



US Army Corps
of Engineers®

Civil Works Programs

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

DTIC QUALITY INSPECTED 8

1998

Civil Works Program Statistics

This information is intended to illustrate the scope of the Civil Works mission carried out by the U.S. Army Corps of Engineers. Statistics are as of 30 September 1997 unless otherwise specified.

PROGRAM FACTS - GENERAL

- Total Fiscal 1998 Appropriation: \$4.05 billion
 - Construction, General: \$1.469 billion
 - Operations and Maintenance, General: \$1.740 billion
 - Mississippi River and Tributaries: \$294 million
 - General Investigations: \$157 million
 - Regulatory Program: \$105 million
 - Flood Control & Coastal Emergencies: \$4 million
 - Other: \$288 million
- Non-federal cash contribution expected, FY 1998: \$123.1 million
- Revenue generated by Trust Funds, FY 1997:
 - Inland Waterway Trust Fund: \$113.4 million
 - Harbor Maintenance Trust Fund: \$790.7 million
- Number of military personnel assigned: 174
- Number of Civil-funded civilian employees: 26,048
 - Work years worked in Fiscal Year 1996: 27,053
- Number of division offices with Civil Works mission: 8 District offices: 38
- Number of projects under construction: 491
 - Specifically authorized by Congress: 351
 - "Continuing Authorities" Projects: 140
- Real estate managed (including underwater): 11.7 million acres (18,281 square miles)
 - Total lake surface area at full pool: 9,934,000 acres (15,522 square miles)

NAVIGATION

- Commercial navigation (shallow draft) channels operated/maintained: 12,000 miles
- Navigation lock chambers owned and/or operated: 275 (237 O&M-funded)
- Locks over 100 years old: 26. Oldest 2 locks opened in 1839
- Deep draft harbors maintained by Corps: 299
- Shallow draft harbors (coastal & inland): 627
- Tonnage handled by U.S. ports and waterways (1996): 2,284 million tons
- --Value of foreign trade handled at ports (1996): \$627.4 billion
- --Jobs generated by foreign trade at ports (1994): 15.9 million
- Federal taxes generated by foreign trade at ports (1994): \$154 billion
- Material dredged per year (Construction & maintenance, 1996): 258 million cubic yards
- Dredges & other vessels owned/operated: 1,200
- Replacement value of inland system: over \$125 billion

FLOOD CONTROL

- Major lakes and reservoirs managed: 383
- Levees emplaced: 8,500 miles
- Average annual damages prevented by Corps' projects (1987-96): \$16.2 billion
- Damage prevented in 1996: \$22.3 billion
- Cumulative damage prevented, 1928-96: \$319 billion; Adjusted for Inflation: \$565 billion
- Flood damage suffered per year in U.S.(1987-96): \$3.6 billion
- Damage suffered in 1996: \$6.1 billion
- Flood control expenditures, 1928-96: \$37.5 billion; Adjusted for Inflation: \$99 billion
- Damage prevented per dollar expended, 1928-96: \$5.65

FLOOD PLAIN MANAGEMENT SERVICES

- Responses to requests for information in Fiscal Year 1997: 42,000
- Value of property affected by FPMS guidance: \$5 billion

ENVIRONMENTAL PROTECTION

- Environmental activities within Fiscal Year 1998 appropriation: \$993.7 million
- Percentage of total appropriation: 24%

HYDROPOWER

- Number of projects in operation: 75
- Installed generating capacity: 20,720 megawatts
- Power generated in 1995: 77.4 billion kilowatt-hours
- USACE owns & operates 24% of U.S. hydropower capacity, or 3% of total U.S. electric capacity
- Revenue from power sales (1995): \$569.2 million
- Nonfederal power plants operated at Corps' facilities (not counted in statistics above): 67, with 1,957 megawatts capacity

RECREATION

- Number of sites: 4,330 at 456 Corps' projects (mostly lakes)
- 10% of U.S. population visits at least one Corps project each year
- Visits in 1996: 376 million
- Spent by visitors at Corps' projects: \$10 billion
- Jobs (full or part time) generated by visitation: 600,000
- Concessionaires on Corps' projects: 400, with gross fixed assets of \$225 million
- Volunteers at Corps' projects: 70,500 Hours worked, 1996: 927,000

WATER STORAGE

- Total capacity of major Corps lakes: 329.2 million acre-feet
- Total active storage: 218.7 million acre-feet
- Projects with authorized M&I water supply storage: 118
- Projects with authorized irrigation storage: 68

REGULATORY PROGRAM

- Individual and letter permits issued in Fiscal Year 1997: 4,676; Permits denied: 203
- Activities authorized through regional permits: 38,003
- Activities authorized through nationwide permits: 39,883
- Jurisdictional determinations, Fiscal Year 1997: 56,300
- Percentage of permit actions completed within 60 days: 94%
- Acres of wetlands where activity was permitted: 34,700
- Acres of wetland restoration/creation required by those permits: 53,400

SUPPORT TO OTHER AGENCIES

- Value of reimbursable work for other agencies in Fiscal Year 1997: \$700 million
- Number of agencies supported: 60
- Principal agencies supported: Environmental Protection Agency; Federal Emergency Management Agency; Depts. of Energy, Interior, Justice, Transportation, Housing & Urban Development; Local Governments

EMERGENCY OPERATIONS

- Disasters responded to in 1997: 8
- Major emergency responses: N. California/W. Nevada Flooding; Ohio/Mississippi River Basin flooding; ND-SD-MN Snowmelt/Flood; Arkansas Tornado; Devils Lake High Water, ND; Great Lakes High Water & Flooding

Formerly Utilized Sites Remedial Action Program (FUSRAP)

- Fiscal 1998 Appropriations: \$140 million.
-



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, WATER RESOURCES SUPPORT CENTER
INSTITUTE FOR WATER RESOURCES
CASEY BUILDING
FORT BELVOIR, VIRGINIA 22060-5586

REPLY TO
ATTENTION OF

CEWRC-IWR

MEMORANDUM FOR COMMANDER, Defense Technical Information Center,
Cameron Station, Alexandria, VA 22314

SUBJECT: Transmittal of

1. Reference AR 70-31.
2. Two copies of "Civil Works Programs" have hereby been submitted.
3. Initial distribution of this report has been made to appropriate Corps of Engineers agencies. It is recommended that copies of this report be forwarded to the National Technical Information Center.
4. Request for the DTIC Form 50 (Incl 2) be completed and returned to WRSC-IWR.

FOR THE DIRECTOR:

Enclosures

A handwritten signature in black ink, appearing to read "K. E. Schilling", is positioned above the printed name and title.

Kyle E. Schilling
Director

U.S. Army
Corps of Engineers

Civil Works Programs

DTIC QUALITY INSPECTED 3

1998

19980429 061

INTRODUCTION	1
INTEGRATED WATER RESOURCES DEVELOPMENT	
AND MANAGEMENT	1
RESPONDING TO THE NATION'S NEEDS	3
VALUE OF CORPS' MANAGED INFRASTRUCTURE TO SOLVING WATER	
RESOURCES PROBLEMS	4
Return on Investment of the Corps Capital Stock	4
Revenues to the Treasury	5
Annual Returns	5
MAINTAINING THE INFRASTRUCTURE	6
BUSINESS PROGRAMS	9
NAVIGATION	10
Inland Waterway System	10
Ports and Harbors	12
Dredging	13
FLOOD AND COASTAL STORM DAMAGE REDUCTION	15
Flood Damage Reduction	15
Coastal Storm Damage Reduction	16
Continuing Authorities	17
Residual Damages	17
ENVIRONMENTAL PROTECTION	19
Ecosystem Restoration	21
Environmental Mitigation	22
Environmental Stewardship	22
Environmental Compliance	23
Formerly Utilized Sites Remediation Program	24
EMERGENCY OPERATIONS	25
REGULATORY FUNCTION	27
RECREATION	30
HYDROPOWER	32
WATER SUPPLY	34
SUPPORT FOR OTHERS	36
ADDENDUM - Value of U.S.Army Corps of Engineers Civil Works Program to the Nation	39
EXAMPLES OF HOW THE CORPS CAN HELP	51
WHERE TO FIND THE CORPS	53

Civil Works Programs

INTRODUCTION

This pamphlet provides an overview of the contribution that the Corps of Engineers Civil Works Program makes to National economic well-being and environmental sustainability. Taxpayers, Congress, and the Administration are demanding that government agencies provide valuable services for the investment of taxpayer dollars entrusted to their stewardship. This pamphlet describes the products and services the Civil Works program produces and the impact these products and services make on National prosperity and well-being. The pamphlet also highlights budgetary and other issues that are important to consider when deliberating resource allocations.

INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT

The United States Army Corps of Engineers Civil Works program is responsible for the development, management, protection, and enhancement of the Nation's water and related land resources for commercial navigation, flood damage reduction, environmental restoration, and allied purposes. The Corps provides responsible stewardship of its water resources infrastructure and the associated natural resources, and provides emergency services to the Nation for disaster relief. As part of the Civil Works mission, the Corps also provides planning, engineering, environmental, recreation, research, and real estate services to other Federal agencies and non-Federal

customers. It also provides support to the Army in both peacetime pursuits and during national emergencies, and stands ready to adapt to evolving national needs and priorities. Through its regulatory program, the Corps plays a major role in the protection of the waters of the United States, including wetlands.

The contribution that the Corps Civil Works program makes to the Nation rests on three key strengths:

Technical Capability. The Corps of Engineers has over 28,000 persons in the Civil Works program. They are engineers, architects, economists, biologists, archeologists, and many other technical professionals capable of providing the full range of engineering services in the planning, design, program and project management, construction management, and operations/maintenance phases of projects. In addition to the in-house professional engineering services, Corps of Engineers professionals provide comprehensive contract management of highly complex engineering projects. They assure the appropriate independent review of contractor work, and ensure that the government is receiving value for contract dollars expended.

Planning and Decision-Making Process. Civil Works investments must undergo an extensive development process in which a multitude of often competing and conflicting public needs, priorities and preferences come into play. In addition, the water resource investment process is different from most other Federal investment decision processes in that it requires extensive cost-benefit analysis or cost effectiveness and incremental cost analyses. While a sometimes painful and lengthy process, the end results are projects that satisfy multiple purposes in often creative and innovative ways. Corps

professionals are experienced in negotiating this complex and difficult public interest process. They make use of sophisticated multiple purpose planning and decision making methodologies, as well as employ innovative public involvement techniques to ensure that the process of integrating and balancing public needs and concerns is accomplished effectively and efficiently.

Forming and Participating in Partnerships.

The Corps recognizes the value in forming partnerships to achieve the best overall answers in the contemporary world. The Corps' partners include other Federal agencies, state, tribal, and local governments, academia, industry professional organizations, environmental and public interest groups, the private sector, and organizations of private citizens. The Corps' partnerships are varied, some being formal or having strict guidelines defined by law or agreement. Others are more informal, contributing to information sharing and fostering communication. The Corps employs private architectural-engineering and construction firms for a high percentage of its design and virtually all of its construction work. The partnership between the Corps and the private sector represents an immediate force multiplier of several hundred thousand architects, engineers, and builders and is readily convertible to support the Nation during times of national emergency.

Water Resources Development Evaluation and Prioritization

The evaluation of public spending for U.S. Army Corps of Engineers water resources projects is accomplished on several different levels. Virtually all new projects carried out as part of the Corps Civil Works program are subjected to a series of economic and related engineering and environmental decision making analyses.

Congress does not appropriate funds for the various Corps mission areas on a *program* basis. Rather, it reserves decision-making on a *project by project* basis, with some exception for some limited continuing authorities for small projects. (Exceptions to this include Corps Regulatory Program, and the new Formerly Utilized Sites Remedial Action Program (FUSRAP); the Support for Others program is funded by other agencies as reimbursable work).

Various tests are applied *at the project level* to first determine the Administration's position regarding the appropriateness of Federal participation in the project; and second, *at the programmatic level*, to assign a priority to the project in the Army's annual budget request to the Office of Management and Budget as part of the process by which the President's recommended budget is developed for each Federal fiscal year.

Project recommended for Federal action usually consist of the alternative plan that most reasonably maximizes net economic benefits, consistent with the trade-offs needed to protect the environment. An alternative approach, cost effectiveness and incremental cost analyses, is used for ecosystem restoration and protection projects, where outputs are not measured in monetary terms.

Completed water resources projects that are operated and maintained by the Corps of Engineers are funded based on a uniform prioritization framework. The various operation and maintenance (O&M) project work items are grouped into categories for purposes of defining appropriate funding levels. Prioritization is established based on the use of performance measures and benchmarks developed for the Corps' O&M business functions, including the identification of high priority project outputs; the use of the results of benefit-cost or other economic analyses (such as cost effectiveness, or incremental cost); the application of other criteria such as maintaining system or project operations; and safety, health and engineering integrity considerations.

RESPONDING TO THE NATION'S NEEDS.

In the past three decades, the public has been awakening to the realization that growth and development must be managed in a sustainable manner. As part of that realization, the Corps has worked steadfastly towards fulfilling an integrated view of social aims, economics, and technological innovation as part of its water and natural resources management responsibilities. The traditional economic-based purposes and outputs of water resources projects have expanded to include: restoration and protection of valued habitat and ecosystems; preservation of native cultures and cultural artifacts; as well as the provision of aesthetic and spiritual experiences often associated with the interaction of water, architecture, and the surrounding environment.

Human population is growing and shifting to new regions in the U.S. Urbanization is expanding, and the economic structure is being realigned to adapt to the globalization of production and consumption patterns. Environmental quality, technological adaptation and transformation, and economic development must be interdependent goals in fostering the potential for sustainable development. Environmental engineering will play a major role in facilitating the transformation towards a future of sustainable development. Water resources management reflects a link between the environment, social well-being, equity, and economics. The practice of water resources management is, de facto, environmental engineering.

As our Nation enters a period of historical maturity and preeminence in world affairs, it is doing so during a period of profound economic, social, and political realignments, both globally and at home. The Nation's economy depends on its increasing productivity, creativity and

trade. Import and export commodities must flow through our ports and waterways if trade is to expand and sustain our economy allowing the labor market to grow. The deep water port and inland navigation system of the U.S. is one of the principal determinants of our country's participation in the growth of world trade and the benefits that it brings to our economy. The Nation's trade policies - GATT, NAFTA and fast-track trade agreements with South America depend on accessibility to an efficient waterborne transportation network. This network is constructed and maintained by the Corps of Engineers.

Sustainable development also means taking care of our surroundings, i.e. the environment in which we live.

That

environment is not always benign, and natural climate variability

spawns recurring floods, droughts, hurricanes, coastal erosion, tornados, forest fires, and landslides. A large part of the Corps' planning and engineering talent is directed towards reducing society's vulnerability to natural hazards so that they can live and work in a safe and stable environment. Engineering creativity and innovative methods are also directed at restoring ecosystems that have been degraded by previous generations and controlling the potential damage that might occur from contemporary growth and development activities. Sustainable development requires a much higher level of integrated watershed management than ever experienced across all levels of government and all related programs within those institutions. Already, new partnerships are forming to solve unique problems of acid mine drainage, "Brownfields" remediation, contaminated dredge material disposal, and large-scale ecosystem restoration.

Sustainable development requires a much higher level of integrated watershed management than ever experienced...

The Nation has already invested significantly in

Responsible Public Engineering in Responding to the Nation's Needs

The U.S. Army Corps of Engineers water resources programs have been in the forefront in developing creative responses to national economic development needs. Through those programs they have provided the infrastructure needed for demographic expansion, commerce, defense, agriculture, and protection against natural hazards. These programs are part of the overall mission of the Corps of Engineers which is to provide quality, responsive engineering services to the Army, other Department of Defense agencies, and the Nation in times of peace and war. The essence of public engineering is the transformation of society's goals, needs and mandates into technologies and infrastructure systems that link people, towns and industries with one another and to the rest of the world. Public engineering anticipates and responds to public values, whether it be the aesthetics of architectural design or the need to protect and restore the environment. The tangible reflection of society's need for competent and practical problem-solving that reflects public values is the public works engineering profession.

its water resources infrastructure. Engineers have designed and achieved a high level of performance and return on investment, while ensuring a high degree of public safety and reliability. Sustaining the growth and development of the Nation in an environmentally responsible manner requires that the Corps complete its ongoing transformation from water resources engineers to environmental engineers, from developers of the nation's water resources to stewards of the environment.

VALUE OF CORPS' MANAGED INFRASTRUCTURE TO SOLVING WATER RESOURCES

PROBLEMS

The Nation has made a series of water resource investments. These investments constitute a *portfolio* or a capital stock which provides an annual stream of benefits to the nation. Appendix A, *Value of the Corps of Engineers Civil Works Program to the Nation* provides more indepth discussion of this topic. Some of the benefits to the Nation can be readily measured in monetary terms, including flood damages prevented, reduced navigation transportation cost, hydropower, recreation, and water supply. Benefits from other programs such as emergency operations, regulatory, or environmental restoration, although providing significant returns, are not typically measured in monetary terms. Whether measured in monetary or non-monetary terms, all individual investment or program decisions are scrutinized in terms of, not only efficiency and effectiveness, but also completeness and acceptability.

The Corps' annual budget serves either to maintain the benefit stream (research and development, operations, maintenance, and major rehabilitation) or to increase the portfolio and, therefore, the future benefit stream (research and development, planning, design, and new construction). Evaluation of gross annual benefit estimates for those project purposes which can be measured in monetary terms can provide a partial estimate of the annual rate of return on the Corps' portfolio. This approach is analogous to how an individual investor would estimate the rate of return on a common stock portfolio, built up over a period of years. This approach and other analyses can help address the question, "does the country get a positive return from an approximate \$3 - \$4 billion annual investment in the Corps' program?"

