.¹¹⁰

The work of the National Council on Public Works Improvement stressed the need for an intergovernmental working group to spread technology and information and, more generally, to find more efficient and economical ways of solving problems. The council's "infrastructure strategies" called for cooperation, planning, and innovative financing. The approach broadly appealed to a budget-minded Congress and to the Bush administration. Not only did the approach call for greater nonfederal participation, it promised solutions to the intractable problems of the nation's deteriorating infrastructure without enormous increases in federal spending. With the support of Assistant Secretary Page's office and OMB, Congress approved funding for a 3-year integrated or multiagency national

infrastructure study. The intent of the study was to follow up and expand on the performance-based work of the National Council on Public Works Improvement reports and to involve independent third parties, such as the National Academy of Sciences, the American Public Works Association, and the U.S. Advisory Council on Intergovernmental Relations. Because of its involvement in previous infrastructure work, OMB specified that the Institute for Water Resources be the coordinating agency for the federal infrastructure strategy program.¹¹¹

When the Bush administration's 1991 budget included an OMB initiative for developing an infrastructure strategy program to be coordinated by the Corps, IWR's responsibilities increased.¹¹² The Institute established an infrastructure investment team within the director's office and work on the federal infrastructure strategy fell to the policy and special studies division. The first study manager was Lim Vallianos, an engineer formerly with the Wilmington District. The Institute established an infrastructure investment team within the director's office, and shortly thereafter Robert Pietrowsky, a civil engineer who had come from the New York District, became the team director. Although in aggregate terms the Corps' infrastructure inventories were not as large as those of other federal agencies such as the Department of Transportation (DOT) and the Department of Energy (DOE), IWR's long-term work on infrastructure secured the agency's position as coordinator of the study.¹¹³

IWR served as a liaison for the program, which involved all levels of government, elected officials, and private enterprise. Among the many organizations involved were DOT, DOE, a White House working group, the Urban Institute, the National Research Council, the American

Society for Civil Engineers, and ACIR. ACIR had a significant role in the program. Congress had created the 26-member commission (consisting of 9 federal and 14 state and local government representatives, and 3 people from the general public) in 1959 to monitor and improve the performance of the federal system.¹¹⁴ The commission represented a broad range of federal and nonfederal agencies, elected officials, interest groups, and business people.

Although the Bush administration had been supportive of the infrastructure strategy program, the program received even higher priority early in the Clinton administration. Rebuilding the nation's infrastructure had been a major Clinton campaign pledge. His administration became actively involved in the strategy program coordinated by IWR. Clinton appointed Michael Deich, who had worked in another capacity on the program, to lead the White House working group. The Assistant Secretary's office also was involved, assigning economist Robert Stearns to participate.¹¹⁵

The federal infrastructure strategy study generated keen interest throughout government and the private sector. The study generated several well-received reports. Some were published by IWR and some by ACIR.¹¹⁶ The reports reflected the collective views on infrastructure of the program's participants. In many ways, they mirrored the Corps' experiences in water resources development in recent years. Water resources projects were an integral part of the overall infrastructure, and the planning and financing issues that confronted the Corps faced all resource agencies by the end of the 1980s. The Institute also contributed to a better understanding of financing issues by overseeing the publication of a history of the Water Resources

Development Act of 1986. Martin Reuss of the Corps office of history wrote the manuscript that analyzed the political, economic, and social factors involved in passage of WRDA-86. In October 1991, IWR published the history as a policy study.¹¹⁷

In that same year, the Intermodal Surface Transportation Efficiency Act introduced a number of financing provisions similar to those of WRDA-86. As a result, infrastructure investments were required to be more "performance or outcome-based"¹¹⁸ and to be directed toward specific strategic goals. To achieve the goals, the infrastructure strategy program attempted to clarify various governmental responsibilities, incorporate the most rational budgeting and costing processes, and encourage adequate maintenance and adoption of new technology.¹¹⁹ The research team learned that federal research and development technology for building and maintaining infrastructure was advanced. However, the technology had usually not made its way to nonfederal governments. Moreover, the team found that a maze of laws and regulations regarding construction, maintenance, and financing often burdened responses to infrastructure problems.¹²⁰ As research continued, the strategy called for emphasis on creative maintenance based on rational priorities, flexible government financing, streamlined regulations, and more technology transfer to maintain and enhance the nation's infrastructure.

Changes in WRSC

During the late 1980s, the Corps of Engineers initiated several organizational changes that affected the Institute for Water Resources directly or indirectly. In December 1988, Chief of Engineers Hatch approved the establishment of the

Washington Level Review Center (WLRC), successor to the Board of Engineers for Rivers and Harbors. WLRC was established to accelerate the civil works project development process while maintaining quality control. Its mission was to review feasibility reports that BERH and the Assistant Secretary of the Army for Civil Works required. Moreover, WLRC reviewed postauthorization change reports, detailed project reports, general design memorandums, and other decision documents requested by the director of civil works.¹²¹

For IWR, the most significant aspect of this establishment was that WLRC became a part of the Water Resources Support Center.¹²² The Institute and BERH had worked together, mainly in the areas of training, since the late 1960s. BERH oversaw the Corps planning associates program, from which IWR drew several staff members over the years. The two organizations had conducted many jointly sponsored seminars, workshops, and training courses on water resources planning. WLRC, however, was now more focused on review of field planning documents.

With the reorganization, WRSC now included the Hydrologic Engineering Center, the Navigation Data Center, the Washington Level Review Center, the Institute for Water Resources, and administrative offices. The dredging division, until then part of WRSC, was incorporated into the civil works directorate. The Institute retained its organizational structure, with research, policy studies, and navigation divisions, all of which had increasing reimbursable programs.¹²³ Overall funding for IWR had increased consistently, along with a slight increase in full time employees (FTE), after a brief decline following completion of the national waterway and hydropower studies in 1983. In fiscal year 1986, funding stood at \$3.63 million

and FTE at 32.6. By fiscal year 1989, IWR's funding had reached \$5.28 million, and FTE had risen to 38.¹²⁴

Because of the steadily increasing budget and workload, members of the Institute began to review their organizational structure once again in 1990. In May, acting director Kyle Schilling replaced James R. Hanchey, who had become chief of planning in the Lower Mississippi Valley Division. Schilling explained to WRSC director Kenneth Murdock that IWR's workload was heavy throughout the Institute because of ongoing programs and the addition of the National Study of Water Management During Drought and the federal infrastructure strategy.¹²⁵ He and other senior members of IWR believed that changes were needed, especially in the policy studies division. At that time, his recommendation was to split the policy studies division into two parts: policy and strategic studies, and national and special studies. The former would assume most of the work of the traditional policy studies program dating back to 1975 and also undertake work in response to increasing demands in headquarters for program management. The latter would undertake the two ongoing national studies through their completion in 1993 and 1995 and remain as a division of "institutional memory and focus" for emerging issues of national interest.¹²⁶

The Program Analysis Division

During the early 1990s, Corps leaders increased internal examination of the civil works program. Brigadier General Patrick J. Kelly, who became director of civil works in 1988, viewed program analysis as another important component in improving water resources planning by the Corps. In Kelly's opinion, new civil works programs might appear to work

well throughout the agency, but without systematic evaluations their effectiveness could be neither measured nor improved.¹²⁷

In early 1991, General Kelly called on IWR to coordinate the increased program management support. He met with WRSC director Kenneth Murdock and IWR director Kyle Schilling in February to discuss organizational modifications to the Institute. An examination of IWR's current activities and structure reflected many recent developments in the Corps civil works program. The three divisions were mainly engaged in customer-oriented work. The navigation division provided services to the Inland Waterway Users Board and field offices requiring systematic navigation analysis. The research division continued its refinement of IWR-MAIN, development of risk analysis procedures, and preparation of planning methodologies with a focus on environmental evaluations. The policy and special studies division, as it had been renamed in 1990, performed continuing work for the civil works directorate, conducted national studies on drought and infrastructure, and managed the alternative dispute resolution program.¹²⁸

Besides these major tasks, each IWR division also conducted numerous reimbursable studies and other activities. If a major new initiative such as program analysis was to be assigned to IWR, a significant reorganization appeared necessary. Senior members of IWR believed that water supply and conservation, drought studies, risk analysis, NED guidelines, navigation analysis, flood damage reduction, and project financing were among the vital analytical services that the Institute performed for civil works. They also believed that IWR's current workload fully engaged its staff and required an increasing amount of contract support. However, with severe budgetary

constraints, exacerbated by the national recession of the early 1990s, there could be few additions to the full-time staff. At the same time, a general downsizing was under way at Corps headquarters, caused by reductions in the Army and in overall federal personnel strength. With fewer people in headquarters to handle civil works policy and planning issues, more work came to the Institute.¹²⁹

With such considerations in mind, the civil works directorate implemented another reorganization of IWR during the summer of 1991. The most tangible aspect of the reorganization was the creation of a fourth division, program analysis. The new division consisted of individuals from the policy and special studies and the research divisions. Mark Dunning, who had worked in the research division since coming to IWR, became chief of the program analysis division. Joining him was John Singley, a sociologist who had worked in the policy and special studies division since 1988. Among its initial projects, the new division developed methods for prioritizing civil works maintenance projects. The division also worked to develop ways to estimate construction spending and participated in an agencywide study of the reorganization of the civil works functions of the Corps of Engineers.¹³⁰

