CHAPTER III. SHIFTING WATER DEVELOPMENT PRIORITIES

Over the last 150 years, the federal role in water project decision-making and financing has evolved primarily out of a concern for the objectives of an expanding industrial and agricultural economy. These objectives have included: stimulating regional economic growth (inland navigation, irrigation, hydropower); providing for the national defense (ports and harbors); and creating aesthetic or nonmarketable benefits (flood control, water quality, fish and wildlife preservation). To be sure, these are still valid objectives for federal investment in some new water projects. But most of the federally important water projects are now in place, to a large degree satisfying the economic development objectives that have guided past policies. As a result, emerging water development priorities are shifting away from large interstate projects toward local development, rehabilitation, and efficient management of existing water projects. This trend suggests a much stronger role for economic efficiency as a guiding principle in public investments.

SHIFTS IN FEDERAL SPENDING

The days of huge federal outlays for equally large water projects appear to be over. In real terms, appropriations for water project construction under the four federal water agencies have declined by almost 80 percent over the last 16 years, from about $6 billion in fiscal year 1968 to $1.3 billion in fiscal year 1984 (see Figure 1). Major river basins--the Ohio, Mississippi, Missouri, and Colorado, to name only a few--have been improved to provide flood control, navigation, and hydropower.

By contrast, federal spending for operation, maintenance, and rehabilitation (OM&R) of existing facilities has increased. Since 1968, the combined OM&R appropriations for the Corps, the Bureau, and the TVA have increased by 38 percent in real terms. As a percentage of new construction appropriations, OM&R appropriations have increased from 23 percent in 1968 to over 100 percent in 1984 (see Figure 2). For the first year in history, the Corps' budget request for operation and maintenance for fiscal year 1984 is larger than its budget request for construction.

Figure 1.

Combined Appropriations for Water Project Construction by the Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, and Tennessee Valley Authority

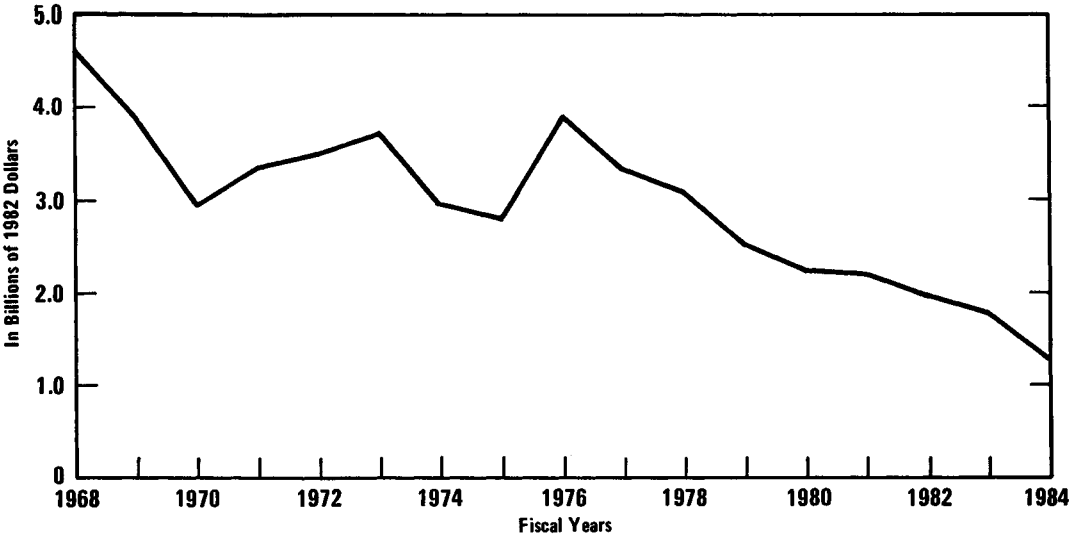
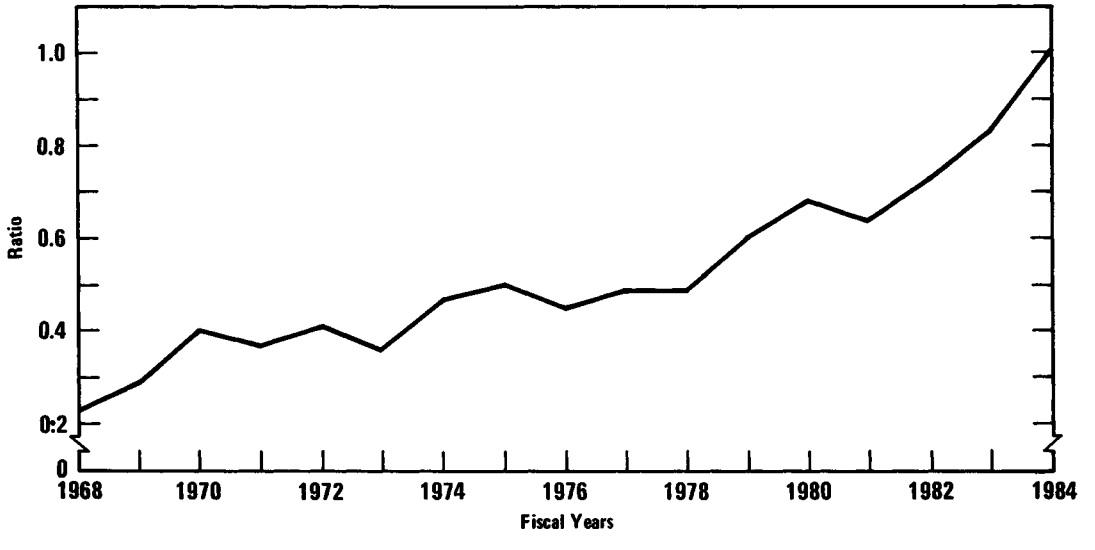