Return on Investment of the Corps Capital Stock

Analysis of return on investment requires a defined portfolio. This information can be described in terms of the dollar value of the capital stock of Corps investments. Work from the Federal Infrastructure Strategy Program can provide such an estimate. The study estimated the Corps' *net capital stock* to be \$119.1 billion as of 1993. This is the total amount of net investment the Corps has put in place over the years through 1993, after subtracting out accumulated retirement of investments and depreciation.

Total annual returns (National Economic Development benefits) from flood damages prevented, navigation cost savings, hydropower generation market values, recreation visitor benefits, and water supply storage values were estimated to be approximately \$32.6 billion in 1993. Subtracting the \$1.6 billion of 1993 Operations and Maintenance costs and dividing the result by the depreciated value of the Corps' capital stock (\$119.1 billion), produces an annual return of about 26 percent. This is an estimate of the annual rate of return to the nation from the accumulated investment in the Corps' capital stock (portfolio). This analysis excludes non-Corps investments and operation and maintenance expenditures. It also excludes returns from those investments, for example ecosystem restoration, for which returns can not be measured in monetary terms.

The annual return on investment in Corps water resources projects is 26 percent.

Revenues to the Treasury

Returns to the nation from investments in the Corps' program can also be measured in terms, for example, of Federal tax revenues, and other revenues, and savings.

Total annual revenues and savings to the Treasury are estimated to be \$30.2 billion.

Based on income generated from activities associated with Corps project outputs, annual income taxes to the Treasury were estimated to be \$22.6 billion in 1993. This was estimated by applying average tax rates to the annual national income generated by economic activity associated with each project output. An estimated \$7.6 billion in additional revenue was generated from various sources including: Inland Waterway Trust Fund (\$103 million), Harbor Maintenance Trust Fund, (\$621 million), hydropower generation sales (\$515 million), water supply contracts (\$13 million), federal tax casualty loss deductions not taken due to reductions in flood damages (\$2.1 billion), flood emergency assistance payments not made from treasury (\$4.2 billion), and recreation fees (\$25 million).

Annual Returns

Any attempt to estimate the benefits of the Corps' Civil Works budget for a specific year is problematic. That is because the significance of the annual expenditures is not on the benefits that occur that year, but rather the long term potential for the investment to preserve or increase the capability of the infrastructure (capital stock).

Benefit-cost ratio for maintenance, new construction, and General Investigation studies is 7 to 1.

Estimating the benefit-cost ratio of continuing the Corps' maintenance, new construction, and General Investigation (new studies) programs, therefore requires some assumptions as to what would occur in the absence of these investments. One study estimated that the benefit-cost ratio for these investments would be about 7 to 1, assuming a 10 percent per year reduction in project outputs in their absence.

MAINTAINING THE INFRASTRUCTURE

The Corps' Civil Works Appropriations (budgets) vary year to year due to a number of factors. Currently, it hovers in the \$3.5 - \$4.0 billion range. It is apportioned approximately 45% to new investments (new projects, reconstruction of existing projects, major rehabilitations), and 55% for operations and maintenance of the stock of already completed projects entrusted to the Corps' care.

Over time the trend has been for an increase in the Corps' Civil Works budget **when measured in nominal or current dollars** (Figure 1). This growth in appropriations accompanies the increase in the project portfolio which the Corps planned, constructed, and for which it currently provides operation and maintenance. This portfolio of projects represents investment in the infrastructure which facilitates economic growth and development. A sizable share of the Corps' projects, both present and in the foreseeable future are in the navigation business area. This

Civil Works responsibility entails the design, construction, operation, and maintenance of the Nation's waterways, ports, and harbors for the primary purpose of facilitating commerce.

There are three groups of exceptions to the upwardly sloping trend of current dollar Civil Works appropriations (see Figure 1). The first two groups can be explained by factors such as the slowdown in general economic growth resulting in Federal budgetary constraints or by changes in the political climate. These downturns are respectively 1973-1975 and 1980-1986. The last exception in the trend, 1994 to 1996, cannot be explained by these same reasons since the Federal budget has grown over this period concurrent with the growth of the economy.

Since 1965, the Corps' Civil Works budget, regardless of its general increase over time, has continually become a smaller percentage of both the total Federal government budget and the Nation's Gross Domestic Product (GDP) (see Figure 2). In the context of the Federal budget and the growth in the number of projects, the Corps' mission has continually grown with the

**Civil Works Appropriations
Current Dollars**

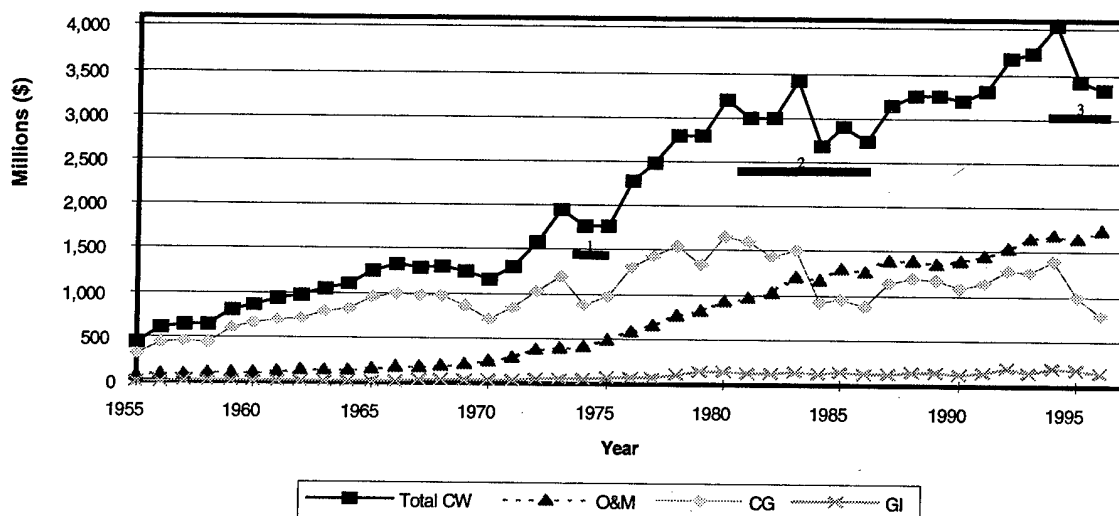


Figure 1. Trends in Current Dollar Civil Works Appropriations.

[O&M: Operations and Maintenance; CG:Construction General; GI: General Investigations]

nation's demands, while it has managed to complete its work and manage its responsibilities with less relative share of the Federal budget. Since 1955, the Corps' Civil Works appropriations have not exceeded 1.1% of the Federal government budget, and currently represent about 0.2% of all Federal government outlays.

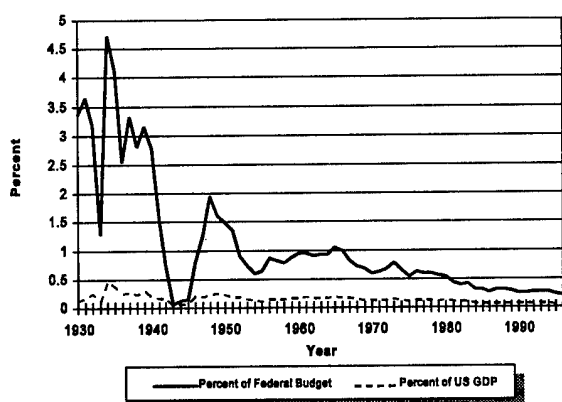


Figure 2. Civil Works Appropriations - Percent of Federal Budget and U.S. GDP.

Measuring the Corps' Civil Works appropriations in **constant dollars**,

demonstrates a different trend altogether and tells a different story. When measured in constant dollars (1995) the Corps' Civil

Works budgets have declined almost 50% since reaching their high point in 1973 (see Figure 3). Thus, although the Corps' Civil Works budget has generally increased in nominal terms, the overall purchasing power of its budget has decreased. This means that the increase in the Corps' appropriations have not kept pace with the increase in inflation. Indeed, an illuminating statistic is that the 1996 and 1958 Civil Works budgets are equivalent when measured in constant dollars.

Although the Corps' Civil Works budget has generally increased in nominal terms, the overall purchasing power of its budget has decreased ... the 1996 and 1958 budgets are equivalent when measured in constant dollars.

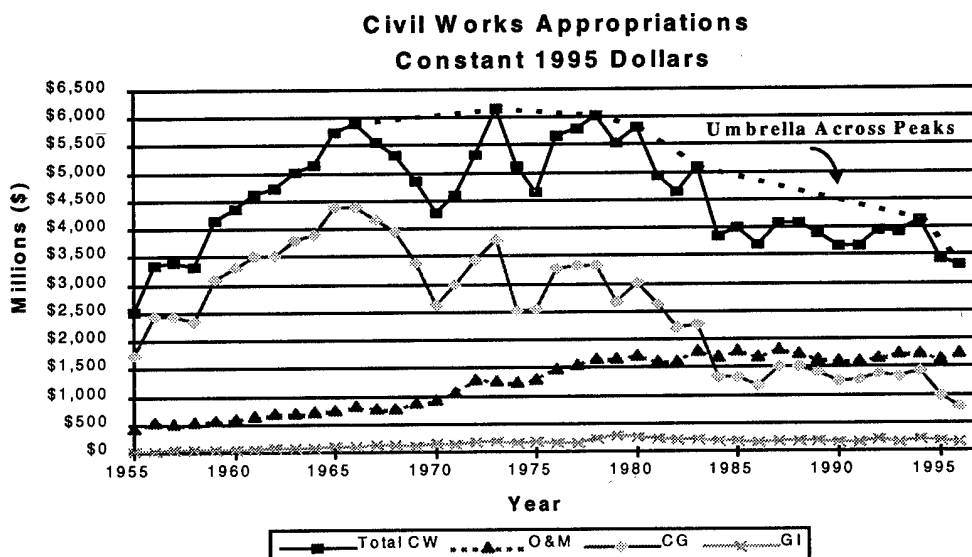


Figure 3. Constant 1995 Dollar Civil Works Appropriations.

The Corps' project inventory today, however, is vastly different than in 1958 or 1973. Today, the Corps must continue to operate and maintain the projects built prior to 1958, as well as those built and completed since 1958. It also provides for investigation and construction of new projects and completes these missions with about the same purchasing power as it had in 1958. In addition, much of the capital stock -- the multi-purpose dams, Federal levees, navigation channels, locks and dams, etc. -- for which the Corps is responsible for is aging. Some of this infrastructure is in need of replacement or major rehabilitation to meet the demands of our growing national economy. There is currently a growing backlog of deferred maintenance (now estimated at \$1.4 billion) on the Corps' existing and aging infrastructure. While the Corps will not jeopardize safety, this growing backlog of maintenance hinders its ability to operate and manage existing water resource projects within available funds, and to efficiently provide justified levels of project services.

If the Corps is to continue to be able to support new projects, it must find savings within its operation and maintenance program. Toward this end, the Acting Assistant Secretary of the Army (Civil Works) and Chief of Engineers recently published a compilation of potential cost savings measures which provide a starting point for analysis of operation and maintenance projects, and activities within Corps divisions and districts. However, the Corps may be near the limit in achieving fundamental savings from such efficiency measures, and post-poned maintenance can result in increased costs later.

Finally, the Corps, like every other private sector firm and government agency, is looking inwardly to ensure that the planning and engineering services that it provides to the nation meet the needs of the public, i.e. the ultimate customers. The Corps is striving to provide better service to the Army and Nation in traditional mission areas as well as enhanced service in strategically targeted Army military

and other civil mission areas. The Corps is undergoing its own performance review and reinvention to revolutionize its effectiveness, seek new opportunities, and invest in a talented, productive and diverse work force. The changes are being felt now across all the mission areas and will become steadily apparent as the services, business practices, bold process re-engineering, and innovative technology applications take hold across Corps district offices as "conventional wisdom."

BUSINESS PROGRAMS

The Corps' primary Civil Works missions are:

(1) **navigation**; (2) **flood and coastal storm damage reduction**; (3) **environmental protection**; (4) the **regulation of work by others in waters of the United States, including wetlands, and the oversight of the deposit of dredged and fill material in these waters**; (5) **emergency operations**; and (6) **support to other Federal agencies**. The Corps approaches water resource studies and projects utilizing an integrated systems (or watershed) perspective, often addressing not a single, but multiple objectives associated with its priority mission areas (i.e., navigation, flood and storm damage reduction, and environmental protection). Applying this perspective, the Corps may also consider additional allied water resources purposes in conjunction with the six primary responsibilities listed above. These allied purposes can produce additional water resources outputs associated with (7) **hydropower**, (8) **water supply**, including municipal/industrial or irrigation, and (9) **recreation**.

Together, the three priority mission areas of navigation, flood and storm damage reduction, and environmental protection typically represent over 80 percent of the Corps annual Civil Works appropriations.

The business programs are described in the following sections; the pages for each program are provided here to provide a quick reference to each program description.

<u>Business Program</u>	<u>Page</u>
-------------------------	-------------

NAVIGATION	10
FLOOD AND COASTAL STORM DAMAGE REDUCTION	16
ENVIRONMENTAL PROTECTION	21
EMERGENCY OPERATIONS	26
REGULATORY FUNCTION	28
RECREATION	31
HYDROPOWER	33
WATER SUPPLY	35
SUPPORT FOR OTHERS	37

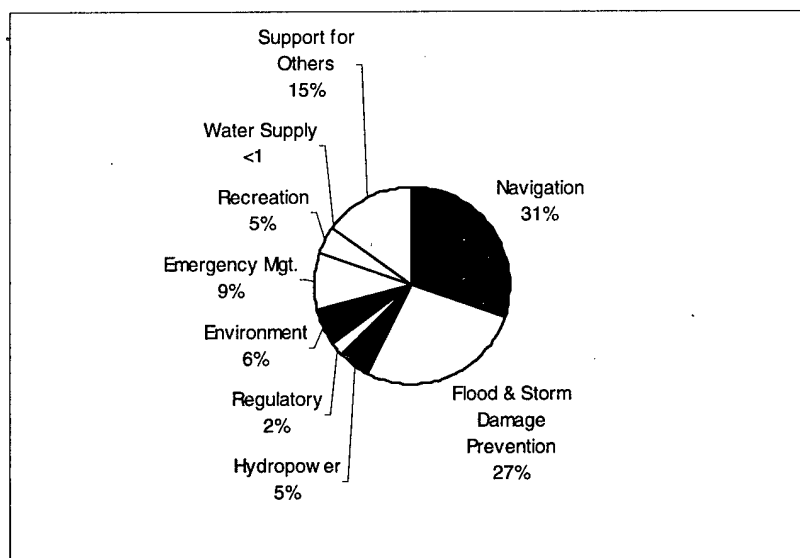


Figure 4. Civil Works FY97 Budget Authority by Business Program.

For operational and corporate performance management purposes, the Corps has defined the above areas as "business programs" which characterize the overall Civil Works mission. Figure 4 illustrates the distribution of FY 1997 budget authority by business program area.

NAVIGATION

The role of the U. S. Army Corps of Engineers with respect to navigation is *to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for movement of commerce, national security needs, and recreation.* The Corps accomplishes this mission through a combination of capital improvements and the operation and maintenance of existing projects. Capital improvement activities include the planning, design, and construction of new navigation channel works. These activities are performed for the navigation of shallow draft (equal to or less than 14-foot draft) and deep draft (greater than 14-foot draft) vessels on both inland waterways and harbors, coastal and lake ports, harbors and channels.

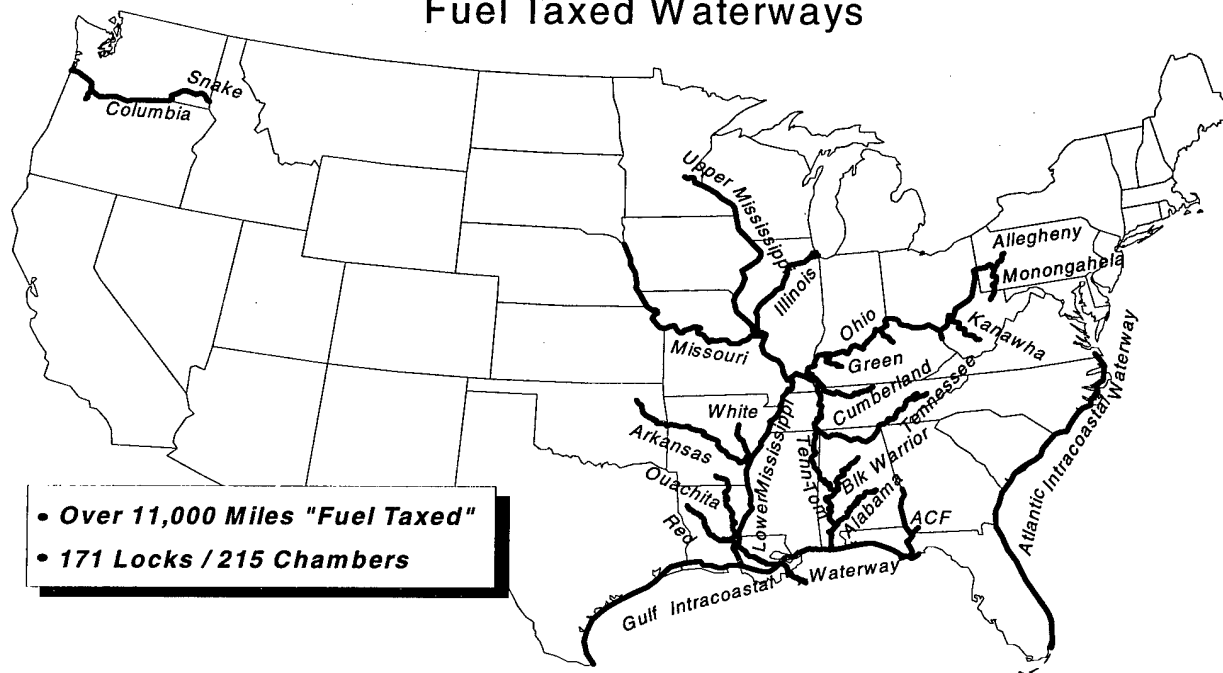
The system of waterways and harbors maintained by the U.S. Army Corps of Engineers remains one of the most important elements of the Nation's commercial transportation and national defense systems. Total waterborne commerce of the U.S. is about

2.2 billion tons annually. In a typical year, more than one billion tons of import/export cargo worth in excess of \$500 billion dollars flows through U.S. ports. More than one billion tons of additional cargo is shipped annually as domestic waterborne commerce. The inland waterways carry about one-half of all U.S. grain exports. U.S. ports and harbors also serve as vital logistical transportation centers to supply American troops deployed overseas, while waterways have played an increasing role in movements of military equipment and commercial cargo.