The 1991 reorganization affected other parts of IWR as well. The research division became the technical analysis and research division to better describe its increasing role in providing technical assistance and consulting to headquarters and the field. The division staff worked with policy and special studies and navigation to refine the planning tools it promoted as practical, efficient, and environmentally and socially sensitive approaches to water resources projects.¹³¹ Changes in the policy and special studies division reflected an expansion of the traditional policy studies mission for the

civil works directorate. With the reorganization, the division's work included the national drought study, the national wetlands mitigation banking demonstration study, the federal infrastructure study, reimbursable work, and study of the economic impacts of climate change. The navigation division, which had undergone an extensive reorganization in 1987, remained essentially unchanged.¹³²

The Corps of Engineers Recreation Study

During the 1989 federal budget deliberations, Congress drastically cut Corps funds for recreation management. The figures suggested that the agency would be forced to close down many recreation areas and curtail services in others. In response, Secretary Page requested that the Chief of Engineers establish a task force to develop strategies "to maintain and enhance public recreational opportunities at Corps projects while reducing federal costs for development and operation of recreational facilities."¹³³ Deputy Chief of Engineers Major General R.S. Kem chaired the task force, which consisted of senior headquarters personnel. David Wahus, a senior staff member in the construction/operations division, was temporarily reassigned as full-time executive director of the study. The study also included a steering committee composed of senior staff members and a management team of Corps personnel. William Hansen of IWR, who had been involved in Corps recreation studies since the 1960s, served as technical study manager, assisted by Leigh Skaggs, also of the technical analysis and research division. Hansen and Skaggs coordinated consultants and advised other Corps personnel assigned to the study.¹³⁴

IWR's long experience in recreation analysis made it the natural choice to coordinate the national recreation

study. Working chiefly with Theresa Hoagland of the Ohio River Division (the primary author of the study) and Roger Hamilton of the Waterways Experiment Station, Hansen and Skaggs coordinated the work, which included an historical overview of federal recreation management. The main objective of the study, published in October 1990, was to formulate a plan to keep Corps recreation sites open and maintained in a time of declining federal funding. The report explored dozens of options and recommended 24. One would expand the fee collection program and retain revenues for recreation purposes. Other plans included increasing the use of volunteers and supplemental labor, retaining more federal lease money for the Corps recreation program, and initiating a challenge cost-share program with states and localities. To encourage more state and local participation, the study encouraged more flexible and less costly federal rules and federal renovation of facilities. In general, the report recommended that the Corps take a more businesslike approach to encourage private involvement in management.¹³⁵ The task force worked closely with the steering committee and management team in producing the final report and presented its findings to the Office of Management and Budget and concerned committees of Congress. The report was influential in changing laws regarding fees and uses of Corps recreation facilities. Implementation of some of the study recommendations has been ongoing since 1991 and has been significant in helping the Corps meet its objective of managing recreation with fewer federal expenditures.¹³⁶

Environmental Valuation Research

Another research program coordinated through IWR is the evaluation of environmental investments research program. In the transition of the Corps civil works program away from traditional engineering and toward environmentally sustainable development, IWR had been an active participant, authoring the original environmental guidelines for the civil works program and continuing to work on environmental issues into the 1990s. By that time, IWR had explored methods for placing values on environmental resources for benefit-cost evaluations. Moreover, IWR's planning methodologies research had developed nonmarketed evaluation techniques through work in travel cost and contingent value methods. Meanwhile, the Waterways Experiment Station was also conducting research aimed at placing quantifiable values on environmental resources. Such work led to the evaluation of environmental investments research program; in early 1992, IWR became the lead performing element.¹³⁷

The objective of the ongoing EEIRP program, managed jointly by IWR and WES, is to provide Corps planners with methods to evaluate environmental restoration and mitigation projects that might be undertaken alone or as part of a larger water resource development. Through identification of environmental and cultural resource significance, determination of objectives, and incorporation of risk analysis methods, the Corps could make wiser decisions on the level and approach of environmental investment. Accurate evaluation would help the Corps prioritize its investments to maximize environmental and economic sustainability in an era of limited federal funds.¹³⁸

The National Operation and Maintenance Program

The effort to make the federal government more efficient took many forms by the early 1990s. During the late 1980s, top managers of the Corps of Engineers' fastest growing program, operation and maintenance (O&M), acknowledged the need for better performance evaluation by initiating an outside study to ensure that federal expenditures for project operation provided an effective level of service at the lowest possible costs to the taxpayers.¹³⁹ The contractor's findings pointed to several deficiencies in the Corps' O&M program that hampered effective use of technology. The program was decentralized among 36 district offices, and as a result, efficiency and standardization were severely compromised.¹⁴⁰

While the Corps' O&M program underwent review, the federal legislature, at the urging of President Clinton, debated a general review of the entire government process. In 1993, Congress passed the Government Performance and Results Act, calling for reviews of most federal agencies. One response of the Corps was the establishment of a pilot project to improve the O&M program. Coordinated by IWR, the ongoing pilot project attempts to identify O&M weaknesses in hydropower, navigation, environmental stewardship, recreation, and flood control. Its goals are to establish accurate measures of performance for Corps facilities, to standardize procedures and monitoring capabilities, and to evaluate quality of work and customer satisfaction. The ultimate objective is to ensure that government money spent on O&M provides the maximum return.¹⁴¹

IWR at a Glance: 1993

In addition to those already mentioned, each division of the Institute for Water Resources had a variety of specialized programs by 1993. Programs housed in the Policy and Special Studies Division included research into the economic impacts of climate change and the National Wetlands Mitigation Banking Demonstration Study. Under the direction of division chief Eugene Stakhiv, the climate change program attempted to evaluate the economic impact of so-called greenhouse gases on the earth's climate. This truly long-range investigation was based on the presumption that if pollutants were indeed warming the earth's atmosphere, the economic impact could be extreme. A significant rise in sea level could inundate harbors, undermine seawalls, and destroy navigation works worldwide. A number of IWR global warming policy studies during the 1980s led to the establishment of the economic impacts of climate change research program in 1992. The program assessed the potential impact of global warming on Corps projects on the world economy. Stakhiv, the program director, participated in an international forum on the issues by chairing a subgroup on hydrology and water resources within the United Nations Intergovernmental Panel on Climate Change.¹⁴²

The first phase of the wetlands mitigation banking demonstration study authorized in WRDA-90 drew to a conclusion in 1993. The study reviewed existing banks, drafted preliminary guidance for Corps headquarters regulations, and recommended subsequent studies for the second phase.¹⁴³ Researchers reported that the loss of wetlands had slowed greatly during the past 20 years, in part because of the regulatory permit program of the Corps, but also because of mitigation banks. In recent years,

environmental advocates have begun to accept mitigation banking. Pending the results of the demonstration study, the Corps cochaired a federal interagency effort to develop federal mitigation banking guidance.¹⁴⁴

The IWR navigation division continued systemwide analytical work in 1992 and 1993. In October 1993, the division published the 1992 Inland Waterway Review, which provided an updated analysis of the waterway system for the general public but specifically for the Inland Waterway User Board.¹⁴⁵ Moreover, the navigation and research divisions jointly produced A Review of 16 Planning and Forecast Methodologies Used in U.S. Army Corps of Engineers Inland Navigation Studies in June 1992.¹⁴⁶ IWR worked with the users board to develop a system of priorities wherein each potential waterway improvement received a rating based on systematic analysis and trust fund limitations.¹⁴⁷ In 1992, the navigation division became leader and facilitator of a Corps task force that analyzed O&M investment strategies for the users board. Such studies called for a variety of risk-analysis-based solutions to improve the efficiency of the existing waterway system.¹⁴⁸

The technical analysis and research division continued its long-term programs in 1992 and 1993. In 1993, it published two more volumes in the NED Procedures Manual series. One was the NED cost manual, and the second developed public survey techniques to comply with OMB recommendations for gathering planning data.¹⁴⁹ The division also continued to refine and upgrade the IWR-MAIN water forecasting system as part of the planning methodologies program. The Risk Analysis for Water Resources Investments program expanded as well, as the division explored using the methodology in operation

and maintenance, maintenance dredging, flood damage, and environmental evaluations.¹⁵⁰

Program analysis, IWR's newest division, consolidated some existing functions and added new activities in 1992 and 1993. The division managed the ADR program in support of the chief counsel's office. It used case studies, partnering and mediation evaluations, a 10-year reader on public involvement and ADR, training sessions, and the beginning of a periodical ADR newsletter.¹⁵¹ The primary function of program analysis was to provide process management solutions to organizational problems for various Corps clients, including the programs, operation and maintenance, and project management divisions. Members of the division sought out clients among these groups and other parts of the Corps, such as the reorganization program office. During 1992 and 1993, the division prepared a reorganization "lessons learned" report based on case studies in two field operating activities. It also continued a long-term program to develop a business approach for managing Corps-operated recreation areas.¹⁵²

Measured by its workload and diverse functions, IWR had unprecedented value to the Corps of Engineers in 1993. From the passage of WRDA-86 to the 1991 reorganization, the Institute for Water Resources matured as a policy and planning analysis organization in the Corps civil works program. Many factors contributed to IWR's steadily increasing responsibilities and workload. Federal water resources development practices had changed, which forced changes in the Corps civil works program. The civil works program itself came under greater influence from the Office of the Assistant Secretary, which favored initiatives such as more nonfederal participation, uniform adherence to NED planning, and risk analysis. The civil works directorate relied

on the Institute, whose staff had experience with such initiatives. However, the IWR staff shaped its own destiny as well. By taking the lead in proposing new approaches to problems, such as ADR, infrastructure strategies, water conservation methods, and wetland mitigation banking, the IWR staff set the agenda on work it considered important to the Corps and the nation. When viewed cumulatively, the Institute's activities in the early 1990s ranged over a spectrum from short-term policy analysis to long-term national planning.