Figure 2.

Ratio of Combined Operation, Maintenance, and Rehabilitation Appropriations to New Construction Appropriations of the Corps of Engineers, Bureau of Reclamation, and Tennessee Valley Authority



REALIZATION OF ECONOMIC DEVELOPMENT GOALS

The principal federal water resources programs were authorized in the early part of this century in response to emerging national development needs. But over the last half century, many of the development goals have changed markedly. One of the best examples is the irrigation program administered by the Bureau of Reclamation. Conceived at the turn of the century, the Bureau's mission was to help settle the West by subsidizing the construction of irrigation works and thus the price of irrigation water for family farmers. For the average federal dollar invested in building irrigation projects, all nonfederal interests combined invest only 11 cents. Today, western agriculture is a mature industry, due in part to 80 years of building subsidized irrigation projects. Western lands have indeed been settled over the past 80 years--in some areas, excessively so. Under water resource constraints, some western states, notably Arizona and California, are actively exploring ways to transfer agricultural water rights to more valued uses (primarily municipal drinking water).

Navigation projects provide yet another example of goals that have changed. The mission of the Corps of Engineers in 1826 involved developing the nation's waterways to provide a link for commerce between older U.S. cities (the major domestic centers of consumption) and the developing agricultural and industrial regions of the Midwest. As agriculture and industry moved west, development of inland waterways followed. Today, most agricultural and industrial regions are served by inland waterways, railroads, interstate highways, and oil and gas pipelines. But the federal government still pays for 94 percent of all lock and dam construction, dredging, and operation costs associated with maintaining the waterways. The historical policy basis for a subsidized system of waterways has been eroded by the development of highly competitive alternative means of transport. The problem is no longer one of developing the only practicable means of transporting goods but of maintaining the most efficient transportation network to serve the needs of the entire nation. 1/

SHIFTS TOWARD LOCAL PROJECTS

In part, federal interest in developing the nation's water resources grew out of a need to facilitate interstate commerce with a system of

---

1. National Water Commission, New Directions in U.S. Water Policy, Final Report, Summary, Conclusions, and Recommendations (June 28, 1973).

inland waterways and ports and harbors. Today, these facilities are in place to the extent that they are economically justified relative to other competing modes of interstate transport. Future navigation needs will be primarily rehabilitation and maintenance of existing works. 2/ Federal activities in flood control, irrigation, and hydropower originated as single-purpose solutions to localized water development needs. But in the 1930s, with the advent of the river basin planning concept, these and other federal water development proposals were combined into major multipurpose interstate projects. Like the development of any natural resource, the most favorable sites were developed first. For example, under the TVA, the Tennessee River Basin's interstate water resources potential has largely been developed over the past 50 years. Similarly, a series of five large multipurpose reservoirs on the Missouri River mainstem already provide interstate flood control, irrigation, navigation, and other benefits to nine states.

Most analysts would now agree that the majority of large multipurpose projects that appear capable of meeting economic and environmental standards have already been built. For example, out of ten new projects recommended for funding in 1983 by the Bureau of Reclamation, four were for rehabilitation and maintenance of existing irrigation systems, four were for local irrigation construction, and two were for upgrading hydroelectric facilities at existing dams. Of nine projects proposed by the Corps of Engineers as new starts in 1983, four were local flood control projects designed to protect urban areas and three were hydroelectric projects with 100 percent local financing. In the Water Resources Council's first assessment of the nation's water resources in 1968, it was estimated that annual nationwide flood losses would total about $5 billion by 2020, and that three-fifths of these losses would occur in small upstream communities. Protecting these communities involves local flood control measures. Many downstream communities were considered protected by major flood control dams already constructed by the Corps of Engineers.