Inland Waterway System

There are approximately 25,000 miles of inland and intracoastal waterways in the United States. Of this total, about 11,000 miles constitute what is known as the commercial *Fuel-Taxed Inland Waterway System*. Vessel operators using fuel-taxed waterways pay into the Inland Waterways Trust Fund, which is used to fund half the cost of new construction and major rehabilitation of inland waterway infrastructure on the system.

Fuel Taxed Waterways



The *Fuel-Taxed Inland Waterway System* generally provides a minimum 9-foot navigation channel throughout the Mississippi River and tributaries, while the Gulf Intracoastal Waterway portion has a 12-foot authorized depth and the Columbia-Snake element has a 14-foot depth.

Inland waterways are ideal for transporting large tonnages of bulk commodities over long distances. Barges typically carry about 1,500 tons, but some can carry up to 3,000 tons. A 1,500 ton capacity barge is equivalent to 15 jumbo rail hopper-cars or 58 large semi-trucks. Tows of multiple barges are very fuel efficient. A barge tow on the Lower Mississippi River may consist of 40 barges containing up to 60,000 tons, which is equivalent to six 100 car unit trains or over

trending upward in actual dollars, although costs have remained relatively flat in constant dollars. Operations and maintenance costs on the *Fuel Taxed System* averaged approximately \$450 million (actual dollars) between 1977 and 1996. During this same period waterway traffic grew over 20%.

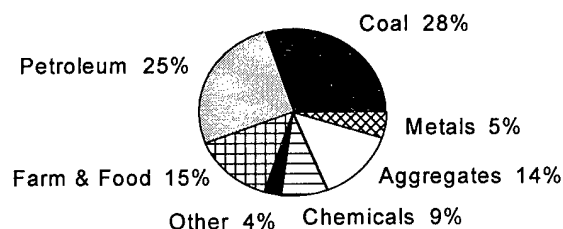
Construction of new locks with additional capacity and major rehabilitation of older locks is essential to maintain the efficiency of the waterway system and maximize net transportation savings. Many of the locks with critical delay problems have larger replacement projects either underway or in design. Others are part of system studies underway by the Corps, such as the segments on the Upper Mississippi River and Illinois Waterway, the Ohio River system, and the Texas portion of the Gulf Intracoastal Waterway.

Most domestic waterborne commerce consists of internal movements on the inland waterways. Internal traffic has generally trended upward, increasing from less than 200 million tons in 1950 to over 620 million tons in 1996. Coal is the major commodity transported on the system, followed by petroleum products, and food and farm products. Other major commodity groups transported on the system include non-metallic minerals, industrial chemicals, metallic ores, forest products and agricultural chemicals.

Queuing delays at locks are estimated to cost waterway operators on the order of \$700 per hour, increasing total transportation cost and diminishing economic benefits. Delays range up to 12 hours per tow on occasion at high traffic density locks. Lock delays throughout the waterway system amounted to over 550,000 hours in 1996, causing an estimated \$385 million in delay costs to the

By the year 2000, 40 percent of all lock chambers on the *Fuel Taxed Inland Waterway System* will have exceeded their original 50-year design lives. As a consequence of aging facilities and increased waterborne traffic, the operations and maintenance costs needed to maintain the system have generally been

**Historic Inland Waterway Traffic
Commodity Shares**



The Water Resources Development Act of 1986 authorized eight new or replacement locks throughout the system. Construction of these locks gradually caused an increase in

The waterways support thousands of U.S. jobs in water transportation and in a variety of agricultural, mining, and manufacturing industries which use the waterways. There are nearly 800,000 jobs in river states with a total \$1.7 billion in payroll generated by the inland water transportation industry, and over \$425 million in payroll taxes (Federal and state) generated annually by the inland water transportation industry.

annual capital outlays from \$50 million in 1987 to a peak of nearly \$300 million in 1991, when construction of most of the locks were underway simultaneously. Outlays have since fallen with the completion of several locks to about \$190 million in 1995 and \$170 million in 1996.

Subsequent legislation authorized an additional six projects and ten major rehabilitations. As these projects move into the peak construction phase around the year 2000, outlays will need to increase sharply to nearly \$400 million annually. However, this need for increased levels of expenditures for system modernization comes at a time when future Federal discretionary spending is being constrained. The Corps' total annual spending (including construction and operations and maintenance funding) for inland waterways generally increased in actual dollars between 1987 and 1994, averaging approximately \$872 million for that period (see Figure 5). However, subsequent spending in 1995 and 1996 sharply declined with reductions of 15.6 and 23.6 percent, respectively, from the base average of the previous eight years. In fact, the \$666 million expended in 1996 was actually lower than 1987 outlays (\$696 million).

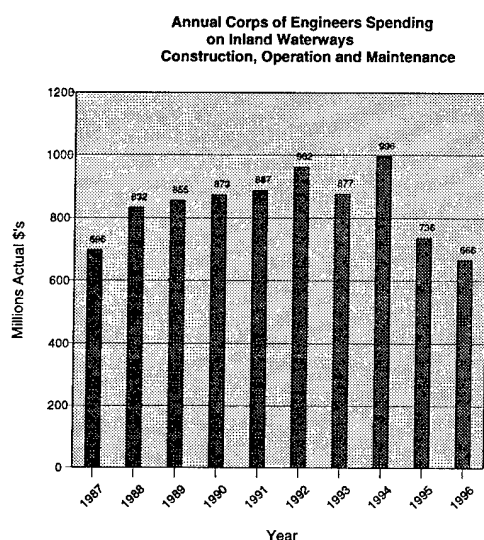


Figure 5. Annual Corps Spending on Inland Waterways Construction, Operation and Maintenance.

Ports and Harbors

The Nation's modern port infrastructure is vital to maintaining the Nation's status as an economic superpower. Over the last twenty years our national economy has become increasingly interdependent with the global marketplace. United States foreign trade has increased to where it now accounts for about one-fifth of the U.S. gross domestic product (GDP). The *U.S. Harbor System* provides the critical link in the Nation's intermodal freight transportation network. Approximately 98% of the Nation's international trade is transported via water.

The importance of the Corps mission in maintaining channel depths at U.S. harbors is underscored by an estimated one job in five Nation wide being dependent, to some extent, on the commerce handled by these ports. On the average, the imports and exports of any given state use the facilities of approximately 15 different ports around the country. Over 75 U.S. ports annually handle more than 5 million tons of cargo. This network of ports truly serves the Nation as a system, providing shippers and carriers across the U.S. and worldwide with the intermodal and economic efficiencies needed to maintain a robust economy.

The *U.S. Harbor System* maintained by the Corps comprises all navigation projects for which operations and maintenance costs are recoverable from the Harbor Maintenance

U.S. ports and harbors annually handle about \$600 billion in international cargo generating over \$150 billion in tax revenue, nearly \$16 billion in jobs, \$515 billion in personal income, contributing \$783 billion to the Nation's GDP, and \$1.6 trillion in business sales. Foreign waterborne trade now annually exceeds one billion tons, with imports totaling approximately 675 million tons and exports approaching 500 million tons. U.S. ports annually handle over 13 million TEUs* of foreign container traffic.

* (TEUs = "twenty-foot equivalent units", an industry term for one 8'x8'x20' container)

Trust Fund. This includes all Federal navigation projects except those that are part of the *Fuel-Taxed Inland Waterways System*. The Corps maintains approximately 1,000 such port and harbor projects at an average annual cost of about \$525 million (1996 dollars). The annual Federal construction costs for the system averaged about \$125 million for the period 1977-1996.

Approximately 300 of the projects within the Corps' portfolio are deep draft projects, while about 700 are shallow draft coastal or inland harbors. The deep draft projects have been maintained by the Corps at an average annual expenditure of about \$450 million, while shallow draft operations and maintenance costs average almost \$74 million annually (both in 1996 dollars) over the last twenty years.

One hundred percent of the Corps' operations and maintenance costs for the U.S. Harbor System are drawn from the Harbor Maintenance Trust Fund. Trust fund receipts between 1990 and 1996 increased from \$176 million to \$741 million. The trust fund balance has been increasing in recent years as the volume of commerce subject to the fee at U.S. ports has risen significantly and at a faster pace than expenditures. At the same time, efforts to minimize dredging requirements for both economic and environmental reasons have reduced trust fund transfers to the Corps. This pattern is projected to continue in the near-term, although a number of factors may mitigate this trend. These include a possible reduction in fee level, a pending legal challenge to levying the fee on exports, and the potential to use Trust Fund revenue for purposes beyond those currently authorized.

Dredging

Dredging of channels, harbors, and waterways is accomplished by either industry (contractor-owned) or Corps' (government owned) dredges or equipment. To maintain the Nation's navigable waterways, between 250 to 300 million cubic yards of material are dredged in the United States each year. Maintenance work typically represents over 80% of the dredging quantities, while about 70% or more of the dredging is accomplished by industry equipment.

The annual cost of the Corps' overall dredging program increased to over \$500 million in 1993 and has remained above that level since. The Midwest Flood of 1993 was responsible for an increased quantity in 1994, as natural disasters periodically cause wide fluctuations in the annual quantity of dredged material and dredging outlays.

The U.S. Army Corps of Engineers and the U.S. Environmental Protection agency use scientific procedures for identifying and assessing contaminated sediments at dredging projects. These procedures have been published in technical manuals to ensure that dredged material will be managed in an environmentally responsible manner. About 95 percent of the dredged material is not contaminated and is a resource which, if placed in proper locations, can be put to productive use. Of the total annual amount dredged, about 60 million cubic yards are placed in ocean waters at about 108 sites approved by the U.S. Environmental Protection Agency. The remaining materials are placed in a variety of locations, including uplands, beach sites, or shallow waters to create wetlands and riverine sandbars. When contaminated sediments are identified in material that must be dredged for navigation, proper safeguards are undertaken to isolate the contaminants from the environment. Where dredged materials are highly contaminated and traditional disposal is not suitable, one of a number of special remediation technologies might be considered.

Key Corps of Engineers Navigation Authorities

General Navigation

- Authority stems from the Commerce Clause of the Constitution.
- Federal work must be in the general public interest and available to all on equal terms.
- The Federal interest extends only to primary access channels, anchorages, turning basins, locks and dams, harbor areas, jetties and breakwaters.

Navigation, Inland Waterways

- Section 102, Water Resources Development (WRDA) 1986 (Public Law 99-662) established that projects on waterways subject to the Federal fuel tax are funded 50 percent from Federal general revenues and 50 percent from the Inland Waterways Trust Fund (IWTF), with no non-Federal cost sharing. Inland channels not authorized for improvement using the IWTF are cost shared according to the terms for harbors. The operations and maintenance of inland waterway projects is established at 100 percent Federal cost.

Navigation, Harbors

- Section 101 and 214, WRDA 1986 and;
- Section 13, WRDA 1988 (P.L. 100-676) generally establish cost sharing policy for construction, and operations and maintenance of Corps harbor projects. The non-Federal share for the construction of the "General Navigation Features" (GNF) associated with each harbor is based on the project's depth below mean low tide: down to 20 feet the non-Federal share is 10 percent of GNF costs, over 20 feet and down to 45 feet the non-Federal share is 25 percent, and for projects exceeding 45 feet the non-Federal share is 50 percent of the GNF costs.

Dredged Material Disposal

- Section 201, WRDA 1996 (P.L. 104-303) provides that land-based and aquatic dredged material disposal areas built for the operations and maintenance of navigation projects shall be considered a GNF and cost shared in accord with Title I of WRDA 1986.
- Section 207, WRDA 1996 allows the Federal government to select, with the consent of the non-Federal sponsor, a disposal method for a navigation project that is not the least-cost option if it is determined that the incremental costs of such disposal are reasonable in relation to the environmental benefits, including benefits to the aquatic environment, derived from the creation of wetlands and shoreline erosion control.
- Section 217, WRDA 1996 allows additional capacity at Federal confined disposal facilities, beyond what would be required for project purposes, for acquisition and use by non-Federal interests at their expense.

Continuing Authorities Program

- Section 107, 1960 River and Harbor Act (P.L. 86-645), as amended, authorizes the Corps to study, adopt, construct and maintain "small" navigation projects without specific authorization, but using the same procedures/policies that apply to Congressionally authorized projects. The Federal cost of a "small" project can not exceed \$4 million, per Section 915(d) of P.L. 99-662.

FLOOD AND COASTAL STORM DAMAGE REDUCTION

Flood and coastal storm damage reduction products and services provided by the U. S. Army Corps of Engineers are aimed at saving lives and reducing the level of property damage incurred by floods and storms. They are part of a continuing process, involving both Federal and non-Federal action, that seeks a balance between resource use and environmental quality in the management of the inland and coastal flood plains as components of the larger human communities. This process is called flood plain management. The flood damage reduction aspects of flood plain management involve modifying floods and modifying the susceptibility of property to flood damages. The former embraces the physical measures, commonly called "flood control"; the latter includes regulatory and other measures intended to reduce damages by means other than modifying flood waters. By guiding flood plain land use and development, flood plain regulations seek to reduce future susceptibility to flood hazards and damages consistent with the risk involved and serve in many cases to preserve and protect natural flood plain values.

Most Corps flood and coastal storm damage reduction projects are constructed as joint ventures between the Federal government and non-Federal sponsors. New projects, once built, are typically owned, operated and maintained by the sponsors. **These projects have prevented nearly \$500 billion in riverine and coastal flood damages since 1950 alone** (see Figure 6). In conjunction with the Corps' Flood Plain Management activities, the National Flood Insurance Program (NFIP) and the many state and local flood plain regulatory controls also have prevented billions of dollars in flood

damages, saved many lives, and provided several billion dollars of flood damage relief and flood insurance payments.

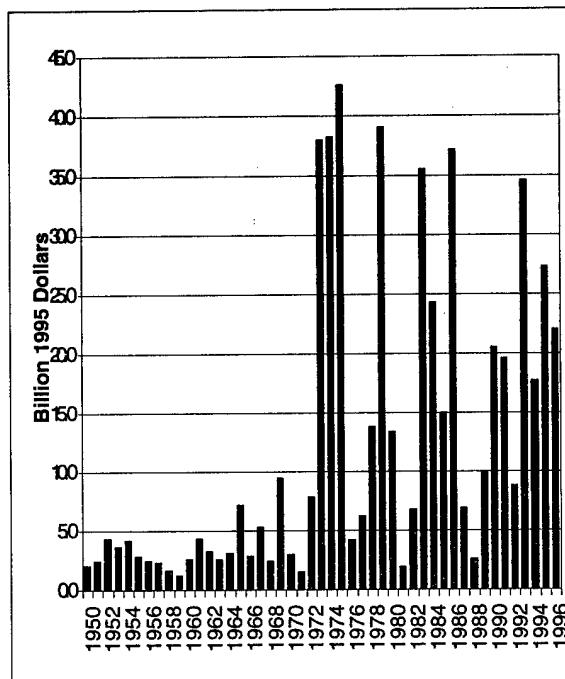


Figure 6. Real Flood Damages Prevented 1950-1996

Flood Damage Reduction

In the **Flood Control Act of 1936**, Congress established as a nationwide policy that flood control (i.e., flood damage reduction) on navigable waters or their tributaries is in the interest of the general public welfare and is therefor a proper activity of the Federal Government, in cooperation with the states and local entities. The 1936 Act, as amended, and

Since the Flood Control Act of 1936 the Corps has constructed approximately 400 major lake and reservoir projects, emplaced over 8,500 miles of levees and dikes, and implemented hundreds of smaller local flood protection projects that have been turned over to non-Federal authorities for operation and maintenance.

scope of the Federal interest to include consideration of all alternatives in controlling flood waters, reducing the susceptibility of property to flood damage, and relieving human and financial losses.

Since the Flood Control Act of 1936 the Corps has constructed approximately 400 major lake and reservoir projects, emplaced over 8,500 miles of levees and dikes, and implemented hundreds of smaller local flood protection projects that have been turned over to non-Federal authorities for operation and maintenance. The Federal government has expended about \$100 billion (1996 dollars) for flood damage structures and their operation and maintenance.

Through the **Flood Plain Management Services Program**, created through **Section 206 of the 1960 Flood Control Act**, the Corps also can provide flood plain information,

technical assistance, and planning guidance (at 100% Federal cost) at the request of states and local governments to help them reduce potential flood damages. As a key element of the Nation's flood damage reduction approach, the Corps' Flood Plain Management Services program complements its protection measures by reversing pressures for development of flood plain lands. The program has provided free site specific and community flood hazard information, advice and guidelines to many thousands of public and private agencies, groups and individuals for over 30 years. Requests for those services number around 50,000 per year. Thus far, specific flood hazard information (e.g., flood elevations by frequency at specific locations) has been provided to guide development involving around \$6 billion in property value.