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² Quoted in Ibid.

³ Annual Report of the Secretary of the Army for Civil Works Activities, FY86, p. 53-3.

⁴ Ibid., pp. 53-1-53-4; Dietz interview; Antle interview, 26 Aug. 1994.

⁵ WRSC Information Exchange Bulletin Vol. 1, No. 2 (Apr. 1987), located in Civil Works/Planning files, OHA.

⁶ Antle interview, 26 Aug. 1994; ER 10-1-23, 31 Aug. 1987.

⁷ WRSC Information Exchange Bulletin Vol. 1, No. 2 (Apr. 1987).

⁸ U.S. Army Engineer Institute for Water Resources, The 1988 Inland Waterway Review (Nov. 1988), pp. 102-103.

⁹ Ibid.; Antle interview, 26 Aug. 1994.

¹⁰ Quoted in The 1988 Inland Waterway Review, p. 103.

¹¹ Ibid.

¹² Antle interview, 26 Aug. 1994.

¹³ The 1988 Inland Waterway Review, pp. 103-104; Annual Report Fiscal Year 1987, p.53-3.

¹⁴ The 1988 Inland Waterway Review, p. 104.

¹⁵ Ibid., p. 1; Antle interview, 26 Aug. 1994.

¹⁶ The 1988 Inland Waterway Review, pp. 2-5, 15-16.

¹⁷ Ibid., pp. 5-6.

¹⁸ Ibid., pp. 85-86; WRSC Information Exchange Bulletin, Vol. 1, No. 5 (July-Aug. 1987).

¹⁹ U.S. Army Engineer Institute for Water Resources, The 1992 Inland Waterway Review, IWR Report 92-R-7 (Oct. 1992), p. 111.

²⁰ The 1988 Inland Waterway Review, p. 6.

²¹ Executive Order 11990, 24 May 1977.

²² 33 CFR 320 Regulatory Program of the Corps of Engineers, Federal Register, Vol. 42, No. 138 (19 July 1977), section 4(b).

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²⁴ Quoted in Reuss, Interview with William R. Gianelli, p. 34.

²⁵ Ibid., pp. 34-35.

²⁶ Ibid., pp. 30-35; Telephone interview, author with Robert Brumbaugh, Institute for Water Resources, 1 Sept. 1994. Hereafter cited as Brumbaugh interview.

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²⁸ Fact Sheet, Mitigation Banking, undated 1983, HQUSACE Policy Div. files.

²⁹ Ibid.

³⁰ U.S. Army Engineers Institute for Water Resources, Wetlands Mitigation Banking Concepts, IWR Report 92-WMB-1 (July 1992), p. 1; Reuss, Interview with William R. Gianelli, pp. 24-25.

³¹ Memorandum for the Dep. Assistant Sec. of the Army (Civil Works) from Maj. Gen. John F. Wall, Dir. of Civil Works, subj: Mitigation Banking Concept, 14 Apr. 1983, HQUSACE Policy Div. files.

³² Ibid.

³³ Quoted in Reuss, Interview with William R. Gianelli, p. 28.

³⁴ Ibid., pp. 28-30.

³⁵ Ibid., p. 31.

³⁶ Ibid., p. 30-35; Schilling interview, 13 June 1994.

³⁷ U.S. Army Engineers Institute for Water Resources, Wetlands Mitigation Banking Concepts, p. 5.

³⁸ HQUSACE, Digest of Water Resources Policies and Authorities, p. 20-1.

³⁹ U.S. Army Engineers Institute for Water Resources, Wetlands Mitigation Banking Concepts, p. 3.

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² Ibid., pp. 4-5.

⁴³ Ibid.; Brumbaugh interview.

⁴⁴ Ibid.

⁴⁵ Ibid.; U.S. Army Engineers Institute for Water Resources, Wetlands Mitigation Banking Concepts, p. i.

⁴⁶ Unsigned memorandum, "Continuing Policy Study: Lessons Learned from the 1986 Drought," HQUSACE Policy Div. files.

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⁶¹ Ibid.

⁶² Ibid., p. 3.

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⁷³ Ibid., p. II-18.

⁷⁴ Ibid., pp. II-18-II-19.

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⁷⁹ Ibid., p. 1.

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⁸⁴ U.S. Army Engineer Institute for Water Resources, Socioeconomic Considerations in Dam Safety Risk Analysis, p. 65.

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¹⁰³ Ibid., p. 10.

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¹⁰⁵ See appendix for a list of ADR Series publications.

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¹²⁶ Ibid.

¹²⁷ Dunning interview; Annual Report Fiscal Year 1991 of the Secretary of the Army on Civil Works Activities, Vol. II, p. 47-2.

¹²⁸ Annual Report Fiscal Year 1990 of the Secretary of the Army on Civil Works Activities, Vol. II, p. 48-1.

¹²⁹ Memorandum for WRSC Director from Schilling, subj: Alternative Organizational Structure for IWR, 6 March 1991, IWR DO files; Shabman interview; Barnes interview.

¹³⁰ Memorandum for WRSC Director from Schilling, 6 March 1991, IWR DO files; Policy Studies Program, IWR-WRSC, undated 1991, IWR DO files; Annual Report Fiscal Year 1991 of the Secretary of the Army on Civil Works Activities, Vol. II, p. 47-2.

¹³¹ *Ibid.*; IWR Program and Study Team Directory, p. 13.

¹³² *Ibid.*

¹³³ Ltr., Robert W. Page, ASA-CW, to Richard G. Darman, Director, OMB, 3 Oct. 1990, subj: Production of National Recreation Study," copy in Headquarters, U.S. Army Corps of Engineers, U.S. Army Corps of Engineers Recreation Study: A Plan Prepared for the Assistant Secretary of the Army (Civil Works) Vol. I (Sept. 1990), p. iii; Telephone interview, author with William Hansen, Institute for Water Resources, 10 Feb. 1995. Hereafter cited as Hansen interview.

¹³⁴ *Ibid.*

¹³⁵ HQUSACE, National Recreation Study, Vol. I, pp. 131-135.

¹³⁶ Hansen interview.

¹³⁷ See James L. Regens, A Critique of the Use of Existence Values in the Evaluation of Water Resource Development Projects, IWR Report 93-R-1 (Jan. 1993), for a description this concept and methods of calculation; Memorandum through Director, Civil Works for Deputy Director, Civil Works, subj: EEIRP, 13 Dec. 1991, IWR files.

¹³⁸ Hansen interview; "Evaluation of Environmental Investments Research Program" undated information sheet by IWR; Environmental Protection Agency, Watershed Events: A Bulletin on Sustaining Aquatic Ecosystems (Summer 1994).

¹³⁹ U.S. Army Corps of Engineers, "National Operation and Maintenance Program Plan of Improvement: Performance Plan for Fiscal Year 1995," 31 Aug. 1994, p. 6.

¹⁴⁰ Ibid.

¹⁴¹ Ibid., pp. 22-33.

¹⁴² IWR Program and Study Team Directory, p. 13; Interview, author with Eugene Stakhiv, Institute for Water Resources, 21 July 1993.

¹⁴³ See Chapter Five for previous details on the wetland mitigation banking study.

¹⁴⁴ U.S. Army Engineer Institute for Water Resources, National Wetland Mitigation Banking Study: First Phase Report, IWR Report 94-WMB-4 (Jan. 1994), p. vii; IWR Program and Study Team Directory, pp. 14-15; Brumbaugh interview.

¹⁴⁵ U.S. Army Engineer Institute for Water Resources, 1992 Inland Waterway Review, Oct. 1992, passim.

¹⁴⁶ U.S. Army Corps of Engineers, Institute for Water Resources, A Review of 16 Planning and Forecast Methodologies Used in U.S. Army Corps of Engineers Inland Navigation Studies, IWR Report 92-R-4 (June 1992), passim.

¹⁴⁷ Ibid, p. 88; Antle interview, 30 Aug. 1994; Interview, author with Mary Leggett, USACE Waterways Experiment Station, 8 Jan. 1994.

¹⁴⁸ Antle interview, 30 Aug. 1994; IWR Program and Study Team Directory, pp. 29-30.

¹⁴⁹ U.S. Army Engineer Institute for Water Resources, National Economic Development Procedures Manual--Public Surveys, Vol. I, IWR Report 93-R-2 (Jan. 1993), p. 3.

¹⁵⁰ IWR Program and Study Team Directory, pp. 7-11.