GROWTH IN STATE AND LOCAL CAPABILITIES

Many federal water development programs were conceived at a time when state and local governments were considerably less sophisticated than they are today. At the time that these programs were conceived, primarily over the three decades between 1930 and 1960, state and local government

---

2. See U.S. Army Corps of Engineers, Institute for Water Resources, National Waterways Study--A Framework For Decisionmaking--A Summary (January 1983).

staffs were smaller in number, less well-trained in technical areas, and generally less able to manage complex water resource development projects. In addition, there was less interstate communication and a much lower level of state spending for water resources than there is currently. Between 1960 and 1980, the number of state and local water resources employees increased from about 70,000 to about 115,000, or a 64 percent increase, while the number of federal employees has remained constant. State and local general expenditures for all water resources purposes increased from $89 per capita ($16 billion total) in fiscal year 1960 to $111 per capita ($25 billion total) in 1980 (in 1982 dollars). 3/ The number of interstate water planning and management organizations more than doubled since 1960. 4/

State and local capabilities to finance water resources development have also matured considerably over the past 20 years. State bonding activity has increased seven-fold since 1959. In the state of New Jersey alone, over $1 billion in water resources bonds have been issued since 1969. Over the three-year period 1980-1982, the fifty states combined issued almost $8 billion in water resources general obligation and revenue bonds. 5/

In response to the continuing decline in federally funded water development, many states have created new state water development programs or have stepped up ongoing programs. In Florida, recently created Water Management Districts are authorized to levy ad valorem taxes in order to finance local water projects. They also have created local water supply capital funds from a recently imposed real estate transfer tax. Newly created demand for water resources services will be financed by incoming residents under this program. In Montana, a water development

---

3. Calculated from unpublished data provided by the U.S. Bureau of the Census. Partial information may be obtained from two of their annual publications, Government Finances and Public Employment.

4. The proliferation of interstate organizations resulted in part from the Water Resources Planning Act of 1965 and activities funded through the U.S. Water Resources Council, created by that act. In 1982, when most of the activities of this agency and its staff were eliminated, funding for many interstate water planning agencies was abolished. While some interstate groups have reorganized to continue their work, the future of others is in question.

5. For additional details, see U.S. Congressional Budget Office, Current Cost-Sharing and Financing Policies for Federal and State Water Resources Development (July 1983).

fund was created in 1981 to make loans and grants to individuals and substate groups for all water development purposes. The fund is financed from mineral royalties and a portion of the state coal severance tax. In Pennsylvania, $300 million in general obligation bonds were sold in 1982 to make public water supply loans to local jurisdictions from a special public water supply loan fund. These are only a few examples of the states' growing financial capabilities. In all, 32 states now bond at the state level for water development; 26 states dedicate portions of some state taxes or collect user fees to finance water resources development; 33 states have water development loan and grant programs; and 29 states have established some form of special fund to support new water development.

CHAPTER IV. ECONOMIC EFFICIENCY AND WATER RESOURCES INVESTMENTS

Throughout the history of federal water resources development, efficiency of public investment has been recognized as one basic objective. It has not been the only objective, however, and rarely has it been the dominant concern. Water projects have been undertaken for economic, social, military, or political purposes. When these latter objectives guide investment decisions, often the result is a smaller net economic gain than otherwise would be available. Inefficient public investments cause national income to be smaller than it would be if conditions of maximum economic efficiency were to prevail. 1/ To the extent that economic efficiency becomes a major objective of water resource investment, the methods by which water projects are evaluated, financed, and ultimately paid for would require reexamination.

This chapter begins by defining economic efficiency as it applies to water projects. It then sets out guidelines for rethinking project selection, cost sharing, and financing policies directed at greater public investment efficiency. Chapter V identifies alternative water resource policies that could lead to greater efficiency and assesses their advantages and disadvantages.

ECONOMIC EFFICIENCY

Definition

Economic efficiency is an objective of investment decisionmaking that can be used to select among alternative water project designs (or indeed, between building a project or not). A water project is considered efficient if the dollar value of benefits to the economy flowing from the project is

---

1. For a thorough treatment of economic efficiency and water resources development, see John V. Krutilla and Otto Eckstein, Multiple Purpose River Development, (Baltimore, Md.: Johns Hopkins Press, 1958, published for Resources for the Future).

greater than the dollar value of goods forgone by individuals in order to construct and operate the project. Thus, when a water resources investment is guided by economic efficiency, the result is increased total national income. A water project's relative efficiency can be enhanced by altering its size, composition, or timing so that project benefits increase without incurring additional costs.