About 50,000 requests for Flood Plain Management Services are received annually, and flood hazard information provided to date has guided development involving about \$6 billion in property value.

Evidence indicates that flood plain regulatory controls, as prompted by the NFIP, have greatly deterred the development of damageable property in the Nation's flood plains. However, such controls are not universal, and are not always strongly enforced. As a result, growth in damageable development has continued over recent decades, albeit at a reduced rate. Although the NFIP has been a powerful incentive to state and local governments to adopt regulatory controls, the insurance itself has not been a panacea. Of the 20,000 communities in the United States, over 90 percent are participating in the National Flood Insurance Program (NFIP). However, fewer than 20 percent of all flood plain occupants are actually buying the insurance. A number of proposed watershed approaches to water resources problems and opportunities involve more holistic and integrative approaches to flood plain management. They also emphasize examination of the potential applicability of non-traditional measures and closer collaboration among agencies involved in floodplain management activities.

Coastal Storm Damage Reduction

The Corps' work in shore protection began in the 1930's when Congress directed the Corps to study ways to reduce erosion along the U.S. coastline and the Great Lakes. Prior to World War II, Corps involvement in coastal storm damage reduction was limited to a few storm damage reduction projects protecting against hurricane induced ocean surges, and cooperative analyses, planning studies and technical advisory services for beach erosion control.

Hurricane protection was added to the erosion control mission in 1956 when Congress expanded the Corps' role by authorizing cost-shared Federal participation in shore protection and restoration of publicly-owned shore areas. Protection of private property is permitted only

if such protection is incidental to the protection of public areas, or if the protection of private property would result in public benefits. Federal assistance for periodic nourishment was also authorized on the same basis as new construction, for a period to be specified for each project, when it was determined that it would be the most suitable and economical remedial measure.

The Corps' shore protection program has produced 82 specifically authorized and constructed projects, protecting 226 critically eroding miles of the Nation's 2,700 miles of shoreline.

The Corps' shore protection program has produced 82 specifically authorized and constructed projects. These 82 projects protect 226 miles of the nation's 2,700 miles of shoreline that have been identified as critically eroding. These projects were constructed between 1950 and 1993 at a cost of \$670 million. The total cost of the program, including initial restoration, periodic nourishment, structures and emergency measures, has been estimated at \$1.8 billion (1995 dollars). Approximately 65% of these costs have been Federal expenditures, with the remainder being contributed by local project sponsors.

Federal policy has established that projects associated with an existing shore protection project, and projects associated with impacts caused from other Federal projects (Federal harbor mitigation) will be a higher budgetary priority. In addition, projects that are flood related, projects in an area of public infrastructure and/or primarily residential, commercial, and industrial structures, will also be a higher priority. Such projects, however, must be located in areas which are not recreational or tourist destinations, and do not involve significant long-term Federal

investments beyond the initial construction project.

Continuing Authorities

The Corps has several authorities under which it can plan, design, and construct certain types of water resources investments without specific Congressional authorization. These authorities constitute the Continuing Authority Program when referred to as a group.

Section 14 of the Flood Control Act of 1946 authorizes the study, adoption, and construction of emergency streambank and shoreline protection works (up to \$500,000 Federal share per project) to protect highways, bridges, and other public works. **Section 205 of the Flood Control Act of 1948** authorizes the construction of small flood control projects (up to \$5 million Federal share per project).

Section 208 of the Flood Control Act of 1954 permits in-stream clearing and snagging projects in the interest of flood control (also a \$500,000 Federal limit).

There are two continuing authorities that apply to small projects within the shore protection program. **Section 103 of the River and Harbor Act of 1962** authorized Federal participation in the cost of protecting the shores of publicly owned property. **Section 111 of the River and Harbor Act of 1968** provided authority to investigate and implement structural and nonstructural measures for the prevention or mitigation of shore damages attributable to Federal navigation works. Project cost limits for each of these authorities are \$2 million.

Residual Damages

Despite all the damage prevention and flood plain management efforts, massive residual

Residual Damages

Despite all the damage prevention and flood plain management efforts, massive residual flood damage problems remain across the Nation. Emergency disaster relief costs are still high, averaging around \$3 billion per year (1991-1997), and uninsured losses continue to mount. Although total residual damages remain high, additional insights into the trend in flood damages can also be provided through examining the Nation's annual flood damages as a percent of Gross National Product (see Figure 7). While damages vary widely from year to year, they represent a relatively constant, if not slightly decreasing, percent of GNP from 1903 through 1996.

There are two aspects of the residual problem. One is the extensive unprotected development still remaining within the "100-year" flood plains along the Nation's streams, despite all flood control, floodplain management, and

regulatory efforts. The other is the continuing development just outside of the "100-year" floodplain, where it is not subject to floodplain regulations, but is subject to less frequent (for the particular stream and location) floods. Also, development in "flood free" areas continues to contribute to increasing storm water runoff rates, increasing flooding potentials beyond previous expectations. Today, there are over 20,000 communities in the United States. Most of these, as well as extensive rural floodplain areas, are subject to some magnitude and frequency of flooding. Only 10-15% of these communities are protected to some extent by flood protection measures. Very few are afforded a high degree of protection.

At present, the Corps has flood damage prevention feasibility studies underway for less than one percent of the Nation's communities.

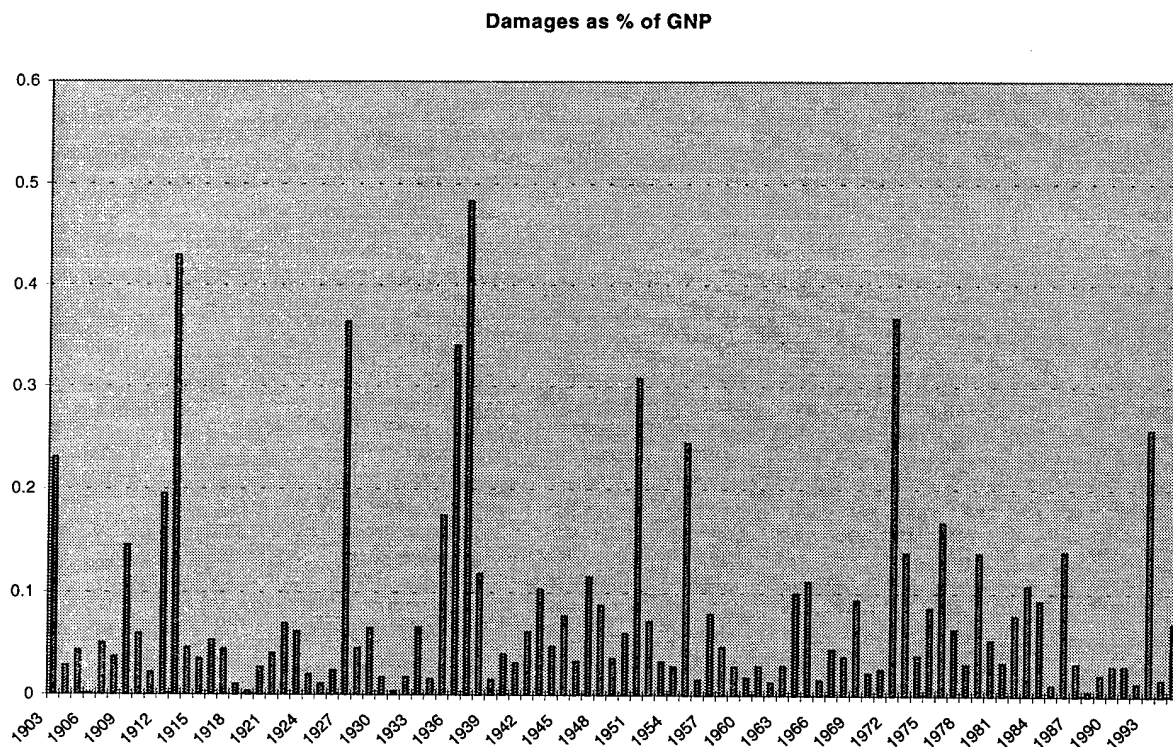


Figure 7. Annual Flood Damages as Percent of Gross National Product

Environmental Protection

The *Environmental Protection* business function is a growing, multifaceted mission area that makes critical contributions towards meeting the Nation's environmental goals. Not only is this program area growing, it is evolving. Areas of emphasis under this *Environmental Protection* program area include: *ecosystem restoration*, *environmental mitigation*, *environmental stewardship*, and *environmental compliance*.

Environmental considerations have been a major part of the U.S. Army Corps of Engineers commitment to providing comprehensive engineering, management, and technical support to the Nation for two centuries. As a matter of law and good engineering practice, the Corps has attempted to manage its projects to minimize adverse environmental impacts. The Corps' project portfolio includes over 140 water resources projects that have fish and wildlife management objectives as an authorized purpose.

Since 1986, the Corps has worked to transition its programs and hone its capabilities to better respond to national environmental restoration and protection priorities related to water and related land resources. Today, the Corps strives not only to **comply** with environmental requirements, but to aggressively **advance** goals and policies related to environmental restoration, protection, and stewardship. The Corps incorporates environmental considerations into the decisions for every proposed project. Consistent with the requirements of the **National Environmental Policy Act (NEPA)** the Corps completes an Environmental Impact Statement for most proposed projects. Numerous other environmental laws also influence decisions associated with the impacts of proposed projects (see Table 1). In addition to meeting compliance requirements, the Corps also plans

and implements projects specifically for the **purposes of ecosystem restoration**. Furthermore an ecosystem perspective is now being applied in considering both the environmental impacts of Civil Works projects, and mitigation or restoration alternatives.

Funding for environmental protection and restoration studies, projects, programs and research has more than doubled over the past ten years, and now constitutes over 20% of the Civil Works budget. (This includes funding for the Regulatory Program and the new Formerly Utilized Sites Remedial

Action Plan.) At any given time, over 50 studies are underway to examine the condition of existing ecosystems, or portions thereof, to determine the feasibility of restoring degraded ecosystem structure and function, or to protect ecological resources from future degradation.

Efforts are also now underway within the Corps to examine watershed management in a more holistic manner that gives consideration to both economic and environmental objectives, as well as to non-traditional alternatives for accomplishing watershed management goals. This approach attempts to balance the shifting needs and desires of water resources stakeholders through employing known tools and procedures in innovative combinations.

The Corps has entered into many new partnerships as part of its evolving environmental programs.

Collaborative multi-agency approaches and efforts contributing to broader regional goals are given

Funding for environmental studies, projects, programs and research has more than doubled over the past ten years, and now constitutes over 20% of the Civil Works budget

The Corps has been the co-leader for 53 *Coastal America* projects in over 20 states.

high priority, e.g. projects that contribute to regional environmental management plans, or multi-agency initiatives. The Corps participates in cooperative efforts, such as the *Coastal America Partnership* that effectively combine Federal investments to achieve greater ecosystem restoration benefits than individual agencies alone can achieve.

Table 1. Federal Environmental Laws

(Source: Civil Works Environmental Desk Reference)

Abandoned Shipwreck Act of 1987	Food Security Act of 1985
American Folklife Preservation Act	Hazardous Materials Transportation Act
American Indian Religious Freedom Act	Historic Sites Act of 1935
Anadromous Fish Conservation Act	Historical and Archeological Data - Preservation
Antiquities Act of 1906	Land and Water Conservation Fund Act of 1965
Archeological Resources Protection Act of 1979	Magnuson Fishery Conservation and Management Act
Bald Eagle Protection Act	Marine Mammal Protection Act of 1972
Clean Air Act	Marine Protection, Research, and Sanctuaries Act of 1972
Clean Water Act	Migratory Bird Conservation Act
Coastal Barrier Resources Act of 1982	National Environmental Policy Act of 1969
Coastal Wetlands Planning, Protection and Restoration Act	National Historic Preservation Act of 1966
Coastal Zone Protection Act of 1996	National Invasive Species Act of 1996
Coastal Zone Management Act of 1972	National Trails System Act
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA)	Native American Graves Protection and Repatriation Act
Conservation Programs on Government Lands (Sikes Act (Fish and Wildlife Conservation on Military Reservations)	Noise Control Act of 1972
Deepwater Port Act of 1974	North American Wetland Conservation Act
Emergency Planning and Community Right-To-Know Act of 1986	Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990
Emergency Wetlands Resources Act	Oil Pollution Act of 1990
Endangered Species Act of 1973	Outer Continental Shelf Lands Act
Environmental Quality Improvement Act of 1970	Pollution Prevention Act of 1990
Estuaries-Inventory- Study	Reclamation Projects Authorization and Adjustments Act of 1992
Farmland Protection Policy Act, Subtitle I of Title XV of the Agriculture and Food Act of 1981	Reservoir Areas-Forest Cover
Federal Facilities Compliance Act of 1992	Resource Conservation and Recovery Act of 1976
Federal Insecticide, Fungicide, and Rodenticide Act	Rivers and Harbors Appropriation Act of 1899
Federal Land Policy and Management Act of 1976	Safe Drinking Water Act
Federal Water Project Recreation Act	Soil and Water Resources Conservation Act of 1977
Fish and Wildlife Conservation Act of 1980	Solid Waste Disposal Act
Fish and Wildlife Coordination Act	Submerged Land Act
Flood Control Act of 1944	Surface Mining Control and Reclamation Act of 1977
	Sustainable Fisheries Act
	Toxic Substances Control Act
	Wild and Scenic Rivers Act
	The Wilderness Act

Ecosystem Restoration

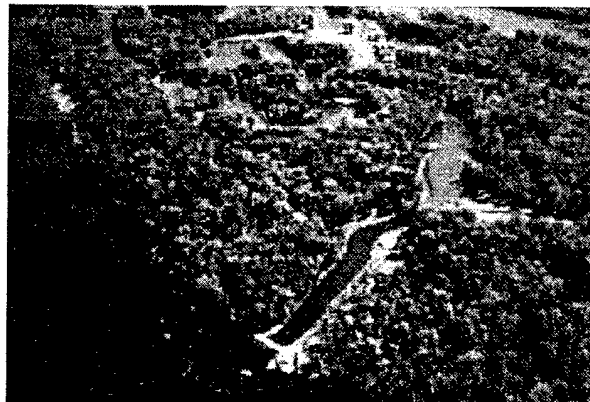
Ecosystem restoration is among the priority budget categories in the Civil Works program. Until recently, priority has been given to those initiatives where an existing Civil Works project has resulted in environmental degradation or where modification to an existing project would provide the most cost-effective means to accomplish the restoration. However, the Corps recognized the numerous needs and opportunities for restoration of ecological resources "not linked" to existing projects, and sought and received authority to address these opportunities in the Water Resources Development Act of 1996.

Ecosystem restoration is now one of the priority budget categories within the Civil Works program.

The Corps' role in ecosystem restoration focuses on problems and opportunities associated with restoring or protecting ecological resources. Restoration opportunities involving modification of hydrology or substrate are likely to be most appropriate for Corps' initiatives, and can involve either structural or operational approaches. Most of these restoration opportunities are likely to address wetlands, riparian, and aquatic ecosystems. These projects can be linked with modifications to the operation or structure of existing projects, or not. Dredged material also can be used to benefit aquatic ecosystems. Like other types of Civil Works projects, ecosystem restoration projects must be justified. However, they are not justified in monetary terms, but rather through alternative processes which use both non-monetary and monetary information.

Ecosystem restoration studies can be individually authorized or pursued through one of three programmatic authorities. **Section 1135 of the Water Resources Development Act of 1986** authorized the Corps to review existing

projects to determine the need for modifications that would help improve the quality of the environment. These modifications can be to the physical infrastructure itself or to project operation. Restoration initiatives, which are cost-shared with non-Federal sponsors, must be consistent with the authorized purposes of the project being modified. Since 1991 the Corps has completed 18 Section 1135 projects, and over a dozen others are currently under construction. **Section 204 of the Water Resources Development Act of 1992** provides authority to use dredged material from Federally-authorized navigation channels to protect, restore, and create aquatic and ecologically-related habitats, including wetlands. **Section 206 of the Water Resources Development Act of 1996** recently provided additional authority to engage in aquatic ecosystem restoration projects.



In addition to specific ecosystem restoration programmatic authorities, **Section 22 of WRDA 1974** gives the Corps authority to offer technical planning expertise in support of state and tribal development of comprehensive water resources plans for the development, use, and conservation of water resources in a basin. Among the objectives which can be addressed by these studies are flood damage reduction, water supply, water conservation, water quality, hydropower, erosion, navigation, and environmental resource restoration and

protection. This authority was expanded to include **ecosystems** and **watersheds** by **Section 221 of the Water Resources Act of 1996**.

There are many examples of Corps ecosystem restoration activities. As part of a comprehensive review of the entire **Central and Southern Florida System**, the Corps is working to develop ways to restore the south Florida ecosystem as well as meet other water-related needs in the region. Since 1990, the Corps has participated in a regional program to protect and restore coastal wetlands in Louisiana, under the **Coastal Wetlands Planning, Protection and Restoration Act**. Through the **"Lake Tahoe Basin (California and Nevada) Ecosystem Restoration Study"**, the Corps is one of the principal Federal agencies working to address the degradation of Lake Tahoe water quality. Each of these examples and the Corps' other ecosystem restoration initiatives are collaborative efforts with other agencies, organizations, and private citizens.