¹⁵¹ Ibid., pp. 36-38.

¹⁵² Ibid., p. 35.



CHAPTER SIX: TOWARD TWENTY-FIVE YEARS: PROSPECTIVE AND RETROSPECTIVE

During 1993, its 24th year of operation, the Institute for Water Resources continued to refine its services to the Corps of Engineers. Following the 1991 reorganization, each division was positioned to undertake existing responsibilities and accept new work to help the Corps to adapt to changing needs and priorities. The new alignment of the Institute placed planning methodology, navigation analysis, policy studies, and program analysis work in specific divisions. The reorganization acknowledged the types of work that IWR's customers requested, and the new alignment provided for both specialized focus and collaborative work that spanned the Institute's divisions. A number of customers, including headquarters, field agencies, navigation organizations, intergovernmental groups, and Congress, relied increasingly on the Institute's services.

Including long-term work, new national studies, and policy studies, the Institute had well over 100 studies in progress. Funding increased accordingly. The 1991 budget of \$8.1 million rose to \$12.3 million in 1992 and to approximately \$14 million by mid-1993. Full-time staffing increased from 41 in 1991 to 48 in 1993.¹ The basic workforce of the Institute in 1993 consisted of 14 economists, 12 engineers, 5 environmental planners, 3 geographers, 3 physical scientists, 3 community planners, 2

sociologists, 2 computer scientists, an urban planner, a transportation specialist, a program analyst, and 6 administrative specialists. Although economists and engineers still comprised the majority of the staff, almost half of IWR's in-house employees were trained in other disciplines. Even more significant, however, was the expansion of IWR's traditional practice of leveraging resources to obtain state-of-the-art capability through contracts and personnel details. The only way to cope with the greatly increased and diverse workload was through adoption of a flat (or non-growing) organization extended by consultants, intergovernmental personnel, and visiting scholars.²

The changing workforce was the result of a steady flow of new disciplines into IWR since its establishment and also a reflection of the changing direction of the civil works program since the late 1960s. As IWR broadened its range of study to include public involvement, social impact assessment, policy studies, national studies, environmental regulations, navigation systems analysis, new planning methodologies, and program analysis, its workforce became increasingly diversified. A multidisciplinary approach to research has compelled IWR to bring in new specialties since its beginnings.

While diversity in training and experience has been an important strength of the Institute, its planning approach to problem solving has probably been even more important in providing quality products to customers. IWR's employees have historically worked together to develop multidisciplinary answers, an approach that encourages collaboration and rarely allows a narrow focus. IWR engineers understand economic analysis; IWR economists and engineers perform environmental evaluation; IWR's

other specialists also use all of the tools of social and physical science in their work. Regardless of their training, people who work at IWR have always been encouraged to approach their tasks as team members in collaboration. This approach was in part responsible for IWR's full engagement in a variety of services to the civil works directorate, field organizations, and other government agencies in the early 1990s.

The Institute for Water Resources approached its 25th year with internal optimism generated by a full workload. At the same time, however, the entire Corps of Engineers civil works program was under intense scrutiny. The Corps of course was but one of many federal agencies targeted for funding reduction. The soaring deficits of the 1980s prompted the Bush and Clinton administrations to find new ways to eliminate positions. Reorganization plans for the Corps of Engineers included reductions and consolidations in both headquarters and field operating agencies. No organization within the Corps was above consideration for substantial workforce reductions or elimination.

The Institute for Water Resources was involved in important services for the Corps and experienced an almost twofold increase in workload from 1990 to 1993. During the time, however, staffing numbers remained relatively flat. IWR's success in fulfilling its obligations with small growth in staff is in part attributable to matrix management, and also to knowledge of and sensitivity to its customers' needs. The Institute's status as a laboratory for the Corps civil works program has permitted the production of objective analyses of water resources issues, including navigation, flood control, and planning methodologies, and reimbursable services for field offices. IWR's personnel constantly survey developing

water resources scholarship and keep abreast of political change to anticipate, or be an "antenna" for, future Corps needs. IWR has the support of many top officials in the agency who are aware of its work. As the entire civil works program is scrutinized in the 1990s, however, no Corps laboratory is immune to reduction or elimination.

Despite an uncertain future, IWR's workload continues to grow. Much of its current work involves examining ways to streamline various parts of the civil works program, and in this respect the Institute is developing answers to questions about reducing the federal role. The Institute recently completed a study for the assistant secretary to enhance recreation opportunities at Corps projects while reducing federal costs. Building on research, IWR has developed an ongoing environmental valuation program aimed at providing better tools for assessing the value of environmental investments. The ongoing planning methodologies and risk analysis research programs are designed to maximize federal water resources investments in light of recent intergovernmental cost-sharing legislation. The objectives of drought and infrastructure studies include developing strategies that will minimize the impact of severe droughts and optimize maintenance and improvement of the nation's public works in a time of declining federal investment. IWR is also applying its drought-planning methods in comprehensive river basin studies of the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint regions of the southeastern United States. In response to the Government Performance and Results Act of 1993, IWR has supported the conduct of an OMB Performance Pilot being executed by the operations, construction and readiness division of the civil works directorate. With a recent overall reduction in planning and policy personnel in

headquarters, IWR has undertaken many tasks previously handled in downtown Washington, DC, and those responsibilities continue to grow.

Viewed in retrospect, the Institute's present status is the result of a steady progression of events dating back to the origins of planning and economic analysis in the Corps. Those who believed the civil works program needed better planning analysis to survive advocated the creation of an organization to assist in that effort. They prevailed in their beliefs when the Institute for Water Resources became a reality in April 1969, establishing an organization of economists, planners, and engineers trained in graduate-level planning to work together on the future of the civil works program. Predictably, their vision of the Corps included broader economic analysis and careful attention to environmental and social impact, views that often conflicted with the conservative engineering culture of the Corps. Such tension was part of the broader conflict between engineers and planners in the organization.

At times in its early history, the Institute imperiled its future by work that was considered too academic or futuristic to serve the Corps' immediate needs. Members of the Institute discovered that large agencies do not change rapidly and are averse to bold, new direction. However, they also learned that change could occur incrementally through work that directly applied to civil works needs. While producing work to meet immediate needs, IWR personnel saved many ideas that were initially rejected. Often, they were ready with answers and analysis when one of those ideas arose as a priority issue.

IWR's history is the ongoing story of a small organization of multidisciplinary professionals and their attempts to improve the adaptation of a large, decentralized

agency to changing conditions. Substantial evidence exists in the previous pages to suggest that IWR was valuable to the civil works program from its opening to the present day. The early perception in OCE, however, was that IWR's highly academic early work was not valuable enough. A significant redirection in the mid-1970s placed IWR on the road to becoming a more product-oriented organization. General-expense-funded work, more applied economic evaluations, flood damage reduction analysis, public involvement techniques, and assistance to the Corps regulatory program were among the products that increased the applicability of IWR's multidisciplinary expertise and the visibility of its personnel. The usefulness of such work gave IWR more credibility in OCE. The national waterway and hydropower studies of the late 1970s and early 1980s added new depth and dimension to the Institute. During the same time, IWR developed a policy studies component that aided OCE primarily with civil works policy studies of 3 to 6 months duration.

During this period, the senior members of IWR cultivated working relationships with many individuals in OCE, but some also gained the attention of people in OASA-CW. IWR's policy studies and planning methodologies endorsed nonfederal participation, risk analysis, and water conservation--approaches supported by proponents of fiscal austerity. As the influence of OASA-CW rose during and after William Gianelli's tenure, IWR's work gained greater exposure. The Institute participated in the development of cost-sharing provisions in WRDA-86 and became the Corps' center of expertise for NED planning guidelines. The Institute also developed the IWR-MAIN water supply forecasting system that has become the standard for water agencies nationwide. IWR refined

and consolidated navigation information and data collection to provide systematic analysis of the national waterways for the Inland Waterways Users Board and Corps districts and divisions. Working with the Corps' office of counsel, IWR introduced the minitrial, arbitration, and mediation into the Corps lexicon through the ADR program. IWR also served as the lead agency in developing the techniques for implementing risk and uncertainty analysis in civil works planning, and it participated in several research programs aimed at improving performance regarding federal investments.

In the reorganizations of 1981, 1987, and 1991, the Institute adapted to changing times and Corps needs. Navigation analysis, research, and policy studies had established and expanded customer bases, and when the Corps perceived a need for additional program analysis, IWR responded with a new division in 1991. Ongoing programs in research, policy, navigation, and program analysis aimed at streamlining government attest to IWR's sense of the future of the Corps of Engineers and the federal government.

From its beginnings, the Institute has occupied a unique position in the civil works program. Its original mission was complex, and both military and civilian proponents looked to IWR to provide answers to a host of perplexing environmental, economic, and social challenges to federal water resources development in the 1960s. As IWR approached its 25th year, the institutional memory spanned a period of sweeping change in federal water resources history. The Institute's employees could look backward to many significant accomplishments in their efforts to support the civil works program and the Corps mission of nation building. They could also look at a current workload more diverse, timely, and crucial to the Corps of

Engineers than at any time in the history of the Institute for Water Resources.

¹ "IWR Funding, FY 1983-1993," WRSC RMO Office files.