One way to evaluate a water project's "benefits to the economy" is to add all users' willingness to pay for the marketable benefits to some other measure of the value of the nonmarketable benefits. In an irrigation project, for example, a farmer should be willing to pay for irrigation water so long as his increase in income from irrigating is greater than his increase in production costs resulting from irrigation (including the added costs for water delivery, distribution, and irrigation equipment). Evaluation of nonmarketable benefits is sometimes more difficult. Individuals (or public entities) may not be willing to pay very much for public goods available to others even though by some other measure, these benefits are worth more to "society" collectively than they cost to produce. Flood control benefits, for example, can be evaluated on the basis of damages prevented even though private parties may not be willing to pay for protection. 2/

In this paper, changes in cost-sharing conventions and administrative processes are aimed at distinguishing efficient water projects (or levels of development of a given project) from inefficient projects. Assessing the relative efficiencies of competing projects can also help decisionmakers choose those projects with the greatest returns to the national economy, subject to fulfilling other policy goals. It is the former objective--simply distinguishing efficient projects from inefficient ones--that is of primary concern here. The latter objective--choosing among efficient projects--is important for proper resource allocation, but may have undesirable distributive effects among regions or may conflict with the pursuit of other social or political goals. Nonetheless, choosing among efficient projects is an appropriate longer-term goal of water policy reform.

---

2. Market imperfections are discussed in more detail elsewhere in this paper. For a more complete discussion of economic efficiency in water resources development, see Arthur Maass, et al., Design of Water Resource Systems (Cambridge, MA: Harvard University Press, 1962); and Otto Eckstein, Water-Resource Development, The Economics of Project Evaluation (Harvard University Press, 1958).

Efficiency and Market Imperfections

The efficiency of committing scarce resources to the production of water resources benefits could be evaluated easily if all these benefits were derived through a market at prices determined by supply and demand interactions. This is seldom the case, however. For example, there is no ready market for selling flood protection. A system of levees providing flood protection to one member of the community will provide protection to the entire community. Thus, any member could choose not to pay on the chance that the contribution of others would be sufficient, which in turn would make other members reluctant to pay because their share could increase accordingly. Protection cannot be denied an individual who refuses to pay without simultaneously denying protection to all those who are willing to pay. This "free rider" problem can lead to underinvestment in public goods like flood control. Private enterprise, for example, would be unwilling to build flood control structures in the absence of firm contracts to guarantee payment, even though the cost of building flood control works could be far less than the collective community flood damages they would prevent. Conventional markets, therefore, are inadequate to ensure efficient resource allocation to flood control. 3/

This implies a role for public entities in the provision of nonmarketable water resources benefits. But public provision of water resources benefits does not necessarily mean that economic efficiency must be sacrificed. Beneficiaries' willingness to pay for nonmarketable benefits can be approximated (as if a market existed) and the costs of providing them can be identified. For example, flood prevention benefits would equal the aggregate cost of repairing flood damages and avoiding the inconveniences associated with flooding. 4/ Flood control costs are calculated like any

---

3. Similar arguments describe market failures for other water resources benefits, including water quality, fish and wildlife maintenance, instream flow maintenance, and others. For additional detail, see Krutilla and Eckstein, Multiple Purpose River Development.

4. More precisely, benefits include the cost of restoring private and public land and structures to preflood conditions; loss of net farm revenue due to inundation; commercial losses; indirect losses, such as cessation of production, loss of wages and other income; and the cost of evacuation, emergency work, or flood relief. In practice, these benefits are calculated by subtracting annual flood losses with the project from those without the project. Since the incidence of flooding is probabilistic, benefits represent average annual changes in

other water resources investment--the value of land, labor, and materials committed to construction, operation, and maintenance of the project.

Therefore, while market imperfections do exist in the provision of many water resources benefits, economic efficiency can still help guide these investments. Like marketable benefits, such as hydroelectric power or municipal water supply, the application of an efficiency criterion to the provision of nonmarketable benefits has certain implications for cost-sharing and administrative processes.

ECONOMIC EFFICIENCY AND COST-SHARING POLICY

There are three parties to cost-sharing arrangements for water resource investments: the federal government, state and local governments, and private beneficiaries. The economic issue is whether a different division of cost than now exists would lead to greater efficiency. There is much evidence to suggest that efficiency would be improved if the federal government bore a lower share of the cost than it does under current policy.