Another very important, but perhaps less visible, aspect of the Corps' environmental restoration work is the major environmental restoration support provided to other elements of the Department of Defense, the U.S. Environmental Protection Agency, the Department of Energy, and other Federal agencies. This technical support is provided on a cost-reimbursable basis and includes project management, cost estimating, value engineering, hydrological analyses, geological analyses, topographical analyses, real estate assessments, site-wide mapping, environmental documents, and compliance audits.

Environmental Mitigation

The Corps strives to prevent damages to environmental resources to the extent practicable through sound planning and design. The Corps' planning and design procedures incorporate the mitigation principles defined within the Council on Environmental Quality's **NEPA** guidelines (i.e. first avoid the impact; next minimize the impact; and, finally compensate for unavoidable damages to resources).

The Upper Mississippi River System-Environmental Management Program was authorized to offset the impacts of the navigation system on the Upper Mississippi and Illinois Rivers. To date, 23 habitat rehabilitation and enhancement initiatives have been completed, modifying over 20,000 acres to benefit fish and wildlife. Construction is underway on 14 more projects and an additional 13 are in the planning and design stages.

The **Fish and Wildlife Coordination Act of 1958** requires that the Corps consult with other Federal and state agencies to conserve fish and wildlife resources, avoid potential losses, and possibly enhance the fish and wildlife resources that may be impacted by a proposed Corps water resource development project.

Environmental Stewardship

The Corps manages nearly 12 million acres of land and water associated with 463 water resources projects, an area about the size of the states of Maryland and Massachusetts, combined. The Corps' stewardship mission is to manage, conserve, and sustain natural resources consistent with the ecosystem management principles, guidelines, and authorized project purposes, while providing quality public outdoor recreation experiences to serve the needs of present and future generations. The Corps' goal is to provide

natural resources stewardship and public recreation opportunities that contribute to the quality of American life.

Environmental stewardship programs are developed both for mitigation lands (lands on which mitigation measures compensate for adverse ecological impacts unavoidably caused by Corps' projects or activities) and for Corps' administered lands. The Corps strives to work with other Federal resource agencies, as well as state and local agencies in managing long-term public access to and use of the natural resources. Collaborative approaches are used in developing specific natural resource management goals and coordinating management measures for all project lands.

In all aspects of natural and cultural resources management, the Corps promotes awareness of the environmental values and adheres to sound environmental stewardship,

protection, compliance and restoration practices. The Corps integrates the management of diverse natural resource components, such as fish, wildlife, forests, wetlands, grasslands, soil, air, water, and cultural resources (historic properties, archeological sites) with the provision of recreation opportunities.

Numerous opportunities exist for stakeholder involvement in the stewardship of resources at Corps' projects. Cooperation with other natural resource agencies to work toward both national and regional natural resource management objectives is encouraged. Some examples

There are approximately 40,000 archeological sites on Corps lands, with about 5,000 sites listed or eligible for listing on the National Register of Historic Places. Since 1966, the Corps has spent \$300 million on cultural resources management. On the average, the Corps spends \$15 million annually on cultural resources planning and management.

include joint ventures under the *North American Waterfowl Management Plan*, the development and implementation of endangered species recovery plans, participating with the U.S. Forest Service to prevent and suppress forest damage due to pest and disease outbreaks, and partnership efforts under the Civil Works Recreation Fishing Conservation Action Plan.

Environmental Compliance

The Corps takes a pro-active approach to achieving and maintaining compliance with applicable environmental laws and regulations at the hundreds of diverse projects and facilities it operates and maintains throughout the United States. The Corps manages water resources projects and public use areas, and oversees the operation of a myriad of other facilities and operations such as marinas, timber and agricultural areas, oil and gas extraction leases, and other activities conducted by the states and other entities on Corps managed properties.

In order to protect these major investments, assure environmental compliance, and continually improve its stewardship, the Corps has established an environmental compliance program utilizing periodic assessments of its operations under the Environmental Review Guide for Operations, or ERGO.

ERGO is a comprehensive checklist of relevant environmental laws and regulations which provides facility managers with a picture of their compliance status and identification of corrective actions required.

The Corps has instituted a pollution prevention initiative for implementation at Corps' facilities which is aimed at preventing pollution before it occurs. Each Corps' facility has developed a pollution prevention plan to identify areas of opportunities specific to its operations, and methods of accomplishing these improvements.

This initiative has resulted in improvements to the environment and the efficiency of day-to-day operations.

Formerly Utilized Sites Remediation Program

The Formerly Utilized Sites Remedial Action Program (FUSRAP) was one of several U.S. Department of Energy (DOE) programs created to address radioactive contamination in excess of guidelines at a number of sites throughout the United States. DOE and its predecessor agencies, the Manhattan Engineer District and the Atomic Energy Commission, used many of these sites for processing and storing uranium and thorium ores during the 1940s, 1950s, and 1960s. This program was transferred to the U.S. Army Corps of Engineers in the Energy and Water Development Appropriations Act for Fiscal Year 1998.

Sites that became contaminated through uranium and thorium operations during the early period of the Nation's nuclear program were decontaminated and released for use under the regulations in effect at the time. Since then, more stringent standards have been developed. Additional cleanup efforts is being performed to bring these sites into compliance with today's more stringent environmental standards.

To assess these sites further and take appropriate remedial action, DOE initiated FUSRAP in 1974. Under FUSRAP, initial site activities focused on reviewing old records and surveying sites to determine if contamination exists and if remedial action is required. If it is determined that remedial action is required, a site becomes eligible for inclusion in FUSRAP. In addition to sites identified through these surveys, Congress has added other sites to FUSRAP.

Limited clean up action was initiated by DOE in 1979. Major remedial action has been underway since 1981. Currently, FUSRAP consists of 46 sites in 14 states. See Figure 8 for the location of the sites. At the time of transfer of the program to the Corps, remediation had been completed by DOE at 24 of the 46 sites.



Figure 8. FUSRAP Sites.

EMERGENCY OPERATIONS

The U.S. Army Corps of Engineers has been playing a national role in responding to natural disasters for over 200 years. Although emergency preparedness, response, and recovery are primarily the responsibilities of states and localities, in instances where the nature of the disaster exceeds the capabilities of state and local interests, the Corps of Engineers provides emergency response to natural disasters. The Corps acts under Public Law 84-99 and also provides support to the Federal Emergency Management Agency (FEMA) and other agencies under Public Law 93-288 (the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended).

The Corps' *Emergency Management* mission provides capability for the U.S. Army to take a proactive role in preparing for, responding to, and recovering from natural and national emergencies in peacetime and war. It supports the total force and the Nation under Corps, FEMA, and other agency authorities and executive orders.

After "Hurricane Andrew" struck Florida in 1992, FEMA provided over \$536 million to the Corps to execute assistance for debris removal, temporary roofing, emergency generators and pumps, potable water, portable toilets, ice, temporary housing support, showers, washers and dryers, and technical assistance. After "Hurricane Fran" struck North Carolina in 1996, the Corps executed over \$210 million for debris removal, temporary roofing, emergency generators and pumps, potable water, portable toilets, ice, temporary housing support, technical assistance, and other mission assistance.

Under P.L. 84-99, as amended, the Corps is authorized to carry out disaster preparedness work, conduct flood fighting and rescue operations, rehabilitate flood control works damaged by floods, and protect or repair Federal shore protection works endangered or destroyed by coastal storms. The Corps is also authorized to provide emergency supplies of clean water in cases of contaminated water supply and during droughts. After the immediate disaster has passed, the Corps can provide temporary restoration of essential public utilities and facilities, and emergency access for a 10-day period, at the request of a Governor.

The Corps gives emergency assistance top priority and provides immediate response using

every resource and expedited procedure available. Assistance is limited to the protection of life and property. The Corps does not provide assistance to individual homeowners and businesses, including agricultural businesses--except to farmers in the case of droughts.

Rehabilitation

assistance may also be available to repair flood control structures in partnership with local public sponsors on a cost-share basis.

When the Midwest Floods of 1993 struck nine Midwestern states, the Corps assisted dozens of communities in their flood fight efforts. Over \$20 million was spent to provide 30 million sandbags, emergency contracts, and technical assistance. Numerous communities were spared devastation because of these efforts. However, hundreds of levees were damaged or breached in the flood. The Corps provided over \$230 million in levee rehabilitation assistance to repair 210 levees throughout the Midwest.

Under the Stafford Act and the Federal Response Plan, the Corps is tasked by FEMA to provide public works and engineering support in response to a catastrophic earthquake or other major disaster. The Corps is one of the Federal agencies tasked by FEMA to provide

engineering, design, construction and contract management support of recovery operations. Under this plan, the Corps will work directly with State authorities in providing

temporary repair and construction of roads, bridges, and utilities; temporary shelter; clearance or removal of debris; emergency water and power supplies; temporary restoration of public facilities; temporary housing; and technical assistance.

The Corps' total *Emergency Management* budget comprises about 4% of the total Civil Works budget, which is largely spent for planning and preparedness activities, and logistical readiness. The program receives additional funds as appropriated by Congress for specific disaster events to augment its budget. In 1996, for example, the Corps responded to 16 national emergencies and disasters, including: Operation Joint Endeavor; Hurricanes Bertha, Fran, Hortense; the Northeast Blizzard and flooding; the Oregon-Washington floods; Devils Lake, North Dakota floods; the Southwest Drought; and the October Northeaster.

During the *Spring Floods of 1997*, for example, flood waters

In January 1994, the Corps provided over 800 personnel to assist in relief and recovery efforts in response to the "Northridge Earthquake" in Los Angeles, CA (6.8 magnitude), providing electrical power; structural inspections of schools, public buildings; medical facilities; distributing water; and constructing a temporary rail facility for mass transit. Following the "Oklahoma City Federal Building Bombing" in 1995, the Corps provided search and rescue, structural assessment, and technical assistance.

rose to their highest level in the last 100 years in the Red River Valley, between the states of North Dakota and Minnesota. Permanent levees around small towns such as Oslo, Argyle, and Halstead saved those communities, while Grand Forks, East Grand Forks, and some other cities without permanent flood protection were devastated. The Corps' quick response and recovery efforts (Advance Measures projects and flood fighting) dramatically demonstrated the effectiveness of emergency management operations in protecting cities and towns. The Corps prevented \$119 million in damages at a cost of \$15 million in the Upper Midwest during these floods.



Some of the actions taken during the "Spring Floods of 1997" were innovative measures. Under a working agreement with FEMA, and in cooperation with the U.S. Air Force, the City of Grand Forks, the North Dakota National Guard, Agassiz Rural Water District, and Grand Forks Trail Water, the Corps responded with a temporary water supply project to increase water supply. The project involved reconfiguring the water system at Grand Forks Air Force Base to flow from the base to the city of Grand Forks. The objectives were to increase useable water supply to the residents of Grand Forks and the several thousands of temporary evacuees who were relocated to Grand Forks AFB. Prior to the flooding, the 14-inch pipeline carried water the other way: from the city to the base. This response/recovery operation created a patchwork of rural water systems, reopened rural wells, and used buried pipelines and flexible surface hoses.

REGULATORY FUNCTION

The purpose of the Corps' Regulatory Program is to regulate or oversee certain activities in the Nation's waters to protect the quality and availability of those waters for the use and benefit of current and future generations. Activities are regulated through the issuance of Corps' *permits*. Any person, firm, or agency (including Federal, state, and local government agencies) planning to work in navigable waters of the United States, or discharging dredged or fill material in waters of the U.S., including wetlands, must first obtain approval, i.e., a *permit*, from the Corps of Engineers.

Until 1968, the primary focus of the Corps' Regulatory Program was the protection of navigation. **Section 10 of the Rivers and Harbors Act of 1899** requires Corps' approval prior to the accomplishment of any work in or over the Nation's navigable waters, or which affects the course, location, condition, or physical capacity of such waters.

Typical activities requiring permits under Section 10 of the River and Harbor Act are:

- Construction of piers, wharves, bulkheads, marinas, ramps, intake structures, and utility crossings; and
- Dredging and excavation.

Section 404 of the Clean Water Act requires Corps' approval prior to discharging dredged or fill materials into the Nation's waters, *including wetlands*, in compliance with guidelines published jointly by the Corps and the Environmental Protection Agency for implementing Section 404(b)(1) of the Clean Water Act. The Corps' Section 404 regulatory program is the principal way by which the Federal government protects wetlands and other aquatic environments. The program's goal is to ensure protection of aquatic the environment

while allowing for necessary economic development.

Typical activities requiring Section 404 permits are:

- Depositing of fill or dredged material in waters of the U.S. or adjacent wetlands;
- Site development fill for residential, commercial, or recreational developments;
- Construction of revetments, groins, breakwaters, levees, dams, dikes, and weirs; and
- Placement of riprap and road fills.

Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972

authorizes the Corps to issue permits for the transportation of dredged material for ocean disposal when the dumping will not degrade or endanger human health and welfare, or the marine environment, ecological systems, or economic benefits.

Permits

The permit evaluation process includes a public notice and a public comment period. Applications may also require a public hearing before the Corps makes a permit decision. After evaluating all comments and information received, a final decision on the application is made. The permit decision is generally based on the outcome of a public interest balancing process, in which the benefits of the proposed action are compared to its detriments. A permit will be granted unless the proposal is found to be contrary to the public interest.

The Corps seeks to avoid unnecessary regulatory controls. Applicants are not necessarily due a favorable decision, but they are due a timely one. Reducing unnecessary paperwork and delay is a continuing Corps' goal. The General Permit program is the primary method of reducing the

intensity of Federal regulation of minor activities.

General Permits account for the bulk of Corps' permit authorizations. They are typically developed for a group of substantially similar activities the Corps identifies causing only

Summary of Program Activities -Fiscal Year 1997

- Individual and letter permits issued: 4,697
- Permits denied: 203
- Activities authorized through regional permits: 38,003
- Activities authorized through nationwide permits: 39,883
- Jurisdictional determinations: 56,300
- Percentage of permit actions completed within 60 days: 94%

minimal individual and cumulative adverse environmental impacts. Regional General Permits cover activities in a defined geographic area (e.g., county, state, or watershed). The Nationwide general permits, as amended in 1992, are similar to regional general permits, but cover activities that are pertinent anywhere in the nation, regardless of regional distinctions. A few nationwide permits include:

- Discharge of dredged or fill material in rivers, streams, or lakes located above the headwaters or in closed basins and affecting less than 3 acres of waters or wetlands;
- Single projects of less than 10 cubic yards;
- Bank stabilization projects for erosion protection less than 500 feet long; and
- Minor road crossing fills that place less than 200 cubic yards of fill below the ordinary high water mark.

The number of permit actions has increased by 27 percent since 1990, while the average permit evaluation time has decreased by 14 percent.

The Corps has made a concerted effort to reduce the number of old (greater than 2 years old) permit applications. Recently, the number of "old" permit applications was reduced by 70 percent -- from 202 to 62. While 62 "old" permit applications are still too many, the Corps has made significant improvements. In the last three years, the Corps has issued more than 26,000 individual permits and more than 143,000

The number of permit actions has increased by 27 percent since 1990; the average permit evaluation time has decreased by 14 percent.

authorizations under general permits. The average evaluation time for all forms of Corps' authorization is less than 30 days.

Only approximately one percent of all enforcement actions result in any kind of civil or criminal penalty. The vast majority of violations are resolved by after-the-fact permits and voluntary actions by the landowner. Only in extreme cases does the government pursue litigation. Fewer than a dozen enforcement cases have been highly publicized, out of the thousands of enforcement actions that have occurred.

- Acres of wetlands where activity was permitted: 37,400
- Acres of wetland restoration/creation required by those permits: 53,400

Regulatory Decisions in the Context of Watershed Planning

The Corps is encouraging comprehensive planning and a watershed approach to permitting decisions in place of the normally piece-meal regulatory approach practiced to date. Wetland mitigation banking can facilitate such an approach in terms of providing better planned and located mitigation opportunities. The Corps has encouraged implementation of wetland

More than 100 wetland mitigation banks have been implemented to date and hundreds more are in the planning stage. Many of the wetland mitigation banks are being developed for the purpose of providing compensatory mitigation on the open market, that is, for permit applicants who qualify to use a bank to satisfy their compensatory mitigation requirements.

mitigation banking as part of the regulatory process. Mitigation banking can result in more cost effective mitigation for permit applicants that qualify, and often result in more effective mitigation, that is compatible with regional and watershed ecological goals. The Corps also encourages greater use of General Permits, including Programmatic General Permits, which can be based on existing state, tribal, local, or other Federal agency regulatory programs. The Corps supports development of watershed plans, such as *Special Area Management Plans*, from which locally-based general permit programs can be developed and implemented. Watershed plans can also be used to assist in siting mitigation banks.

RECREATION

The U.S. Army Corps of Engineers is one of the Nation's largest providers of outdoor recreation opportunities. Although known primarily for the opportunities managed at its lake projects, the Corps also participates in the design and construction of recreation facilities at a wide variety of other types of water resource projects. Such facilities might include hiking and biking trails associated with a stream channel or levee primarily designed for flood damage reduction.

The objectives of the Corps' *Recreation Program* are: to provide outdoor recreation opportunities on Corps' administered land and

The Corps is the second largest Federal provider of outdoor recreation in the Nation, after the U.S. Forest Service. It hosts over 30 percent of the recreation/tourism occurring on Federal lands on just 2% of the Nation's Federal land base, using less than 9 % of the Federal funds expended on recreation.

water on a sustained basis, and to provide a safe and healthful environment for project visitors. The Corps provides recreation facilities and services *only* as a secondary purpose when they are economically justified, related to a primary water resources project purpose (such as navigation or flood damage reduction), and subject to certain other constraints concerning cost allocation and requirements for non-Federal participation. Although the Corps cannot participate in a single purpose recreation project, national policy requires that during the planning and development of water resources projects, full consideration be given to the inclusion of recreation as a project purpose.