² IWR Program and Study Directory, pp. 45-76.





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INDEX

- 1908 Inland Waterways Commission Report*, 200
1988 Inland Waterway Review, 196, 231, 251-254
1992 Inland Waterway Review, 254, 301
308 Reports, 5, 6
Academicians, influence in planning at the Institute for
 Water Resources, 8-11, 19-22
ACIR, *See* Advisory Council on Intergovernmental Relations
ADR, *See* Alternative Dispute Resolution
Advisory Council on Intergovernmental Relations, 290-291
Aggerholm, David, 23, 39, 65-70, 74, 75, 81, 90
Alexandria, Virginia, 1, 33, 35, 58
Alternative Dispute Resolution, 282-286, 294, 302, 303,
 327
American Public Works Association, 267, 289
American Society of Civil Engineers, 23
Analyzing the Environmental Impact of Water Projects, 70
Annual Report of the Chief of Engineers on Civil Works Activities
 1969, 61
 1970, 63, 67
 1971, 67
 1972, 67, 82
Antle, George, 39, 90, 142, 150, 193, 202, 203
Appalachian Regional Commission, 25, 27, 28
Appalachian Regional Development Act, 25

Arab oil embargo, 160
Arkansas River Development Project, 81
ASA-CW, 137, 148, 191, 205, 207, 216, 226, 228, 231,
247, 250, 258
*An Assessment of Municipal and Industrial Water Use Forecasting
Approaches*, 207
Assistant Secretary of the Army for Civil Works
Blumenfeld, Michael, 147, 215
Dawson, Robert K., 217, 226, 227, 229, 247, 258, 279
Gianelli, William, 190, 215-219, 223, 224, 226, 229,
256-259
Page, Robert, 66, 97, 99, 157, 260, 264, 296
Veysey, Victor V., 137, 147
Atlantic Monthly, 62
Audubon Society, 67

Back, Nathaniel A., 6, 16, 18, 30-32, 34, 39, 74, 77, 94,
129, 131, 137, 148, 221, 247, 282, 293, 325
Ballentine, Thomas, 133, 203, 213
Bastian, David, 192
Batson, Col. Richard J., 95
BERH, *See* Board of Engineers for Rivers and Harbors
Bishop, Bruce, 73-76
Blakey, Lewis, 227
Blumenfeld, Michael, 147, 148, 215
Board of Engineers for Rivers and Harbors, 4, 5, 93, 153,
164, 166, 191, 227, 228, 287, 292
establishment of, 4
succeeded by Washington Level Review Center, 293
training programs with the Institute for Water
Resources, 93
Boland, John, 34, 152, 208-210
Bratton, Lt. Gen. John K., 199

Brazier, George 132
Brumbaugh, Robert, 261
Buffalo Bayou, 271
Bureau of Agricultural Economics, 18
Bureau of Land Management, 67
Bureau of Outdoor Recreation, 136
Bureau of Public Roads, 73
Bureau of Reclamation, 7, 8, 12, 145, 146, 150, 155, 188,
273
Bureau of the Budget, 9, 10, 16, 17, 20, 23, 27
Burton, Theodore, 3, 4
Bush administration, 288, 290
Byrd, Robert, 146

Caldwell, Lynton, 66, 67
California Debris Commission, 3
California Department of Highways, 73
California State Water Project, 190
Callaway, Howard H., 131, 137
Carr, Frank, 283
Carson, Rachel, 60
Carter, Jimmy 133, 144-149, 151, 156, 160, 169, 188, 189,
191, 198, 208, 215, 216, 218, 222, 254
Casey Building, 202
Cassidy, LTG William F., 19, 21-23, 29, 30, 32, 33, 35, 58,
68, 70, 125
Center for Advanced Planning, 1, 33, 36-40, 65, 69, 72, 94,
95, 99
 abolishment of, 99
 as component of IWR, 1, 33
 early tasks of, 38-39
 formation of, 36
Center for Complex Planning, 32

Center for Economic Studies, 1, 33, 36-39, 88, 89, 94, 99
abolishment of, 99
as component of IWR, 1, 33
early tasks of, 39
formation of, 35-36

Center for Urban Studies, 78

Center for Water Resources Engineering, 166

Central Valley Improvement Act of 1992, 265

Chief of Engineers
Cassidy, William F., 19, 21-23, 29, 30, 32, 33, 35, 58,
68, 70, 125
Clarke, Frederick J., 63, 65, 70, 75, 142
Gribble, William C., 97-98, 135
Morris, John W., 125, 146, 160
Pick, Lewis A., 7, 9
Sturgis, Samuel, Jr., 9, 12

Circular A-47, 9, 10, 14

Civil Works Directorate, 17

Civil Works Environmental Planning Conference, 68-69

Civil Works Study Board, 17, 20

Clarke, Frederick J.
Chief of Engineers, 62-63, 65, 70, 75, 142
Deputy Chief of Engineers, 23, 33

Clean Water Act of 1972, 133, 148

Clement, Roland, 67

Clinton administration, 290

Coast Guard, 136, 194

Colorado State University, 20

Committee on Economic Policies, 16

Congressional Record, 19, 62

*Contingent Value Method for Estimating Urban Recreation Use and
Benefits*, 271

The Coordinator, 84, 134, 252

Cooper, Kenneth, B., 95
Copeland, Claudia, 287
Cost Sharing for Shoreline Protection, 225
Cost Sharing Objectives and Approaches, 226
Cost-Benefit Analysis for Inland Navigation Improvements, 84
Council on Environmental Quality, 133, 147, 156
Creighton, James L., 141
Crews, James, 207-209
Criticism of the Corps
 by academicians, 93
 by media, 62
 by Office of Corps of Engineers, 96
 by President Carter, 144-148
Crosby, 95
Cross-Florida Barge Canal, 69

Dalton, James, 203, 213
Dam Outrage: The Story of the Army Engineers, 62
Dam safety, 215-217, 278, 279, 288
Dams and Other Disasters: A Century of the Army Corps of Engineers in Civil Works, 62
Davis, Stuart, 208, 272
Dawson, Robert K., 217, 226, 227, 229, 247, 258, 279
Deich, Michael, 290
Delli-Priscoli, Jerome, 138-140, 213, 282, 285
Department of Agriculture, 3, 10, 15, 18, 95, 147
Department of Commerce, 15
Department of Defense, 21
Department of Energy, 160-162, 289
Department of Natural Resources, 19, 137
Department of Transportation, 164, 193, 289
Departments of Agriculture, 18
Deputy Chiefs of Engineers

Schilling, Kyle E., 148-150, 202, 213, 286, 287, 289,
293-295
Toskey, LTC William M., 154
Dixon, Joseph, 287
Dodge, Burhnam, 40, 65, 74, 95
Dola, Stephen, 216
Douglas, William O., 62
Drew, Elizabeth, 62
Drought Appraisal Study, 128, 150, 151
Drought Assistance Program, 150
Duck Stamp Program, 257
Ducks Unlimited, 257
Duncan, Donald, 153, 205, 206, 213
Dunning, Mark 140, 207, 211, 212, 270, 275, 294, 295

EAB, *See* Environmental Advisory Board
EAP, *See* Environmental Action Program
*Economic and Environmental Principles and Guidelines for Water and
Related Land Resources Implementation Studies*, 186, 216-223,
230
Economic Development Analysis, 275
*Economic Principles and Guidelines for Water and Related Land
Resources Implementation*, 188, 218-220, 231, 248, 268
Economic Research Center, 21, 22
Economic Research Service, 3, 95
Economics Research Center, 29, 35
Economists and the Corps, 15
Edelman, Lester 282, 283
EEIRP, *See* Evaluation of Environmental Investments
Research Program
Eisenhower Administration, 9, 10, 142, 221
Ellender, Allen J., 32, 38
Energetics, 168

Energy crisis, 84, 160, 198, 201
Engineer Circular 1165-2-100, 75
Engineering Analysis, and Development of a Noise Management Program, 11
Engineering Division, 19
Engineering Manual for Civil Works, 16
Engineering Regulation (ER) 10-1-23, 38
Environmental Action Program, 128, 137, 156, 168
Environmental Advisory Board, 19, 65, 67, 68, 93, 138, 256
Environmental Defense Fund, 156
Environmental Guidelines for the Civil Works Program of the Corps of Engineers, 66, 67, 135, 136
Environmental Protection Agency, 78, 298
Environmental Simulation Laboratory, 71
ER 10-1-23, 39, 100
Erie Canal, 200
Eschelman, Col. Charles, 95, 99, 100
Evaluation of Environmental Investments Research Program, 289
Evans, James, 40
Executive Order 11990, 255
Executive Order 12291, 255
An Exploratory Investigation of a Center for Socioeconomic Studies in Water Resources, 30

Feather River, 190
Federal Power Commission, 5, 15
Federal Register, 255
Federal water and related land resources projects, 15
Federal Water Pollution Control Act Amendments of 1972, 129
Fleming, Marilyn, 192

Flood Control Act
1917, 5
1936, 6
1938, 7, 230
1941, 7
1944, 7, 8
1970, 79, 87, 137