The Basis for Federal Sharing of Water Development Costs

The federal government bears a portion of the cost of water projects for two reasons. First, in order to stimulate economic development or induce certain economic activities, the federal government has assumed a large part of the cost that direct users would otherwise pay. Examples include the federal subsidy intentionally built into irrigation or navigation cost-sharing policies. Perhaps less intentional subsidies characterize federal policy for hydroelectric power and municipal and industrial water supply projects.

Second, the federal government has traditionally provided nonmarketable, water-related benefits that the private market would not otherwise provide. The interstate nature of past water projects--multireservoir flood control systems, for example--is one reason why these costs have been borne primarily by the federal government as opposed to state or local govern-

---

4. Continued
losses, assuming constant flood probablities and a reliable relationship between flood intensity and damages incurred. For additional details, see Otto Eckstein, Water Resource Development--The Economics of Project Evaluation.

ments. 5/ In addition, until relatively recently, state and local governments were not well-equipped technically or financially to undertake complex capital-intensive water development projects. Federal provision of flood control projects originated in the 1860s after a series of devastating floods in the lower Mississippi Valley. Local protection efforts were ineffective and the multistate protection plan envisioned by the Corps of Engineers was beyond the financial capability of the states. A national sense of urgency was, in large part, responsible for federal assumption of flood control costs.

How High Federal Cost Shares Promote Inefficiencies

A water development project often provides benefits directly to users (for example, water supply and hydroelectric power) or to the public in the general area of the project (such as prevention of flood damage to an entire river basin). When either group pays only a small portion of a water project's cost, the benefits they receive are, in effect, subsidized, thereby providing an incentive to demand more or larger projects than they might be willing to pay for if their own money was involved. This can cause public overinvestment and poor allocation of resources. Every public dollar invested in a questionable water project is a dollar that cannot be invested in some other productive economic capacity. Federal projects for irrigation and navigation, for which users do not bear their proportion of the costs, provide two examples.

Irrigation. Western farmers pay an average of only 19 percent of the cost of providing federally developed irrigation water, resulting from a 1902 federal policy to subsidize western settlement. The intent of the 1902 Reclamation Act was to stimulate small, private farming (160 acres or less per farm) within the largely unsettled western states by allowing repayment of federal construction costs, without interest and over a ten-year period. Repayment and acreage terms have become more liberal while real interest

---

5. Water projects with interstate implications may justify federal coordination but not necessarily federal assumption of costs. In the case of interstate spillovers, some federal funding can be effective to induce states to build the "socially optimal" project size rather than, perhaps, a smaller project that would benefit only a single state. This argument, however, seems more persuasive in the case of water quality control, in which the federal government provides a large portion of sewage treatment plant capital costs to induce a higher level of pollution control than localities acting on their own behalf might wish to pay for.

rates have risen over the years, maintaining a subsidy to western agricultural interests and resulting in inefficient public investment. 6/

Long after the policy goals of the 1902 Act were achieved (the West is largely developed to the extent dictated by resource constraints), federal subsidies have led to the construction of irrigation projects long before they may be needed, and to the reclamation of lands at per acre costs far in excess of the value of the land after the project is completed. 7/ Because farmers pay such a small share of the real cost of irrigation water, they actively promote more and larger projects than they otherwise would. Federal subsidies for irrigation charge general taxpayers for building projects that small groups of beneficiaries would be unwilling to pay for, if they were assessed their full cost. Furthermore, high federal cost shares, resulting in artifically inexpensive irrigation water, provide farmers with little incentive for efficient use of that resource and allow the cultivation of water-intensive crops that would not be grown if water was priced at the cost of providing it.

Navigation. In the early 1800s, the Congress directed the Corps of Engineers to construct inland waterways and ports and harbors to serve emerging agricultural and industrial development in the South and West. Inland waterways were seen as the only means of transportation to link these regions to cities in the East. As development moved westward, so did federal construction of inland waterways. Federal port and harbor development was originally undertaken to facilitate overseas trade and to provide for the national defense. Today, the federal government pays 94 percent of the construction and operation costs of inland waterways and 84 percent of the cost of ports and harbors. 8/

---

6. In 1939, The Reclamation Projects Act introduced the concept of "ability to pay," allowing farmers to repay a much smaller portion of construction costs over a 40-year period based on increased farm income resulting from the project. In 1982, the acreage limitation was liberalized to allow subsidies to farmers irrigating up to 960 acres.