The Corps has a large and diverse recreation management program, budgeted at \$170 million. It consists of 456 water resource projects located in 43 states, with over 4,300 recreation

areas and 11.5 million acres of land and water. The Corps operates these projects with approximately 1,900 park managers and rangers and in close cooperation with other interests. Approximately 1,850 of these recreation areas are operated by state and local governments and other entities, and over 400 private concessionaires, with gross fixed assets of \$225 million, provide supporting facilities and services, such as marinas and bait and grocery stores.

Recreation facilities provided by the Corps include campgrounds, picnic areas, beaches, boat ramps, trails, and visitor and interpretive centers. Most Corps' projects are east of the Rocky Mountains where almost 80 percent of the Nation's population resides, and the majority are within a one hour's drive of a major metropolitan area. In a typical year over 375 million visits will occur at the 456 projects with recreation facilities that are managed by the Corps. This does not include estimates of the additional amounts of recreation visits that occur on other water resource projects in which the Corps participated in the construction, but does not manage the recreation facilities.

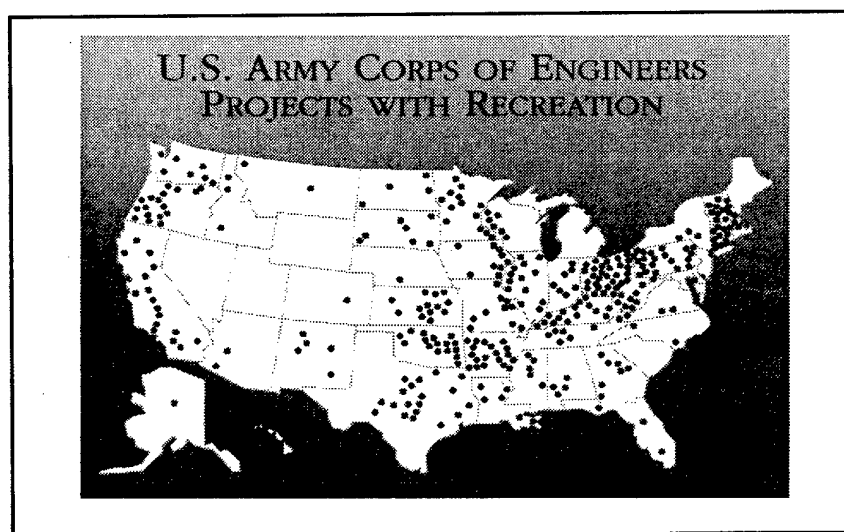


Recreational visitors to Corps' lakes spend significant amounts of money on project services and measurably contribute to the national economy. The Corps' recreation program is an important part of the U.S. Travel

and Tourism industry. Almost one and one half percent of the direct sales in this \$200 billion industry were contributed by visitors to Corps' facilities. Visitors to Corps' lakes spend approximately \$12 billion annually. The direct and indirect effects of this economic activity result in over 600,000 full and part-time jobs in the U.S.

The Corps was initially authorized to build and operate public park and recreation facilities at its water resource development *reservoir* projects by **Section 4 of the Flood Control Act of 1944**. This authority was significantly expanded to include all water resource development, not just reservoirs, by **Section 207 of the River and Harbor Flood control Act of 1962**. The development of recreation facilities was elevated to a full project purpose with the **Federal Water Project Recreation Act of 1965**, as long as non-Federal sponsors would provide half of the development costs and assume all of the operation and maintenance responsibilities for recreation.

Since 1992, several laws have re-emphasized recreational opportunities at Corps' projects. For example, under the **Water Resources Development Act of 1992, Section 203** allows the Corps to accept voluntary contributions for environmental and recreation projects. **Section 225** permits the establishment of a Challenge Cost-Share Program to accept contributions of funds, materials, and services from non-Federal public and private entities to be used in managing recreational facilities and natural resources.



HYDROPOWER

The Corps of Engineers is the single largest producer of hydroelectric power and energy in the United States (see Figure 9). The Corps operates and maintains 75 multiple purpose hydropower projects with a total hydroelectric power capacity of 20,720 megawatts (MW) generating about 78 billion kilowatt-hours (kWh) of electricity per year. The Corps accounts for about 24% of hydroelectric power capacity and about 3% of total electric power capacity in the United States. This output makes the Corps the fourth largest electric utility in the United States behind the Tennessee Valley Authority, Commonwealth Edison, and Georgia Power. In 1995 the Federal Power Marketing Agencies who market Corps hydropower returned over \$500 million to the Federal Treasury from power sales. Non-

Federal developers have also been busy at Corps projects. There are 67 projects with Federal Energy Regulatory Commission (FERC) licenses held by non-Federal developers with a total installed capacity of 1,958 MW.

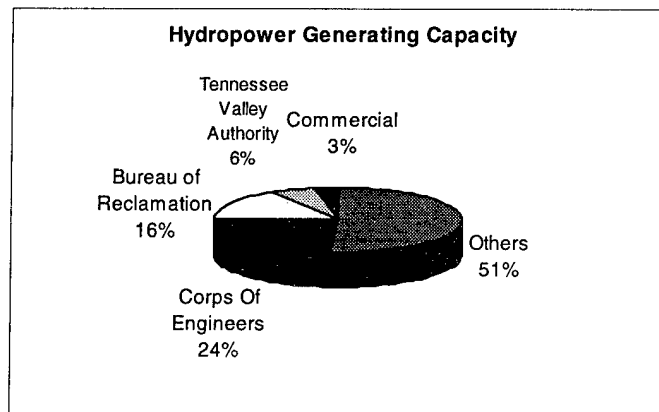


Figure 9. Hydropower Producers

CORPS OF ENGINEERS HYDROPOWER FACTS	
75	Number of Corps multiple purpose hydroelectric power projects with Federal hydroelectric power facilities
20720	Megawatts of Federal generating capacity at Corps projects
77400000000	Kilowatt-hours of electricity generated by Federal hydropower facilities during 1995
24	Percent of United States hydroelectric capacity at Corps projects with Federal hydropower facilities
3	Percent of United States electric capacity at Corps projects with Federal hydropower facilities
569200000	Dollars of revenue returned to the United States Treasury via Federal power sales
67	Number of Corps projects with non-Federal hydropower facilities
1957	Megawatts of non-Federal generating capacity at Corps projects

Distribution of Hydropower Facilities by Corps' Division

Division	Federal Hydropower		Non-Federal Hydropower	
	No.	Capacity (MW)	No.	Capacity (MW)
Great Lakes and Ohio River	10	911.7	34	1,077.7
Mississippi Valley	5	248.6	1	198.0
North Atlantic	0	0	9	37.7
Northwestern	29	15,581.4	2	106.2
Pacific Ocean	0	0	0	0
South Atlantic	14	2,258.5	2	85.5
South Pacific	0	0	10	277.6
Southwestern	17	1,719.8	9	175.3
Total	75	20,720	67	1,958

The bulk of Corps' hydroelectric power capacity is concentrated in the Pacific Northwest with many smaller capacity projects in other sections of the country. The table below shows the distribution by Corps' division of the number and capacity of Corps and non-Federal hydropower facilities at Corps projects.

Hydropower is a low-cost, renewable resource producing no airborne emissions to contribute to acid rain or the greenhouse effect. Corps' hydropower production costs are among the lowest for any form of electric energy. The benefits of this low cost power have been enjoyed for many years by preference customers under the Federal Power Act, and other customers who receive excess electricity after preference customer needs are met. While not without environmental effects, hydropower is considered by many to be the least environmentally damaging major source of electric power. Impacts to waterways caused by dams and the operation of hydropower facilities are currently being addressed, and solutions are being developed for adverse fish and wildlife impacts. Overall, hydropower is an extremely valuable resource for the nation.

The Corps' Hydroelectric Design Center has developed an example to illustrate the amount of power the Corps could produce if all of its units

were running at capacity. The basic unit of measure for electrical power is the watt. Everyone is familiar with a 100 watt light bulb, which consumes 100 watts of electrical power when operating. Ten 100 watt bulbs consume a total of 1000 watts, which is the same as 1 kilowatt. How many 100 light bulbs could the Corps 21,000 megawatts of capacity run? One megawatt is the same as one thousand kilowatts; so

21,000 megawatts is the same as 21,000,000 kilowatts. If 1 kilowatt can run ten 100 watt light bulbs, 21,000,000 kilowatts can run 210 million light bulbs (10 bulbs per kilowatt x 21,000,000 kilowatts).

Various Congressional statutes, including the **Flood Control Acts of 1936 and 1938**, direct the Corps to consider hydroelectric power in the planning, design, and construction of water resource development projects. Corps' policy is to maximize sustained public benefits from each of its projects for all desirable purposes, including power. **Section 5 of the Flood Control Act of 1944** requires the Corps to turn over to the Department of Energy for marketing, power developed at its projects that is surplus to project needs. According to the **Federal Power Act of 1920**, non-Federal power developments may be constructed at Corps' projects through the Federal Energy Regulatory Commission licensing procedures. It is Corps' policy to encourage non-Federal interests to develop such hydropower potential where it is feasible and not authorized for Federal development. Recommendations for Federal hydropower development are made only if it can be shown that non-Federal development is impractical. No general authority exists for the Corps to develop power at non-Corps' sites, but this has been done with specific Congressional authority.

WATER SUPPLY

The Army's involvement in public water supply dates to 1853, when it began building the Washington Aqueduct. To this day, the Aqueduct is operated by the Corps and continues to provide water to the District of Columbia and to Arlington and Alexandria, VA. National policy concerning the Corps' role in water supply has developed over many years and is still being clarified and extended through budgetary guidance and by legislation enacted through various water resources development acts. This policy is based on a recognition that states and local interests have the primary responsibility in the development and management of their water supplies.

The authority for the Corps to include storage for municipal and industrial (M&I) water supply in both new and existing reservoir projects at 100% non-Federal cost, is contained in the **Water Supply Act of 1958**. Water supply storage may be included in any Corps' reservoir to impound water for present and future M&I use. Not more than 30% of the total allocated costs may be for future water needs. Modification of an existing reservoir, by structural changes or reallocation of existing storage, to add or increase dedicated storage for water supply, requires separate Congressional authorization if it would significantly impact existing authorized purposes or involved major structural or operational changes. By policy, the Corps' discretion for any such reallocation is limited to 15% of total usable storage or 50,000 acre feet, whichever is the lesser.

Sponsors must contract to provide 100% reimbursement of costs (including operations and maintenance and repairs, reconstruction, major rehabilitation, and replacement as required). Construction costs allocated to water supply must be repaid within the life of the project but not more than 30 years from initial use of the project for water supply. For new

projects, reimbursement is based on the actual development costs allocated to water supply storage. For reallocations, the cost is based on the current value of that storage.

The Corps has dedicated approximately 9.5 million acre-feet of M&I water supply storage space in 118 reservoir projects throughout the Nation. Approximately 72% of the M&I storage is contained in the reservoir projects located in the Southwestern Division. The vast majority (92%) of the 9.5 million acre-feet of storage is under either a present or future use storage agreement. The approximately 780,000 acre-feet of reservoir storage space that is not under contract is located in 21 Corps' reservoir projects in five states.

The Corps has dedicated approximately 9.5 million acre-feet of M&I water supply storage space in 118 reservoir projects throughout the Nation.

There are no agricultural water supply agreements in Corps reservoir projects in the eastern states. Irrigation water supply is included in Corps reservoir projects under repayment agreements between Bureau of Reclamation and local sponsors.

Irrigation has been included in 47 projects in the western states area that include about 772,000 acre-feet of

"specific" irrigation storage. Another 52.7 million acre-feet of "joint" storage can be used for flood control, navigation, and/or hydroelectric power, and for irrigation purposes.

- Projects with authorized M&I water supply storage: 167
- Projects with authorized irrigation storage: 66

Summary of Water Supply Storage Space by Corps' Division

Corps Division	Number of Projects	Storage Space (Acre-Feet)			
		Present Use	Future Use		Total
			Under Contract	Not Under Contract	
North Atlantic	7	138,450	4,000	0	142,450
South Atlantic	10	120,626	96,740	0	217,366
Great Lakes and Ohio River	17	577,940	51,269	2,200	631,409
Mississippi Valley	6	181,900	0	187,750	369,650
Northwestern	12	184,360	531,380	91,500	807,240
Southwestern	64	4,873,217	1,515,150	497,249	6,885,616
South Pacific	2	258,900	212,000	0	470,900
Total	118	6,335,393	2,410,539	778,699	9,524,631

Summary of Irrigation Storage in Corps' Reservoir Projects

Corps Division	Number of Projects	Storage Reserved for Irrigation (acre-feet)		
		Specific Storage	Joint Storage	Total Storage
Northwestern	30	312,000	48,627,900	48,939,900
Southwestern	2	63,800	0	63,800
South Pacific	15	396,500	4,036,600	4,433,100
Total	47	772,300	52,664,500	53,436,800

SUPPORT FOR OTHERS

The *Support for Others* (SFO) program consists of work performed by the Corps of Engineers and funded by non-Department of Defense Federal agencies, states and political subdivisions of states, other levels of governmental jurisdictions, emerging nations, and international lenders and donors. The work is performed with both civil and military resources, depending on the nature of the project and whether there are military implications.

Support for Others (SFO) Program Summary

The Corps performs \$600-\$800 million of work each year

SFO program supports nearly 60 Federal agencies outside the Department of Defense (DOD). About 98 percent of this support is provided to about 60 Federal agencies over half of which is provided to the EPA Superfund Program.

SFO program supports state, local, territorial and Native American governments, foreign governments and international organizations, and private firms. The term "states" includes any of the 50 States of the United States, plus the District of Columbia; the Commonwealths of Puerto Rico and Northern Mariana Islands; the Territories of the U.S. Virgin Islands, Guam and American Samoa.

The SFO program was formalized in 1984 to centralize the management of the Corps' reimbursable work program. Historically, the majority of SFO work (about 60%) was in support of environmental protection or restoration programs. Most of the work was for the U.S. Environmental Protection Agency's (EPA's) Superfund toxic and hazardous waste cleanup program, EPA's Construction Grants program for sewage treatment plants, and cleanup of contaminated sites belonging to the Department of Energy.

Much of the balance of the SFO program has been for other Federal agencies and state governments, as many agencies do not possess technical expertise to fulfill the in-house

engineering needs of their programs. Furthermore, many do not have the staff to effectively manage engineering or construction work being conducted by private firms under contract.

While Federal agencies represent the greatest share of the SFO program, the Corps has recently lent support to such diverse clients as the government of American Samoa, the Confederated Tribes of the Umatilla Indian Reservation, the John F. Kennedy Performing Arts Center, and various foreign governments. The table on the following page lists SFO customers in 1996 and 1997.

The type of assistance provided by the Corps includes:

- Planning, design, and construction support from personnel trained and educated to be fully knowledgeable about the latest innovations and technologies available. The Corps executes within the terms of a scope of work, agreed to with the agency, with a primary objective of ensuring the desired project is completed on time and within budget.
- Serving as an extension of the agency's staff providing technical expertise, Federal presence, and government oversight to protect the taxpayers' interests. This capability can relieve the agency of the burden of hiring and training specialists to perform these functions.
- Enhancing the performance of private engineering and construction firms since the Corps has expertise in these technical fields and is able to clearly portray the customers needs and effectively manage the execution using a tried and proven process.
- Offering proven Federal technical and contract management experience and effectiveness to assist other agencies in the execution of their missions.

SUPPORT FOR OTHERS CUSTOMERS (1996 & 1997)

Federal Agencies

Department of Agriculture (DOA)
Commodity Credit Corporation (CCC)
Farm Service Agency (FSA)
US Forest Service (USFS)
Melaleuca Quarantine Facility)
Natural Resources Conservation Service (NRCS)
Rural Business and Cooperative Development Service
 American Battle Monuments Commission (ABMC)
 Appalachian Regional Commission (ARC)
 Department of Commerce (DOC)
Economic Development Administration (EDA)
National Oceanic and Atmospheric Administration (NOAA)
 Department of Energy (DOE)
Argonne National Laboratory, Argonne, IL.
Bonneville Power Administration (BPA)
Hanford.
Lawrence Livermore National Laboratory
Federal Energy Technology Center (FETC)
Pantex Plant
Pittsburgh Energy Technology Center

Department of Health and Human Services (HHS)
Food and Drug Administration (FDA)
Indian Health Service (PHS)
Department of Housing and Urban Development (HUD)
US Information Agency (USIA)
Department of Interior (DOI)
Bureau of Indian Affairs (BIA)
Bureau of Land and Minerals Management (BLMM)
Bureau of Reclamation (BOR)
Fish and Wildlife Service (FWS)
Geological Survey (USGS)
Federal Geographic Data Committee (FGDC)
National Park Service (NPS)
Office of Insular Affairs (OIA)
Department of Justice (DOJ)
Bureau of Prisons (BOP)
Drug Enforcement Administration (DEA)
Federal Bureau of Investigation (FBI)
Immigration and Naturalization Service (INS)
Marshall's Service
National Aeronautics and Space Administration (NASA)

STATE/LOCAL/TERRITORIAL GOVERNMENTS

American Samoa Government
Army National Guard
Virginia Institute of Marine Science (VIMS)
Lower Colorado River Authority
Michigan
Minnesota
Tarrant Cty. Water Control & Improvement District,
Fort Worth, TX.
Texas Parks and Wildlife Department
Dade County, FL
S. Florida Water Mgt. District, Restoration of
Kissimmee River Basin
South Carolina Port Authority

The City of Seattle, WA
City of Eugene, OR
Confederated Tribes of the Umatilla Indian Reservation
Rhode Island Department of Transportation
City of Summersville, OH
Florida Department of Community Affairs
Cullman County, AL
City of Columbus, Ohio
Arkansas Electric Cooperative Corporation
Puerto Rico
Midwestern State University

INTERNATIONAL

Argentina
Bahamas
Sweden

Rhein-Rhur District, Germany
South Africa

ADDENDUM

**Excerpts from: *Value of the U.S. Army Corps of Engineers
Civil Works Program to the Nation***

ADDENDUM

PROLOGUE

This Addendum contains excerpts from the report, *Value of the Corps of Engineers Civil Works Program to the Nation* (IWR Paper 97-P-2, December 1997). That report describes analytical procedures, and preliminary results from such procedures, used to determine the net cost or benefit of the U. S. Army Corps of Engineers Civil Works program to the U. S. Treasury. In other words, to help answer the question, does the country get a positive return on the annual \$3.6 - \$4.0 billion investment in the program.