Ford administration, 137

Foster, Charles, 67

Fredrich, Augustine J., 98, 99, 125, 127, 128, 132, 147,
148, 159, 160, 166, 168

Fritz, Wilbert, 30, 31

Fusion Center, 249

FWPCA, *See* Federal Water Pollution Control Act
Amendments of 1972

Gay, Forrest T., III, 256

General Survey Act of 1824, 3

Georgia Heritage Trust, 145

Georgia Institute of Technology Environmental Resources
Center, 74, 75

Gianelli, William, 190, 215-219, 223, 224, 226, 229,
256-259

Gillham Dam, 69

Gilliam, Harold, 67

Global warming, 300

Gould, James, 192

Government Performance and Results Act, 299, 324

Governmental Planning, 11

Graves, Ernest, 16, 131, 135, 136, 148, 150, 158

Great Depression, 6

Great River Environmental Action Team, 6, 25, 101, 124,
135-137, 144, 220, 232, 248, 255, 274

GREAT, *See* Great River Environmental Action Team
Green Book, *See Proposed Practices for Economic Analysis of River Basin Projects*
Gribble, William C., 98, 99, 125, 132, 135-137
Grier, David, 203
Grover, Dana, 208
Groves, Richard H., 33, 34, 40, 65, 91, 95
Guidelines for Risk and Uncertainty Analysis in Water Resources Planning, 281

Hadd, John, 23, 31
Hall, William, 69
Hanchey, James R., 74, 75, 81, 90, 138, 140, 154, 155, 161, 162, 166, 202, 203, 293
Hansen, William, 271, 272, 296-298
Harrison, Robert, 39, 90, 94, 95, 149, 164
Harvard, 8, 11, 13, 31, 95
Hatch, Henry, 228, 260, 291, 292
Hawnn, Art, 192
HEC, *See* Hydrologic Engineering Center
Heiberg, E.R., 166, 208, 217, 227
Hershendorfer, Gary, 39
Hoagland, Theresa, 297
Holliday, William, 227
House Document 308, 5
House Public Works Appropriations Committee, 21
House Rivers and Harbors Committee, 3
Howes, Richard, 39
Hunt, Richard L., 68
Hydroelectric power resources, 157, 161, 162, 196, 197, 200
Hydroelectric Power Potential at Corps of Engineers Projects, 159, 160

Hydrologic Engineering Center, 93, 98-101, 151, 155, 161, 167, 209, 272, 279, 280, 292

ICUZ *See* Installation-Compatible Use Zone

Information Transfer and Analysis Program, 207, 208

Implementation Studies, 218, 248

An Information System for Improving the Evaluation of Non-marketed Outputs, 81

Inland navigation, 84, 85, 93, 97, 166, 192, 194-196, 225, 230, 253, 254, 281, 287, 301

Inland Navigation Studies, 85, 301

Inland Navigation Systems Analysis model, 192

Inland Waterway Users Board, 249, 294

Inland Waterways Commission, 4, 163, 200

Inland Waterways Performance Monitoring System Review

Inland Waterways Revenue Act of 1978, 251

Inland Waterways Trust Fund, 222, 251

Installation-Compatible Use Zone, 211, 218, 248

Institute for Social Research, 71

Institute for Urban and Regional Studies, 81

Institute for Water Resources. *See also* Center for Advanced Planning; Center for Economic Studies activities from 1986 to 1993, 247-304. *See also specific projects*

adding the Fusion Center, 249

creating the Navigation Data Center, 250

developing sophisticated planning methodologies, 269-270

enhancing recreation opportunities, 270-272

evaluating the environmental investments research program, 299-300

examining recreational facilities, 297-299

expanding computer software resources, 267-268

-
- improving efficiency, 300-301
 - integrating risk analysis, 277-282
 - investigating cost-sharing rehabilitation of inland waterways, 253-254
 - mediating disputes, 282-287
 - reducing agricultural and urban flood damage, 272-274
 - regulating wetlands issues, 255-263
 - researching the impact of climate change, 301
 - reviewing urban infrastructures, 287-292
 - strengthening the Program Analysis Division, 295-297
 - studying droughts, 263-267
 - activities from 1980 to 1986, 185-231
 - adopting a new organization, 201-202
 - charging user fees, 221-223, 227-228
 - completing national studies, 192-200
 - constituting Special Studies Division, 191-192
 - constructing cost-sharing programs, 220-228, 229
 - coping with issues raised by national studies, 199-200
 - creating Navigation Division, 201
 - developing computer software, 208-209
 - devising new policies, 211-212
 - eliminating Special Studies Division, 201
 - evolving risk and uncertainty analysis, 212-216
 - expanding education and training, 192
 - fulfilling the Reagan agenda, 185-189
 - implementing more detailed policy procedures, 203-205
 - increasing workload and staff, 185, 200
 - reacting to the energy glut, 194-197
 - separating policy and research, 205

activities from 1975 to 1980, 123-168. See also specific projects

- adding wastewater treatment to mission, 148
- bridging public involvement and social impact assessment, 138-141
- conducting national studies, 157-160
- developing new guidelines, 132-135
- enduring failures, 167-168
- enlarging office staff, 153-155, 158-159
- establishing Research and Development Office, 125-126
- evaluating the Environmental Action Program, 128
- expanding protection for wetlands, 133
- filling the post of ASA-CW, 137, 147
- funding changes, 125-128
- gaining new regulatory functions, 130-132
- holding training classes, 155
- instituting organizational changes, 124-127
- publishing *The Coordinator*, 134
- reviewing water supply policy, 148-153
- studying drought in detail, 149-151
- writing new mission statement, 166-167

activities from 1969 to 1975, 57-102. See also specific projects

- analyzing regional and national navigation, 83-85
- assessing social impact, 79-83
- broadening planning process, 58
- changing management structure, 94-97
- consulting for surveys and water planning, 58, 77-79
- encouraging public involvement, 71, 73, 76-77
- establishing formal research and development department, 97-102

evaluating field reports, 69
in-house training on environmental quality, 68-69
interpreting laws, 64, 79
redirecting civil works programs, 58
reorganizing the Institute, 90-94
reviewing environmental policy, 65-67
formation of, 32-41
 first days at, 40
 funding for, 39
 internal organization of, 38
 mission statement, 36-37
 staffing for, 34
future plans for, 323-325
relationships with universities, 73-75, 92-93
INTASA, 89
Intergovernmental Panel on Climate Change, 300
Intergovernmental Personnel Act, 99, 163
Intergovernmental Review of Federal Programs, 223
Intermodal Surface Transportation Efficiency Act, 292
Internal Revenue Service, 251
Interstate Commerce Commission, 193
*Investigation of the Relationship Between Land Use and Wildlife
 Abundance*, 255
ISTEA, *See* Intermodal Surface Transportation Efficiency Act
ITAP *See* Information Transfer and Analysis Program
IWR Report
 70-3, 89
 70-4, 84
 70-5, 65, 66, 136
 73-3, 70
IWR-MAIN, *See* MAIN, Municipal and Industrial Needs

Johns Hopkins, 31, 210

Johnson administration, 27
Johnson, Lyndon, 15

Johnson, James F., 162
Johnson, Patrick, 40, 74, 90
Johnson, Stanley, 283
Johnston, Bennett, 146
Jordan, Robert E., III, 26, 27, 29-31, 129

Kelley Barnes Dam, 188, 213, 214
Kelly, James L., 95, 98
Kelly, Patrick J., 293, 294
Kem, R. S., 296
Kennedy, John F., 14, 20
Kennedy Administration, 13
Kerr, Robert S., 13
Kingman Building, 33, 37, 94, 166, 202
Kirwan, Michael J., 32-34, 36-38
Kitch, Harry, 227
Kleb, George, 202, 203
Klingerman, Arthur, 227
Koisch, Frank, 33-36, 39, 91, 92, 97, 125, 135
Krouse, Michael, 82, 90, 202, 207

Lane, John, 192
Lee, Colonel John C.H., Jr., 25, 28, 29, 32, 93, 95
Lemley, Jack, 284
Lessons Learned from the 1986 Drought, 263, 264
Lessons Learned from the California Drought (1987-1992), 266
Leven, Charles L., 81
Light, Stephen, 213
Lock Performance Monitoring System, 250, 253
Ludwig, Daniel 125, 137, 143, 148

Maass, Arthur, 8, 9, 11, 13, 17, 62, 95, 221
MAIN, *See* Municipal and Industrial Needs, IWR-MAIN
Marco Island, 132
MARDATA, *See* Maritime Data Network
Marine Design Center, 166
Maritime Administration, 192
Maritime Data Network, 193
Maruyama, Magoroh, 83
Matrix management, 94, 95, 323
McClellan-Kerr Arkansas River Multipurpose Project 81, 84,
142-144
McClellan-Kerr Report, 84
McDonald, Richard, 68, 74, 90, 196, 203, 208
McNamara, Robert S., 21
Mississippi River Commission, 3
Mitigation Banking Demonstration Study, 262, 296, 300
Morgan, Arthur E., 62
Morris, John W., 97-99, 125, 146, 147, 160, 166, 192
Morrison Knudsen, 282, 284
Moser, David, 217, 270, 280
Motz, Annabelle, 272
Mountain States Legal Foundation, 190
Muddy Waters: The Army Engineers and the Nation's Rivers, 8
Mugler, Mark, 213, 227
*Multiobjective Risk Partitioning: An Application to Dam Safety Risk
Analysis*, 279
Municipal and Industrial Needs, 207-210, 267-268, 294,
301, 326
Murdock, Kenneth, 71, 72, 293, 294