7. See National Water Commission, New Directions in U.S. Water Policy, Summary, Conclusions, and Recommendations (1973), p. 168.

8. State and local government contribute necessary lands, easements, and rights-of-way which account for about 6 percent of the costs of inland navigation projects and 16 percent of ports and harbors. In addition, a small fuel tax is collected from users of inland waterways. For example, in 1981 the 6 cent per gallon tax raised $40 million in revenues, or about 6 percent of the 1981 combined federal capital and operating outlays for the inland waterways.

Times have changed, however, and facilitating regional development by providing subsidized waterways may no longer be in the national interest. What is in the national interest is ensuring the most cost-effective transportation system to serve the needs of the entire country. In 1980, federal subsidies covered more than one-fourth of the costs of all inland waterway shipping. This is more than four times the portion of shipping costs covered by rail subsidies and almost 30 times more than truck subsidies. 9/ Oil and gas pipelines, which compete directly with inland barges, receive no federal capital or operating subsidies. Thus, a federal cost-sharing policy providing subsidies encourages waterway investments that may not be cost-effective. 10/ Such a policy also diverts some traffic from railroads or trucks to waterways, because of lower, subsidized transportation costs which transfer proportionately more of the cost of freight from direct users to general taxpayers.

State and local governments may face a similar incentive for overconsumption if the benefits their jurisdictions enjoy are provided by the federal government at a subsidized rate. Availability of federal funds with low cost-sharing requirements from state or local governments can lead to federal construction of projects yielding primarily local benefits. When the cost of a local project is shifted from local beneficiaries to federal taxpayers, scarce federal resources are allocated to support local economic activity, displacing investments in other projects which may have a higher

---

9. For additional details, see U.S. Congressional Budget Office, "Statement of Alice M. Rivlin, Director, before the Committee on the Budget of the U. S. Senate" (March 10, 1982), pp. 7-8.

10. Probably the best example of this is the Tennessee-Tombigbee waterway construction project. The project was originally evaluated in the 1940s and authorized by the Congress for construction by the Corps of Engineers in 1946 based on favorable economics perceived at that time. Because the project would bring economic opportunities to the region, at a very low local cost, local proponents successfully defended the project against formidable opposition until construction finally began in 1971. Based on the most recent calculations made by the Corps (1976), the project will yield $1.08 in navigation and other benefits for every $1.00 invested. In a 1981 review of the project, the General Accounting Office concluded that some 30 to 40 percent of the expected benefits will never materialize. If local proponents had been faced with paying the entire project cost, not 6 percent as under current policy, it is highly unlikely that they would have supported its construction at all. Competing rail or existing waterway routes would have provided a less expensive alternative.

national interest. Federal projects for flood control or municipal water supply provide two examples.

Flood Control. The federal government started to invest in flood control structures in the mid- to late-1800s as settlements in the lower Mississippi Valley began to experience devastating floods. Cost sharing for these projects was eventually formalized in the Flood Control Act of 1936, following severe flooding throughout the nation. Local beneficiaries were required to contribute necessary land, easements, and rights-of-way, as well as to maintain and operate structures after completion. But after two years of frustrated efforts at local coordination and continued severe flooding, local cost-sharing requirements for reservoirs were eliminated. In this context--a feeling of urgency, recognition of local coordination obstacles, and pressure for New Deal jobs programs--the current 100 percent federal share of costs for major flood control works was established. 11/

Although complete self-financing may never be realistic, as long as flood control projects are essentially free goods, communities will have an incentive to overstate their needs to influence the decisionmaking process and thereby receive projects. Moreover, local proponents will try to show that the benefits of flood control projects are larger rather than smaller in order to generate acceptable benefit/cost ratios. 12/ If the costs of flood control projects exceeds the development value of flood-free land, investments in such projects would be inefficient. Local proponents would have less motivation to overstate benefits if they were responsible for paying a larger share of a project's costs.

Experience has shown that recovery of flood control costs directly from beneficiaries is not feasible. Efficiency could be served, however, if local jurisdictions, acting collectively for their protected citizens, paid a higher proportion of the costs of federal flood control projects, perhaps by imposing an assessment on lands benefitting from flood control investments. A higher local share would help ensure state and local support for the most cost-effective flood control projects.

---

11. Local participants in federal flood control projects classified as "local protection" are still required to contribute necessary land easements and rights-of-way that can range up to 20 percent of project capital costs. On average, for all Corps urban flood control projects, local participants pay 17 percent of total project costs. Local participants pay 7 percent on average of rural flood control project costs.