EXCERPTS FROM: *VALUE OF THE CORPS OF ENGINEERS CIVIL WORKS PROGRAM TO THE NATION*

Summary of Results

Table 1 shows Corps annual budget and a summary of the annual benefits of the Corps infrastructure to the nation and the impacts on the U.S. Treasury from project outputs and related economic activities associated with the Corps Civil Works Programs. Estimates are based on

available data and analyses from a variety of sources. Monetary values are in 1993-1994 constant dollars. Estimates are considered to be generally gross.

Through the Corps of Engineers, the nation has made a series of water resource investments. These investments constitute a *portfolio* or a capital stock which provides an annual stream of benefits to the nation.

Table 1: Summary of Annual Value of Corps Programs

	ANNUAL CORPS BUDGET FOR GI, O&M, AND CONSTRUCTION (1994)	NATIONAL ECONOMIC DEVELOPMENT BENEFITS	FEDERAL TAX REVENUES	OTHER REVENUES	SAVINGS TO U.S. TREASURY
TOTAL	\$3.6 BILLION	\$32.6 BILLION	\$22.6 BILLION	\$1.3 BILLION	\$6.3 BILLION

The annual rate of return on the Corps accumulated water resources capital stock is estimated to be 26%. (Calculations are shown on page 44.)

Summary of the Approach and Scope of the Analysis

Through the Corps of Engineers, the nation has made a series of water resource investments. These investments constitute a *portfolio* or a capital stock which provides an annual stream of benefits to the nation. These benefits are realized as flood damages prevented, reduced transportation cost (navigation), hydropower, recreation and water supply forms. The Corps' annual budget serves either to maintain the benefit stream (operations, maintenance, research and development, and major rehab) or to increase the portfolio and therefore the future benefit stream (new construction, planning and research and development). Evaluation of gross annual benefit estimates for each project purpose can provide an estimate of the annual rate of return on the Corps portfolio. This approach is analogous to how an individual investor would estimate the rate of return on a common stock portfolio built up over a period of years.

Failure to invest in maintenance, major rehabilitation, research and development, planning studies and new construction will result in the gradual reduction in capital stock (from normal decay) and in turn the benefit stream

The analysis requires a defined portfolio. This information is readily available and can be described in terms of the dollar value of the capital stock of Corps investments. Work in this area has been accomplished as part of the Federal Infrastructure Strategy Program. The study estimated the *Gross capital stock* which refers to the total amount of investment the Corps has put in place over the years, added up at a particular point in time, after subtracting out accumulated retirements of investments. When depreciation is taken into account, and depreciated capital subtracted out as well, the resulting figure is referred to as *net capital stock*. Obviously, net capital stock is always going to be less than gross capital stock.

The resulting portfolio, defined by the capital stock and an estimated National Economic Development (NED) benefit stream provides context for answering questions related to the value of the Corps CW budget. This will help people to understand what the country buys with its annual investment of \$3.6 billion. Using the portfolio context, operation and maintenance expenses are necessary to sustain the benefit stream. Failure to invest in maintenance, major rehabilitation, research and development, planning studies and new construction will result in the gradual reduction in capital stock (from normal decay) and in turn the benefit stream.

The impact to the treasury can also be estimated. There are the direct payments from the Corps to the Treasury each year, hydropower and water supply revenues, for example. These numbers are readily available. There are also the federal tax receipts from economic activity induced or facilitated by the Corps portfolio. Estimation of federal tax revenue impacts is problematic and requires a number of assumptions about how non market output (flood control, navigation, and recreation) translate into tax revenues.

Total annual revenues and savings to the Treasury related to the Civil Works program are estimated to be \$30.2 billion

A description of how the estimates of federal tax revenues were developed is discussed below.

The study did not include an analysis of values of the emergency operations program, regulatory program or environmental restoration since monetary values do not exist for those outputs. The value of R&D and planning is captured but not specifically identified in the efficiencies accruing to project formulation, design, construction and operations from improved procedures and technologies.

While there are a number of sources of estimates on the employment impacts and regional benefits of the Corps program, this study did attempt to measure those, given the short time frame. Future work could develop a consistent analytical framework to address other economic impacts of the Corps program. The focus of this study is on the monetary benefits and treasury impacts of the Civil Works program.

Return on Investment of the Corps Capital Stock.

The approach entails computing NED benefits by summing available estimates of annual flood damages prevented, navigation cost savings, hydropower generation market values, recreation visitor benefits and water supply storage values shown in Table 3. From this value, subtract annual O&M costs, and divide that result by the depreciated value of the Corps capital stock as shown in Table 2. The number is an estimate of the annual rate of return on the Corps capital stock and is the annual return to the nation from the accumulated investments over the years. A shortcoming of the analysis is that it does not account for the non-Federal contributions to the capital stock and operations and maintenance which contribute to the benefit stream. Nor does the analysis account for associated private investments (e.g. land side facilities at ports). Thus, the rate of return values estimated as accruing to Corps expenditures alone are overstated.

Table 2: Value of the Capital Stock of Corps Projects

CORPS OF ENGINEERS CAPITAL STOCK	DEPRECIATED REPLACEMENT VALUE AS OF 1993 (1993 DOLLARS)
NAVIGATION	\$31.5 Billion
FLOOD CONTROL	\$52.4 Billion
MULTIPLE PURPOSE	\$35.2 Billion
TOTAL	\$119.1 Billion

Source: *Infrastructure in the 21st Century Economy: An Interim Report - Vol. 3, Data on Federal Capital Stocks and Investment Flows* (IWR, 1994)

The annual return on the accumulated investment in the Corps infrastructure (capital stock) is estimated to be 26% as calculated below. The basis for the individual calculations of benefits by project purpose is given in the Appendix.

Depreciated Value of Corps Capital Stock = \$119.1 billion

Annual project NED benefits = \$32.6 billion

Annual O&M cost = \$1.6 billion

Annual rate of return on Corps infrastructure = $(\$32.6 \text{ billion} - \$1.6 \text{ billion}) / \$119.1 \text{ billion} = 26 \%$

Revenues to the U.S. Treasury

Estimates of tax revenues to the federal treasury are based on applying average tax rates to the annual national income generated by economic activity associated with each project output. Estimates of other additions to the treasury include revenues from power sales and water supply storage contracts, flood emergency assistance payments avoided and casualty loss tax deductions not taken as a result of flood protection.

Based on income generated from activities associated with Corps project outputs, annual income taxes to the Treasury are estimated to be \$22.6 billion. Revenues from the Inland Waterway Trust Fund are \$103 million and from the Harbor Maintenance Trust Fund, \$621 million. Revenues from Hydropower generation sales and water supply storage contracts are estimated at \$515 million and \$13 million respectively. Flood protection provides \$2.1 billion in federal tax casualty loss deductions not taken and \$4.2 billion in emergency assistance payments not expended by the treasury. Total annual revenues and savings to the Treasury related to the Civil Works program are estimated to be \$30.2 billion.

Table 3 shows the estimates by project purpose along with the annual Corps budget. The basis for the calculations is given in the Appendix.

Table 3: Annual Budget, Benefits and Revenues to the U.S. Treasury from Corps Civil Works Programs

PROJECT PURPOSE	ANNUAL CORPS BUDGET FOR GI, O&M, AND CONSTRUCTION (1994)	NATIONAL ECONOMIC DEVELOPMENT BENEFITS	FEDERAL TAX REVENUES	OTHER REVENUES AND SAVINGS TO THE TREASURY
Flood Damages Prevented	\$1,460.4 Million	\$18.4 Billion		Disaster Relief Costs Saved \$4.2 Billion Casualty Loss Tax Write-offs Not Taken \$2.1 Billion
Inland Navigation	\$731.8 Million	\$5.50 Billion	\$4.0 Billion	User Trust Fund \$.103 Billion
Deep Draft Navigation	\$697.0 Million	\$1.54 Billion	\$14.5 Billion	Harbor Maintenance Fees \$.646 Billion
Recreation	\$202.1 Million	\$1.40 Billion	\$4.1 Billion	User Fees \$.025 Billion
Hydropower	\$316.0 Million	\$5.00 Billion		Sale of Power \$.515 Billion
Water Supply	\$88.3 Million	\$.775 Billion		Water Supply Contracts \$.013 Billion
Other	\$75.7 Million			
TOTAL	\$3,571.3 Million	\$32.6 Billion	\$22.6 Billion	\$7.6 Billion

Benefit Cost Analysis of the Annual Corps Budget for Any Given Year

Any attempt to estimate the benefits of the Corps CW budget for a specific year is problematic. The following discussion is provided to demonstrate the speculative nature of such an estimate. Since the regulatory program, emergency operations and work for others is not part of the monetary analysis of this report the relevant portion of the Corps CW budget is O&M, Construction, GI, and MR&T. In FY 95 that was about \$3.1 billion out of a total of \$3.5 billion.

The return on the investment in any given year of the \$3.1 spent for O&M and new construction is difficult to estimate without making a number of speculative assumptions. For example, assuming that the \$3.1 billion simply disappears and no other entity picks up the expense then

..it would still pay to continue to maintain and construct [Corps water resources infrastructure] at current levels even if the degradation rate of the capital stock and therefore the benefit stream was very small.

the existing capital stock and the associated returns on the investment portfolio will diminish at some rate (no data on the rate of decay that would result are available, however). The decay rate in the capital stock and associated benefits would be uneven across project purposes, however. For example, for local flood control, O&M is generally performed by non-federal sponsors and the value of the stock and benefit flows from local flood control would diminish more slowly than, for example, inland navigation.

For purposes of discussion, a rough estimate was made of the benefit-cost ratio of continuing the Corps maintenance, new construction and GI programs. Assuming operations continue but not maintenance, new construction and GI studies and an average 10% reduction in project outputs each year over 50 years we can compute the present value of the lost benefits and maintenance, construction and GI costs not expended. Annual maintenance (less operations costs), new construction and GI costs are \$2.5 billion which would have a present value of \$32.6 billion over the next 50 years. NED Benefits lost over 50 years has a present value of \$233 billion. By comparing the present values of the benefits (i.e. NED benefits not lost) to the present value of the cost of continuing maintenance, construction and GI, the benefit-cost ratio of continuing Corps annual maintenance, new construction and GI at current levels would be about 7.4 to 1. Under the "no maintenance, no new construction" scenario fully half of the annual benefits would be lost by year six. A positive B/C ratio is obtained for continued maintenance, construction and GI for decay rates as low as .7% per year. In other words, it would still pay to continue to maintain and construct at current levels even if the degradation rate of the capital stock and therefore the benefit stream was very small. Obviously, ceasing operations would have more immediate and greater adverse impacts on benefit flows.

APPENDIX

DATA SOURCES, ASSUMPTIONS AND CALCULATIONS

	FLOOD CONTROL BENEFITS AND IMPACTS ON U.S. TREASURY
VARIABLES	<p>FLOOD DAMAGES PREVENTED = \$18.4 BILLION</p> <p>RESIDENTIAL DAMAGES PREVENTED = 60%</p> <p>BUSINESS DAMAGES PREVENTED = 21%</p> <p>UNINSURED RESIDENTIAL PROPERTY = 80%</p> <p>TAXPAYERS WHO ITEMIZE = 57%</p> <p>U.S. AVERAGE ADJUSTED GROSS INCOME OF ITEMIZERS = \$56,930</p> <p>MARGINAL FEDERAL TAX RATE = 28%</p> <p>AVERAGE FLOOD DAMAGE PER EVENT (FIA DATA BASE) = \$22,000</p> <p>FEDERAL DISASTER ASSISTANCE PER DOLLAR OF FLOOD DAMAGE FROM GREAT FLOOD OF 93 = \$.23</p>
KEY ASSUMPTIONS	<p>FIA DAMAGE DATA REPRESENTATIVE OF ALL FLOOD PRONE RESIDENTIAL PROPERTIES</p> <p>AVERAGE AGI REPRESENTATIVE OF FLOOD PLAIN HOUSEHOLDS</p> <p>DISASTER ASSISTANCE PER \$ DAMAGE DURING FLOOD OF 93</p> <p>REPRESENTATIVE OF ALL FLOOD DAMAGE EVENTS</p>
COMPUTATIONS	<p>NED BENEFITS = DAMAGES PREVENTED = \$18.4 BILLION</p> <p>SAVINGS TO TREASURY FROM CASUALTY LOSS DEDUCTIONS NOT TAKEN FOR RESIDENTIAL PROPERTIES</p> <p>$.6 \times .8 \times .57 \times (\\$18.4 \text{ BILLION}) = \text{RESIDENTIAL DAMAGES PREVENTED FOR HOUSEHOLDS THAT ITEMIZE} = \\5.0 BILLION</p> <p>AVERAGE LOSS DEDUCTION = $(\\$22,000) - (\\$56,930 \times .10\%) = \\$16,307$</p> <p>DEDUCTIBLE FLOOD LOSSES = $(\\$16,307 / \\$22,000) \times (\\$5.0 \text{ BILLION}) = \\3.7 BILLION</p> <p>RESIDENTIAL TAX WRITEOFFS AVOIDED = $(\\$3.7 \times .28) = \\1 BILLION</p> <p>SAVINGS TO TREASURY FROM CASUALTY LOSS DEDUCTIONS NOT TAKEN FOR BUSINESS PROPERTIES</p> <p>$(.21 \times \\$18.4 \text{ BILLION}) \times (.28) = \\1.1 BILLION</p> <p>SAVINGS TO TREASURY FROM DISASTER ASSISTANCE PAYMENTS NOT MADE = $(\\$18.4 \times .23) = \\4.2 BILLION</p>
SOURCES	<p>DEPARTMENT OF THE TREASURY, OFFICE OF TAX ANALYSIS (FAX MATERIAL, 1994)</p> <p>PHONE DISCUSSION WITH FIA PERSONNEL (JULY, 1994)</p> <p>INFORMAL PHONE SURVEY OF CORPS FIELD PERSONNEL (JULY, 1994)</p> <p>USACE ANNUAL FLOOD DAMAGE REPORT TO CONGRESS FOR FY 93 (COE, 1994)</p>
UNRESOLVED ISSUES/ OMISSIONS	<p>PROPORTION OF DAMAGES PREVENTED BY PROPERTY TYPE ARE BASED ON BEST GUESSES BY SELECTED DISTRICT PERSONNEL AND ARE CONSIDERED VERY GROSS ESTIMATES</p> <p>TREASURY IMPACTS FROM AGRICULTURE DAMAGES PREVENTED ARE NOT INCLUDED</p>

	INLAND NAVIGATION BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	TRANSPORTATION SAVINGS PER TON = \$8.61 TONS SHIPPED = 650 MILLION NATIONAL INCOME PRODUCED FROM TRANSPORTATION SAVINGS = \$19 BILLION AVERAGE INDIVIDUAL AND BUSINESS TAX RATE = 19.6%
KEY ASSUMPTIONS	
COMPUTATIONS	NED BENEFITS = (\$8.61 X 650 MILLION) = \$5.5 BILLION INCOME TAXES TO TREASURY = (\$19 BILLION X .196) = \$3.7 BILLION INLAND WATERWAYS TRUST FUND TO TREASURY = \$103 MILLION
SOURCES	THE PUBLIC VALUE OF INLAND WATERWAYS: SOME STATISTICAL EVIDENCE, (C. JAKE HAULK, PHD, 1994) ASSESSMENT OF ALTERNATIVE ASSUMPTIONS OF OUTLAYS AND REVENUES FOR THE INLAND WATERWAYS TRUST FUND (IWR, 1995)
UNRESOLVED ISSUES/OMISSIONS	INCOME TAXES GENERATED BY NAVIGATION RELATED ECONOMIC ACTIVITY IN THE ABSENCE OF CORPS UNKNOWN

	DEEP DRAFT NAVIGATION BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	TRANSPORTATION SAVINGS = \$1.534 BILLION NATIONAL INCOME PRODUCED FROM PORT INDUSTRY = \$74 BILLION AVERAGE INDIVIDUAL AND BUSINESS TAX RATE = .196 HARBOR MAINTENANCE TRUST FUND = \$646 MILLION
KEY ASSUMPTIONS	
COMPUTATIONS	BENEFITS = TRANSPORTATION SAVINGS = \$1.534 BILLION INCOME TAXES TO TREASURY = (\$74 BILLION X .196) = \$14.5 BILLION OTHER REVENUES = HARBOR MAINTENANCE TRUST FUND = \$646 MILLION
SOURCES	ANALYSIS OF COASTAL PORT DREDGING AND THE EFFECTS ON TRANSPORTATION COST SAVINGS (DRI/MCGRAW-HILL, 1994) PUBLIC PORT FINANCING IN THE UNITED STATES (MARITIME ADMINISTRATION, 1994) THIRD ANNUAL REPORT TO CONGRESS ON THE STATUS OF THE HARBOR MAINTENANCE TRUST FUND (1994)
UNRESOLVED ISSUES/OMISSIONS	TAX COLLECTIONS IN ABSENCE OF THE CORPS UNKNOWN OTHERS MAY CONTINUE TO DREDGE