NAC, *See* Navigation Analysis Center
Nader, Ralph, 60

Nash, Ralph, 284
The Nation's Public Works: Report on Water Resources, 287
National Academy of Sciences, 20, 289
National Academy of Sciences Committee on Water, 20
National Bureau of Standards, 193
National Council on Public Works Improvement, 286
National Dam Inspection Act, 215
National Economic Development, 14, 60, 80, 86, 87, 136,
152, 167, 219, 220, 248, 268, 269, 271-275, 301
National Economic Development Cost Manual, 275
*National Economic Development Procedures Manual: Agricultural Flood
Damage*, 272
*National Economic Development Procedures Manual: Deep Draft
Navigation*, 274
National Economic Development Procedures Manual: Recreation, 271
*National Economic Development Procedures Manual: Overview Manual
for Conducting National Economic Development Analysis*, 274
*National Economic Development Procedures Manual: Urban Flood
Damage*, 273
National Environmental Policy Act, 59-61, 63, 69, 129
 federal agencies respond, 59-61
 legislation enacted, 59-61
 used to stop Corps projects, 69
National Hydroelectric Power Resources Study, 157, 161,
162, 194, 196, 200
National Operation and Maintenance Program, 299, 300
National Park Service, 271
National port study, 84
National Research Council, 278, 289
National Resources Defense Council, 131
National Space and Aeronautics Administration, 282
National Study of Water Management During Drought
National Water Assessment, 194

National Water Commission, 34, 35, 38, 86
National Water Commission Act, 34, 35
National Water Commission report, 86
National Waterways Resources Study, 194
National Waterways Roundtable, 165
National Waterways Study, 162-165, 191, 194-196, 199,
198-200, 204, 252
*The National Waterways Study Draft Report: A Framework for Decision
Making*, 193, 194
National Wetlands Policy Forum, 259
National Wilderness Preservation System Act, 60
National Wildlife Refuge, 136
Natural Resources Defense Council, 131
Natural Resources Defense Fund, 156
Navigation Analysis Center, 191-194, 202, 203, 229, 231
Navigation Data Center, 250, 252, 292
NED, *See* National Economic Development
NEPA, National Environmental Policy Act
Neustadt, Richard, 13
New Deal, 6
New England Natural Resources Center, 67
NEWS, *See* Northeastern U.S. Water Supply Study
NHS, *See* National Hydroelectric Power Resources Study
Nixon, Richard, 59, 74, 137, 215
Nixon administration, 137
Noble, Brigadier General Charles C., 29
Nolton, Darrell, 203, 208, 211, 212
Nonstructural Flood Control Measures: A Sociology of Innovation, 272
North Atlantic Regional Study, 26, 35, 40
Northeastern U.S. Water Supply Study, 22, 35, 40, 78, 149,
150, 158, 162, 263
NRDC v. Callaway, 131
NRDC, *See* See Natrual Resources Defense Council

NWS Information Bulletin, 165
NWS, *See* National Waterways Study

O&M, *See* National Operation and Maintenance Program

OAS, *See* Office of Appalachian Studies

Odum, H.T., 168

Office of Appalachian Studies, 24-28, 33, 36, 39, 40

Office of Civil Functions, 78, 137

Office of History, 195, 291

Office of Regional Water Development, 28, 29, 30, 32

Office of the Secretary of the Army, 17, 18

Offringa, Brigadier General Peter J., 284

Olson, Howard, 90, 164, 203

OMB Performance Pilot, 324

Omnibus Water Resources Act, 79, 189

Omnibus Water Resources Development Acts, 132

Open Space Action Institute, 67

Organization of Petroleum Exporting Countries, 198

Ortolano, Leonard, 69, 77, 138, 139

ORWD, *See* Office of Regional Water Development

P&G, *See Economic Principles and Guidelines for Water and Related
Land Resources Implementation Studies*

P&S, *See Principles and Standards for Planning and Water and Related
Land Resources*

Pacific Northwest River Basins Commission, 76

Page, Robert, 66, 97, 99, 157, 260, 264, 296

Palmer, Dr. Richard, 265, 266

Passaic River flood control project, 262

Performance Monitoring System, 192, 194, 250, 253 *See also
Lock Performance Monitoring System*

Peterson, Jan, 287

Pick, Colonel Lewis A., 8, 9

Pick-Sloan Plan, 8
Pietrowsky, Robert, 286, 288-290
Pinchot, Gifford, 4
A Plan for Planning, 223, 227, 228
Planning and Management Consultants, Ltd., 210, 267
Planning-Programming-Budgeting System, 21, 59
Playboy, 62
PMS, *See* Performance Monitoring System
Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources, 14
Policy and Analysis Division, 19, 23, 24, 27, 32, 39, 66, 71, 91, 98
Policy and Special Studies Division, 261, 280, 289, 294, 295, 300
Portland State University, 83
Pough, Richard, 67
PPBS, 21, 74
Preliminary Inventory of Hydropower Resources, 161
President Theodore Roosevelt's Inland Waterways Commission, 4
Presidential Drought Appraisal Study, 150, 151
Presidential Drought Study, 263
Presidential Project Review, 191
Primer for Surveying Flood Damage for Residential Structures and Contents, 273
Principles and Guidelines, *See* *Economic Principles and Guidelines for Water and Related Land Resources Implementation*
Principles and Standards for Planning of Water and Related Land Resources, 86-88, 99, 136, 151, 152, 188, 218-221, 248, 268, 269
Priscoli, Jerome Delli, *See* Delli-Priscoli, Jerome
Proposed Practices for Economic Analysis of River Basin Projects, 16

Protecting America's Wetlands: An Action Agenda, 259
Public Administration Review, 93
Public Affairs Office, 68, 131, 138
The Public Be Dammed, 62
Public Involvement in Regulatory Functions, 141
Public Law 90-515, 34
Public Participation in Regional Water Resources Planning, 138
Public Participation in Water Resources Planning, 73-75
Public Works Improvement Act, 286
Publications
 1908 Inland Waterways Commission Report, 200
 1988 Inland Waterway Review, 196, 231, 251-254
 1992 Inland Waterway Review, 254, 301
 308 Reports, 5, 6
 Analyzing the Environmental Impact of Water Projects, 70
 Annual Report of the Chief of Engineers on Civil Works Activities
 1969, 61
 1970, 63, 67
 1971, 67
 1972, 67, 82
 An Assessment of Municipal and Industrial Water Use Forecasting Approaches, 207
 Atlantic Monthly, 62
 Contingent Value Method for Estimating Urban Recreation Use and Benefits, 271
 The Coordinator, 84, 134, 252
 Cost Sharing for Shoreline Protection, 225
 Cost Sharing Objectives and Approaches, 226
 Cost-Benefit Analysis for Inland Navigation Improvements, 84
 Dam Outrage: The Story of the Army Engineers, 62
 Dams and Other Disasters: A Century of the Army Corps of Engineers in Civil Works, 62

-
- Design of Water Resource Systems: New Techniques for Relating Economic Objectives, Engineering Analysis, and Governmental Planning*, 11
- Development Benefits of Water Resources Investments*, 81
- Development of a Noise Management Program for Headquarters, U.S. Army, Europe: Strawman Report*, 211
- Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, 186, 216-223, 230
- Economic Principles and Guidelines for Water and Related Land Resources Implementation*, 188, 218-220, 231, 248, 268
- Engineering Analysis, and Development of a Noise Management Program*, 11
- Engineering Manual for Civil Works*, 16
- Environmental Guidelines for the Civil Works Program of the Corps of Engineers*, 66, 67, 135, 136
- An Exploratory Investigation of a Center for Socioeconomic Studies in Water Resources*, 30
- Guidelines for Risk and Uncertainty Analysis in Water Resources Planning*, 281
- Hydroelectric Power Potential at Corps of Engineers Projects*, 159, 160
- An Information System for Improving the Evaluation of Non-marketed Outputs*, 81
- Investigation of the Relationship Between Land Use and Wildlife Abundance*, 255
- Muddy Waters: The Army Engineers and the Nation's Rivers*, 8
- Multiobjective Risk Partitioning: An Application to Dam Safety Risk Analysis*, 279
- The Nation's Public Works: Report on Water Resources*, 287
- National Economic Development Cost Manual*, 275
- National Economic Development Procedures Manual: Agricultural Flood Damage*, 272
-