12. Otto Eckstein, Water Resource Development (1958), p. 154.

Municipal Water Supply. Under the Water Supply Act of 1958, the Corps and the Bureau may include municipal and industrial (M&I) water supply in multipurpose reservoirs, provided that they obtain reasonable assurance that such supplies are needed and will be paid for by local users within the life of the project. But under current Corps' cost-sharing conventions, if the water is never used, no repayment is required. Further, while federally developed M&I water lies unused waiting for demand to develop, the interest portion of construction costs plus all operation and maintenance allocated to the M&I purpose are paid by the federal government. The effect of this subsidy is to reduce the nominal nonfederal cost share of 100 percent for M&I water supply to an effective nonfederal share of only 64 percent. The Corps and the Bureau estimated in 1980 that together they have spent or will spend about $1.3 billion for authorized M&I supply. Even if all supplies eventually are used, the nonfederal share will repay only $800 million of that investment, based on the historic effective nonfederal share for M&I supply. 13/ Further, in a 1978 survey of seven Bureau reservoirs that had reserved industrial water supplies, 96 percent of the reserved supply was not used by potential industrial customers--only four percent of the total supply available was delivered, and the Bureau did not expect to deliver more than that in the near future. 14/

The original intent of the 1958 act was to provide M&I water in the most efficient manner; the economies of scale in many large federal multipurpose developments allow the development of M&I water at a lower cost than could otherwise be achieved. To make this water available to municipalities and to industry at cost would be both efficient and in the national interest. But to provide this commodity at federally subsidized prices transfers the cost from direct beneficiaries to the general taxpayer. Furthermore, low prices promote wasteful use of water once it is delivered. Unused M&I water ties up scarce federal resources, preventing their commitment toward productive economic activity in other uses.

---

13. For additional details regarding the Corps' and Bureau's role in providing municipal and industrial water, see U.S. General Accounting Office, Contracts to Provide Space in Federal Reservoirs for Future Water Supplies Should be More Flexible (May 16, 1980).

14. See U.S. General Accounting Office, Water Supply Should Not Be An Obstacle to Meeting Energy Development Goals (January 24, 1980).

Efficiency-Motivated Changes to Current Cost-Sharing Policy

With the above examples in mind, changes in current cost-sharing policies can be formalized, based upon marketability of project benefits. First, marketable water project benefits would be separated from those that are nonmarketable. Second, regardless of who finances a water project (a separate question from who pays, which is addressed in the next chapter), systems of user fees would be devised to recoup the cost of providing marketable benefits from direct beneficiaries or small groups of users. Finally, the cost of providing nonmarketable benefits would be shared between the federal government and state and local governments when applicable. In order to accomplish the above steps, two sets of criteria are needed: one that separates marketable from nonmarketable benefits, and a second that allocates nonmarketable benefits among the appropriate public entities.

Marketability of Benefits. All water project benefits can be classified as marketable or nonmarketable based on three factors: how benefits are supplied to users or beneficiaries, the cost of marketing, and the ability to distinguish between direct users and the general public. Marketable benefits include municipal, industrial, and agricultural water supply; inland navigation; harbor improvement; hydroelectric power; recreation; erosion control; and drainage. Nonmarketable benefits include fish and wildlife enhancement, water quality, flood control, area redevelopment, and preservation of historic sites and natural or ecological systems. 15/

Hydroelectric power and municipal, agricultural, and industrial water supplies are easily marketed benefits that may be supplied on a unit basis and priced at market or cost-of-service rates for readily identifiable groups of users. Both water and electricity may be purchased in discrete units (gallons or kilowatt-hours, respectively). Marketing costs are generally low and users are easily singled out from nonusers. Most recreation, inland navigation, and harbor improvement benefits are also marketable through a

---

15. Apportioning all water resources benefits into two categories is, perhaps, simplistic considering the diversity of benefits and the criteria that determine marketability. For an interesting discourse on the marketablility of water benefits based on public market failure, see David J. Allee, "Failure of the Public Market--a Framework for Cost Sharing Policy Research," in Ronald M. North and Steven H. Hanke, eds., Financing Water Resources: Cost Allocation, Cost Sharing, Incentives (The University of Georgia, June 1982).

system of user fees to recover allocated costs. 16/ Although these benefits may not be purchased one unit at a time, they may be valued and priced according to use by an easily separated group of users. Inland navigation benefits are probably more efficiently marketed at the federal level because the inland waterway system operates as an interstate transportation network. Systems to recoup the cost of providing these benefits could incur limited administrative costs, but revenue collected would far exceed any overhead.