	RECREATION BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	DAY USE VISITS (388.1 MIL), \$/VISIT (\$3.33) CAMPING VISITS (8.7 MIL), \$/VISIT (\$16.82) CAMPING AND USE FEES (\$25 MILLION) INCOME GENERATED FROM ACTIVITY RELATED TO CORPS RECREATION PROGRAM (\$21 BILLION) AVERAGE BUSINESS AND INDIVIDUAL INCOME TAX RATE (19.6%)
KEY ASSUMPTIONS	
COMPUTATIONS	$\text{NED BENEFITS} = (388.1 \times \$3.33) + (8.7 \times \$16.82) = \1.4 BILLION $\text{TAX REVENUES TO TREASURY} = (\$21 \text{ BILLION} \times .196) = \4.1 BILLION $\text{FEE REVENUES TO TREASURY} = \25 MILLION
SOURCES	A SUMMARY OF THE NATIONAL AND STATE ECONOMIC EFFECTS OF THE 1994 USACE RECREATION PROGRAM (WES, 1995 DRAFT) REGIONAL RECREATION DEMAND MODELS FOR LARGE RESERVOIRS: DATABASE DEVELOPMENT, MODEL ESTIMATION AND MANAGEMENT APPLICATIONS (WES, MARCH 1995)
UNRESOLVED ISSUES/OMISSIONS	INCOME GENERATED WITHOUT CORPS PROGRAM NOT KNOWN FEES RETURN TO CORPS IN FOLLOWING YEAR

	HYDROELECTRIC POWER BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	RETAIL MARKET VALUE PER KW (\$.07) ANNUAL ENERGY GENERATED (70 BILLION KWH) REVENUES FROM SALES TO PMAs (\$515 MILLION)
KEY ASSUMPTIONS	AVERAGE MARKET VALUE FOR ENERGY APPLIES TO CORPS POWER GENERATED
COMPUTATIONS	$\text{NED BENEFITS} = (70 \text{ BILLION KWH} \times \$0.07) = \$5 \text{ BILLION}$ $\text{REVENUES TO TREASURY} = \515 MILLION
SOURCES	SURVEY OF CORPS AND POWER MARKETING AGENCIES (CORPS, 1994)
UNRESOLVED ISSUES/OMISSIONS	

	M&I WATER SUPPLY STORAGE BENEFITS AND REVENUES TO TREASURY
VARIABLES	ACRE FEET UNDER CONTRACT (6.2 MILLION) \$ AVERAGE MARKET VALUE PER ACRE FOOT (\$125.00) \$ VALUE OF CONTRACT STORAGE (\$644 MILLION) 50 YEAR PAYBACK PERIOD
KEY ASSUMPTIONS	MARKET VALUE = NATIONAL AVERAGE COST OF WATER SUPPLY (A LOW END ESTIMATE OF VALUE)
COMPUTATIONS	NED BENEFITS = (6.2 MIL AF) X (\$125) = \$775 MILLION REVENUES TO THE TREASURY = (\$644/50YR) = ~ \$13 MILLION
SOURCES	WATER SUPPLY CONTRACT DATA BASE (CORPS, 1988) WATER INDUSTRY DATA BASE (AWWA, 1992) LESSONS LEARNED FROM THE CALIFORNIA DROUGHT (IWR, 1993)
UNRESOLVED ISSUES/ OMISSIONS	IRRIGATION WATER SUPPLY NOT INCLUDED M&I CONTRACTS ARE IN NOMINAL DOLLARS INTEREST ON CONTRACTS NOT AVAILABLE AND NOT INCLUDED

Examples of **How the Corps Can Help**

Address Water Resources & Engineering Problems

There are a number of ways the Corps can help its partners and other interested parties address water resource and engineering problems and opportunities. These avenues focus not only on the priority areas of navigation, flood damage reduction, and ecosystem restoration -- but also address unique natural- or human-induced problems, or the needs of special geographic regions. Some examples of how the Corps can help are:

★ **Planning Studies.**

☆ *Through participation in individually authorized studies to address water resource development and management needs at varying scopes and scales of consideration.*

☆ *As part of continuing agency authorities, assisting in small local water resources problems related to flood damage reduction, shore protection, emergency streambank and shore protection for public facilities, and snagging and clearing for flood damage reduction.*

☆ *In new areas of emphasis such as Ecosystem Restoration and in Watershed & Regional Water Resources Planning.*

☆ *Addressing multiple objectives including both economic and environmental components. These efforts can be multi-faceted involving not only planning but operational programs and capabilities.*

☆ *Examples of new and unique initiative are:*

☆ *Assistance (technical, planning and implementation) in abating and mitigating degraded surface water quality caused by abandoned mines. Current efforts include at least 15 projects related to the remediation of acid mine drainage in Maryland, Pennsylvania, West Virginia, and Ohio.*

☆ *Technical and planning assistance in carrying out water-related environmental infrastructure and resource protection and restoration.*

★ **Technical Assistance**

☆ *Assisting states & tribes in comprehensive water resource planning, including ecosystem restoration and watershed planning.*

☆ *Providing floodplain management services, applying the Corps' technical expertise and planning guidance to foster public understanding of options for addressing flood hazards and to promote prudent use and management of flood plains.*

☆ *Providing training in a number of areas related to water resources development and management including: Engineering & Hydrologic Analysis, Planning, Wetland Mitigation Banking, Planning & Evaluation for Ecosystem Restoration*

★ **Project Implementation**

☆ *Utilizing expertise from many disciplines to design and guide the construction of Civil Works projects.*

☆ *Applying civil, structural, architectural, mechanical, geotechnical, electrical, marine, coastal, and environmental engineering capabilities.*

☆ *Conducting technical studies, developing designs, as well as advertizing, negotiating, and managing construction contracts for both Civil Works projects recommended for implementation, and in support of work for other Federal agencies.*

★ **Participation in Partnerships.**

☆ *Working hand-in-hand with non-Federal sponsors throughout the country to investigate water resource problems and opportunities and implementing justified recommended projects.*

☆ *Participating with other Federal as well as state and local agencies in partnerships involving collaboration on initiatives which leverage resources, or by providing technical assistance, or both.*

☆ *Participating in collaborative regional interagency initiatives that help provide broad contexts for resource use, restoration and management, such as*
☆ *Coastal America* ☆ *Anacostia River Basin Restoration* ☆
☆ *South Florida Ecosystem Restoration* ☆ *American Heritage Rivers*
☆ *Appalachian Clean Streams Initiative*

★ **Project/System Operation.**

☆ *Operating over 500 water control projects (reservoirs, lock and dams), individually and as systems of projects.*

☆ *Reviewing and updating operations of completed projects periodically to ensure that operation is consistent with authorized purposes and legislative changes, and to consider the potential for responding to new needs and values expressed by communities, agencies, and various interest groups (e.g. Missouri River Operating Plan and Study).*

☆ Working with both other Federal resource agencies and the public to development natural resource management goals for Corps' managed lands as part of its stewardship responsibilities.

★ Response to Emergencies.

☆ Assisting in emergency preparedness, response and recovery from natural and national emergencies. Examples include: temporary infrastructural repair; debris removal, emergency water and power supplies and other technical assistance for floods, hurricanes, tornadoes, and earthquakes.

★ Environmental Remediation.

☆ Through execution of the Superfund and the Formerly Utilized Sites Remedial Action Program (FUSRAP), and other initiatives which include assessment of remediation needs, and the management of contracts for clean-up activities.

★ Research and Development – Laboratories

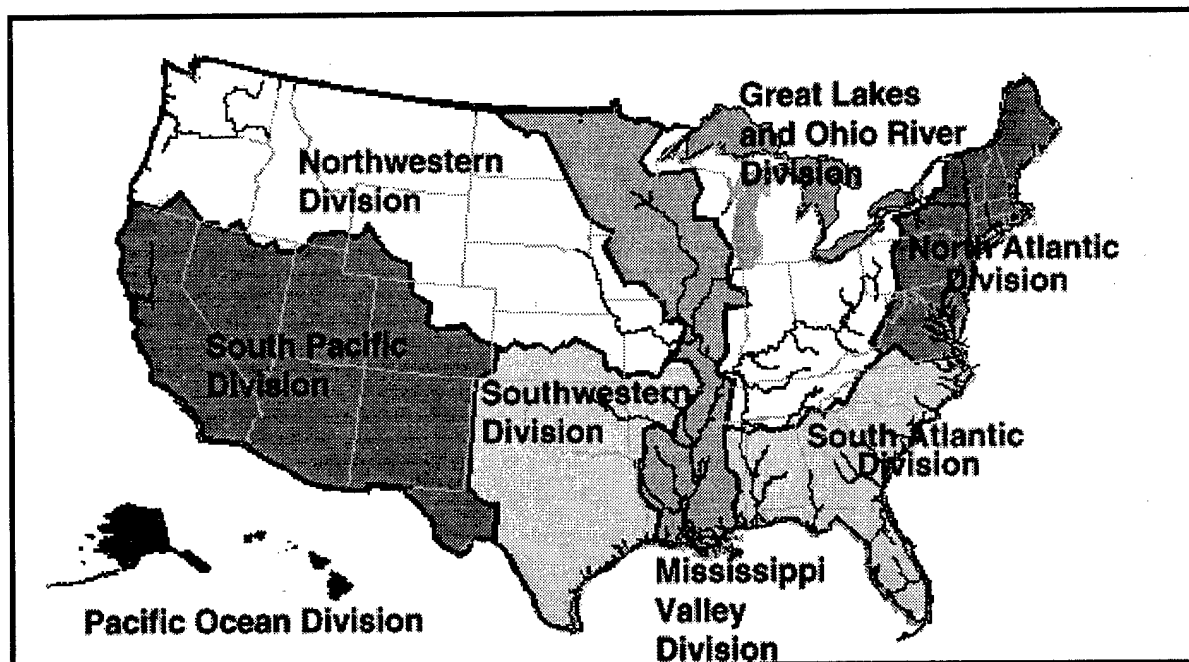
☆ Conducting applied research and providing technical assistance in direct support of Civil Works programs and activities.

☆ Development and adaptation of problem-solving products and process technologies; technology transfer-- moving research to practical application.

☆ Examples of research areas include: materials research; environmental quality assessment, ecosystem restoration and management, dredging operations, structures and materials, hydrologic engineering, construction methodologies, and decision support technologies.

☆ Maintaining the major Civil Works research program through a number of R&D laboratories and Centers including: Waterways Experiment Station, Construction Engineering Research Laboratory, Cold Regions Research Engineering Laboratory, Institute for Water Resources, Hydrologic Engineering Center.

Where to find the Corps: The Corps of Engineers, headquartered in Washington, D.C., is organized into regional offices called divisions, and under them is a network of district offices which work closely with its customers. The map below identifies the division boundaries, and below this is a list of addresses and telephone numbers for each Corps office. The Corps also operates a home page, with links to each of its offices. It can be found at: <http://www.usace.army.mil>.



Civil Works Division Boundaries

Corps' Divisions and Districts

Headquarters

**U.S. Army Corps of Engineers
Directorate of Civil Works**
20 Massachusetts Avenue, N.W.
Washington, DC 20314-1000
202-761-0105

**U.S. Army Engineer Division,
Great Lakes & Ohio River**
P.O. Box 1159
Cincinnati, OH 45201-1159
513-684-3002

Great Lakes Regional Headquarters
111 North Canal Street, 12th Floor
Chicago, IL 60606-7205
312-353-6385

**U.S. Army Engineer District,
Buffalo**
1776 Niagara Street
Buffalo, NY 14207-3199
716-879-4410

**U.S. Army Engineer District,
Chicago**
111 North Canal Street, Suite 600
Chicago, IL 60606-7206
312-353-6401

**U.S. Army Engineer District,
Detroit**
P.O. Box 1027
Detroit, MI 48231-1027
313-226-6413

**U.S. Army Engineer District,
Huntington**
502 8th Street
Huntington, WV 25701-2070
304-529-5211

**U.S. Army Engineer District,
Louisville**
P.O. Box 59
Louisville, KY 40201-0059
502-582-5629

**U.S. Army Engineer District,
Nashville**
P.O. Box 1070
Nashville, TN 37202-1070
615-736-5626

**U.S. Army Engineer District,
Pittsburgh**
Room 1828, Moorehead Fed. Bldg
1000 Liberty Avenue
Pittsburgh, PA 15222-4186
412-644-6800

**U.S. Army Engineer Division,
Mississippi Valley**
P.O. Box 80
Vicksburg, MS 39181-0080
601-634-5000

**U.S. Army Engineer District,
Memphis**
167 North Main Street
Memphis, TN 38103-1894
901-544-3005

**U.S. Army Engineer District,
New Orleans**
P.O. Box 60267
New Orleans, LA 70160-0267
504-865-1121

**U.S. Army Engineer District,
Rock Island**
Clock Tower Building
P.O. Box 2004
Rock Island, IL 61204-2004
309-794-4200

**U.S. Army Engineer District,
St. Louis**
1222 Spruce Street
St. Louis, MO 63103-2833
314-331-8000

U.S. Army Engineer District,
St. Paul
Army Corps of Engineers Centre
190 5th Street East
St. Paul, MN 55101-1637
612-290-5200

U.S. Army Engineer District,
Vicksburg
4155 Clay Street
Vicksburg, MS 39180
601-631-5000

U.S. Army Engineer Division,
Northwestern
P.O. Box 2870
Portland, OR 97808-2870
503-326-6021

Missouri River Regional Headquarters
12565 West Center Road
Omaha, NE 68144-3869
402-697-7214

U.S. Army Engineer District,
Kansas City
700 Federal Building
Kansas City, MO 64106-2896
816-426-3896

U.S. Army Engineer District,
Omaha
215 North 17th Street
Omaha, NE 68102-4978
402-221-3020

U.S. Army Engineer District,
Portland
P.O. Box 2946
Portland, OR 97208-2946
503-326-6021

U.S. Army Engineer District,
Seattle
P.O. Box 3755
Seattle, WA 98124-3755
206-764-3742

U.S. Army Engineer District,
Walla Walla
201 North Third Avenue
Walla Walla, WA 99362-1876
509-527-7424

U.S. Army Engineer Division,
North Atlantic
90 Church Street
New York, NY 10007-2979
212-264-7104

U.S. Army Engineer District,
Baltimore
P.O. Box 1715
Baltimore, MD 21203-1715
410-962-9232

U.S. Army Engineer District
New England
Frederick C. Murphy Federal Building
424 Trapelo Road
Waltham, MA 02254-9149
781-647-8220

U.S. Army Engineer District,
New York
Jacob K. Javits Federal Building
26 Federal Plaza
New York, NY 10278-0090
212-264-0102

U.S. Army Engineer District,
Norfolk
Waterfield Building
803 Front Street
Norfolk, VA 23510-1096
804-441-7500

U.S. Army Engineer District,
Philadelphia
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390
215-656-6515

U.S. Army Engineer Division,
Pacific Ocean
Building 230
Fort Shafter, HI 96858-5440
808-438-1331

U.S. Army Engineer District,
Alaska
P.O. Box 898
Anchorage, AK 99506-0898
907-753-2504

U.S. Army Engineer District
Far East
Far East Unit #15546
APO AP 96205-0610
011-82-2-270-7360

U.S. Army Engineer District,
Honolulu
Building 230
Ft. Shafter, HI 96858-5440
808-438-1331

U.S. Army Engineer District,
Japan
USAED-J. Unit 45010
Public Affairs Office
APO AP 96343-0061
011-81-3117-63-3025

U.S. Army Engineer Division,
South Atlantic
Room 322
77 Forsyth Street, SW
Atlanta, GA 30303-3490
404-331-6716

U.S. Army Engineer District,
Charleston
P.O. Box 919
Charleston, SC 29402-0919
803-727-4299

U.S. Army Engineer District,
Jacksonville
P.O. Box 4970
Jacksonville, FL 32232-0019
904-232-2234

U.S. Army Engineer District,
Mobile
P.O. Box 2288
Mobile, AL 36628-0001

334-690-2528

U.S. Army Engineer District,
Savannah
P.O. Box 889
Savannah, GA 31402-0889
912-652-5822

U.S. Army Engineer District,
Wilmington
P.O. Box 1890
Wilmington, NC 28402-1890
910-251-4000

U.S. Army Engineer Division,
South Pacific
333 Market St., Room 923
San Francisco, CA 94105-2195
415-705-2405

U.S. Army Engineer District,
Albuquerque
4101 Jefferson Plaza, NE
Albuquerque, NM 87109
505-766-2681

U.S. Army Engineer District,
Los Angeles
P.O. Box 2711
Los Angeles, CA 90053-2325
213-894-5311

U.S. Army Engineer District,
Sacramento
1325 J Street
Sacramento, CA 95814-2922
916-557-5100

U.S. Army Engineer District,
San Francisco
333 Market Street, Room 923
San Francisco, CA 94105-2197
415-744-3020

U.S. Army Engineer Division,
Southwestern
1114 Commerce Street
Dallas, TX 75242-0216
214-767-2500

U.S. Engineer District,
Fort Worth
P.O. Box 17300
Fort Worth, TX 76102-0300
817-334-2150

U.S. Army Engineer District,
Galveston
P.O. Box 1229
Galveston, TX 77553-1229
409-766-3899

U.S. Army Engineer District,
Little Rock
P.O. Box 867
Little Rock, AR 72203-0867
501-324-5551

U.S. Army Engineer District,
Tulsa
P.O. Box 61
Tulsa, OK 74121-0061
918-669-7366