-
- National Economic Development Procedures Manual: Deep Draft Navigation*, 274
- National Economic Development Procedures Manual: Recreation*, 271
- National Economic Development Procedures Manual: Overview Manual for Conducting National Economic Development Analysis*, 274
- National Economic Development Procedures Manual: Urban Flood Damage*, 273
- The National Waterways Study Draft Report: A Framework for Decision Making*, 193, 194
- Nonstructural Flood Control Measures: A Sociology of Innovation*, 272
- A Plan for Planning*, 223, 227, 228
- Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources*, 14
- Primer for Surveying Flood Damage for Residential Structures and Contents*, 273
- Principles and Standards for Planning of Water and Related Land Resources*, 86-88, 99, 136, 151, 152, 188, 218-221, 248, 268, 269
- Proposed Practices for Economic Analysis of River Basin Projects*, 16
- Protecting America's Wetlands: An Action Agenda*, 259
- Public Administration Review*, 93
- The Public Be Dammed*, 62
- Public Involvement in Regulatory Functions*, 141
- Public Participation in Regional Water Resources Planning*, 138
- Public Participation in Water Resources Planning*, 73-75
- Quality of Life and Income Redistribution: Objectives for Water Resources Planning*, 82
- A Review of 16 Planning and Forecast Methodologies Used in U.S. Army Corps of Engineers*, 301
-

-
- Revised Plan of Action for Water Conservation*, 208
A River, a Region, and a Research Problem, 81
Social Aspects of Comprehensive Planning, 141
Social Impact Assessment: An Overview, 83
Social Science Information Exchange Bulletin, 141
Socioeconomic Considerations in Dam Safety Risk Analysis, 278
Sports Illustrated, 62
Status of the Inland Waterways, 252
The Susquehanna Communication-Participation Study: Selected Approaches to Public Involvement in Water Resources Planning, 71-73
Testing an Iterative Open Process for Water Resources Planning, 139
Water Resources Decision Making on the Basis of the Public Interest, 138
Wetland Mitigation Banking Concepts, 261
Wetland Values: Concepts and Methods for Wetlands Evaluation, 157
Puget Sound and Adjacent Waters Study, 76
- Quality of Life and Income Redistribution: Objectives for Water Resources Planning*, 82
- RAND Corporation, 31
RAND-type of operation, 31
Read, R.B., 81
Reagan, Ronald, 187-190, 198, 217, 218, 223-226, 228-230, 255, 256, 258, 259
Reagan administration, 188-190, 198, 218, 223-225, 228, 256, 258
RED, *See* Regional Economic Development
Refuse Act, 129
Regional Development Group, 27, 28

Regional Economic Development, 25, 26, 80, 87, 88, 219
Reimbursable work, 128, 155, 159, 166, 187, 191, 193,
296
Reisler, Irving, 29, 91, 125-127
Report of the Senate Select Committee, 13
Reppert, Richard, 133, 261
Research and Development Office, 125
Resor, Stanley R., 62
Resources for the Future Foundation, 264
Reuss, Martin, 291
*A Review of 16 Planning and Forecast Methodologies Used in U.S. Army
Corps of Engineers*, 301
Revised Plan of Action for Water Conservation, 208
Risk Analysis for Water Resources Investments, 280, 301
A River, a Region, and a Research Problem, 81
River and Harbor Act, 79, 80, 129
Roe, Robert, 247
Roosevelt, Franklin, 6-8, 74, 163, 200
Rostenkowski, 229

Sagebrush Rebellion, 190
Sasaki, Brion, 90
Schilling, Kyle E., 148-150, 202, 213, 286, 287, 289,
293-295
Schwartz, Carl H., Jr., 26, 27
Schwarz, Harry, 91
Secretary of Agriculture, 15
Secretary of Health, Education, and Welfare, 15
Secretary of the Army, 15
Secretary of the Army for Civil Functions, 58, 129
Secretary of the Interior, 15
Section 122 of the River and Harbor Act, 79, 80
Section 209 of the Flood Control Act, 79

Section 404, 130-132, 156, 255, 258-260
Senate Document 97, 14, 19, 27, 80, 270
Senate Select Committee on National Water Resources, 13
Sharp, Frank, 192
Sheaffer, John R., 78
Silent Spring, 60
Simpkins, Charles, 207
SIMULATOR, 89
Singley, John, 295
Skaggs, Lee, 296, 297
Sloan, W. Glenn, 8
Smet, Augustus (Augie), 91, 127
Smyth, James, 287
Social Aspects of Comprehensive Planning, 141
Social Impact Assessment: An Overview, 83
Social Science Information Exchange Bulletin, 141
Socioeconomic Considerations in Dam Safety Risk Analysis, 278
Soil Conservation Service, 12, 25, 136
Spewrell Bluff Dam, 145, 146
Sports Illustrated, 62
Stabilization of Corps by Kennedy administration, 13-14
Stakhiv, Eugene Z., 133, 150, 153, 213, 217, 227, 280, 300
Stanford University Department of Civil Engineering, 74
Status of the Inland Waterways, 252
Stearns, Robert, 290
Stine, Jeffrey, 132
Stockman, David, 198, 199, 226, 229
Stoddard, Charles, 67
Sturgis, Samuel, Jr., 9, 12
Subcommittees on Public Works, 32
Susquehanna Communication-Participation, 72, 73

*The Susquehanna Communication-Participation Study: Selected
Approaches to Public Involvement in Water Resources Planning, 71-73*

Swiggart, Forrest, 39

Systems Analysis Branch, 191

Tabb, Robert 130

Tang, 39, 90, 207

TAP, *See* Technical Assistance Program

Technical Assistance Program, 75, 76, 193

Tenneco Corporation, 256, 261

Tennessee Valley Authority, 6, 8, 9, 25

Tennessee Valley Authority, 6, 11, 25, 62, 146, 161

Tennessee-Tombigbee Waterway, 69, 283

Testing an Iterative Open Process for Water Resources Planning, 139

Teton Dam, 188, 215

Tofani, B. Joseph, 12, 13, 17-21, 23, 24, 29, 31, 32, 34, 38,
40, 58, 59, 67, 91, 96-98, 126

Toskey, LTC William M., 154

Tradition Be Damned! The Army Corps of Engineers is
Changing

TRADOC, *See* U.S. Army Training and Doctrine Command

Trisko, Ralph, 90, 160

Truman Administration, 9

Tug Fork Valley, 272

TVA, *See* Tennessee Valley Authority

U.S. Air Force, 194

U.S. Army, Europe, 212

U.S. Army Training and Doctrine Command, 211

U.S. Court of Appeals, 130

U.S. Fish and Wildlife Service, 136

U.S. Geological Survey, 165

U.S. Maritime Commission, 164

U.S. News and World Report, 22
Upper Mississippi River Basin Commission, 136
Urban Institute, 289
USAREUR, *See* U.S. Army, Europe
User fees, 221, 222, 229, 262

Vallianos, Lim, 289
Vance, Cyrus, 17
Veysey, Victor V., 137, 147
Vincent, Mary, 213, 287
Vlachos, Evan, 81-83
Wagner, Thomas P., 139

Wahus, David, 296
Wall Street Journal, 62
Walla Walla District Floodplain Management Study, 76
Walsh, Michael, 208
Washington Level Review Center, 68, 292
Water conservation, 88, 148, 150-153, 166, 167, 191, 206-
211, 213, 215, 216, 231, 303, 326
Water Conservation Study, 150, 151
Water Policy Initiatives, 152, 153
Water Pollution Control Act of 1948, 77
Water Quality Act of 1965, 77
Water resource planning, 11, 12, 23, 71
Water Resources Act, 79, 189
Water Resources Congress, 222
Water Resources Council, 14, 15, 19, 21, 22, 34, 37, 59, 73,
82, 86, 88, 138, 150-152, 161, 221
Water Resources Decision Making on the Basis of the Public Interest, 138
Water Resources Development Act of 1974, 86-88, 221
Water Resources Development Act of 1976, 157, 160

Water Resources Development Act of 1986, 146, 188, 247,
264, 291

Water Resources Development Act of 1990, 261

Water Resources Institute, 29, 30, 32

Water Resources Planning Act, 14, 15, 18, 27

Water Resources Planning Act of 1965, 14, 27

Water Resources Research Act of 1964, 14

Water Resources Support Center, 16, 71, 165, 166, 191,
202, 249, 292

Water Resources The Nation's Public Works: Report on Water Resources

Waterborne Commerce Statistics Center, 250, 253

Waterborne Statistics Center, 166, 192

Waterpower '79, 162, 196

Waterpower '81, 196

Waterways Experiment Station, 151, 209, 280, 297, 298

Waterways study, 162, 163, 165, 191, 195, 199, 200, 252

Watt, James, 190, 218, 219

Wengert, Norman, 39

Werick, William, 264, 266

WES, *See* Waterways Experiment Station

Wetland mitigation banking, 256, 258, 260, 261, 300, 301,
303

Wetland Mitigation Banking Concepts, 261

Wetland Values: Concepts and Methods for Wetlands Evaluation, 157

Wetlands protection, 97, 124, 156, 255, 259, 260

White, Gilbert F., 10, 11, 13, 17, 73, 78

Wild and Scenic Rivers Act, 23, 60

Wilson, Drake, 149, 166

WLRC, *See* Washington Level Review Center

Wolfe, Charles, 81, 90

Woodbury, Brigadier General H.G., 21, 22, 26-28

World War II, 7, 60, 80, 144, 190

WRC, *See* Water Resources Council

WRDA, *See* Water Resources Development Act
Wright, Janet, 213, 227
Wright, Jim, 146
WRSC, *See* Water Resources Support Center
Zabel and Russell Development Company, 130
Zabel v. Tabb, 130
Zagata, Michael, 256