Erosion control and drainage benefits are considered slightly less marketable because they cannot be delivered on a unit supply basis and cost-recovery systems may be slightly more complex. 17/ Nevertheless, users are still identifiable and costs can be recovered relatively inexpensively through imposition of a value added tax, for example. Some types of erosion control benefits and all drainage benefits may be priced according to relative productivity gains, or at the value of beneficiaries' economic output with the project versus output without the project.

Another group of benefits--fish and wildlife enhancement, water quality, flood control, area redevelopment, and preservation of historic or cultural sites--are not easily marketed because administrative costs are high or market imperfections prevent isolation of beneficiaries. Partial recovery of fish and wildlife benefits may be possible through sales of hunting and fishing licenses, but revenues could sometimes fall short of administrative costs. Real estate tax assessments could recover some costs of urban and rural flood damage reduction, but valuation is difficult and

---

16. There is no consensus on the correct way to separate navigation costs from total multipurpose project costs. The Corps of Engineers has devised a number of procedures that are applicable in different situations. Thus, while navigation benefits are marketable, some controversy surrounds separating these benefits from overall project benefits.

17. Erosion control and drainage projects transform previously unusable land into tillable acreage. For example, a drainage project entails construction of channels to drain a swamp and keep this low-lying area drained and usable for production. One type of erosion control project prevents loss of soil from agricultural land, thus allowing cultivation. Erosion control also is used to prevent beach erosion, which may not be marketable.

administrative costs might be high. 18/ Area redevelopment and preservation of historic site benefits might be vendible to concerned groups or associations, but no precedent for such a sale exists and legal or economic problems could arise.

Finally, current or future public goods are considered nonvendible. Such goods include stream flow regulation for aesthetic or ecological reasons, management of nonpoint source water quality (usually land management or forestry), and maintenance of natural areas and ecological systems. When these benefits are provided, the public in general is the beneficiary, not individuals or groups of users. Further, consumption of these benefits does not diminish future availability for other beneficiaries.

Sharing the Costs of Nonmarketable Benefits. Economic principles are perhaps less helpful in allocating the costs of public goods or other nonvendible benefits among the different levels of government. But there are practical considerations that might guide such a policy, including providing incentives to prevent under- and over-consumption, or ensuring equitable treatment of the fiscal capacities of state and local governments relative to each other and to the federal government. If the federal government paid all the costs of nonmarketable benefits, states would have an incentive to demand more water projects than if they had to pay a portion of each one. If the states paid all nonmarketable costs, some worthwhile projects might not be built. Either arrangement would imply that all nonmarketable benefits accrue to only one level of government. Sharing costs would help prevent under- and over-consumption while recognizing that all public entities have a stake in providing public goods.

In addition, not all states are equally able to afford such payments. In relation to federal fiscal capacity, individual states may be at a disadvantage. A marginally larger federal share in financing nonmarketable costs recognizes a stronger federal fiscal capacity--greater creditworthiness, lower interest rates on debt, greater ability to shift funding priorities, and the like. As the economic burden on states is reduced, state-to-state fiscal inequity becomes less important.

---

18. For example, flood control districts in Wisconsin are authorized to levy flood damage reduction user fees to recover the cost of building and maintaining flood control works. So far, only one district has attempted to use its authority, and when beneficiaries were informed of the user fees they would have to pay, the project lost local support.

ECONOMIC EFFICIENCY AND ADMINISTRATIVE PROCESSES

Aside from the inefficiencies promoted by current cost-sharing conventions, the administrative processes by which water projects are evaluated, authorized, and funded are long and complex, often resulting in project delays as long as 28 years. 19/ Delays tie up productive resources for long periods, leaving water resources needs unmet in the field. In addition, the information used to select water projects is often not sufficient to ensure the economic viability of water projects once they are built. Local decisionmaking over water resources investments that yield mostly local benefits could reduce development delays and improve the project selection process. State and local input during benefit and cost evaluation, coupled with a priori knowledge that local benefits will be provided by local sources of funding, might yield more realistic assessments of overall project feasibility.

The Authorization and Appropriation Process

The process by which water development needs turn into public works in operation is quite long--up to 28 years, and at any step along the way, a project may be delayed or cancelled. 20/ For the smaller, more localized projects that are likely to dominate future water resources development, the current process can cause needless delays while water problems persist.

---

19. See Gerald E. Galloway, Jr., Impediments in the Process for Development of Federal Water Resources Projects: Why All the Delay and What Can We Do About It? (prepared for the U.S. Water Resources Council, September 1981).

20. For 24 Bureau of Reclamation projects, the average time elapsed between the initial study and project operation is 28 years. For Corps of Engineers projects, average time between study authorization and project completion is about 26 years. SCS projects move considerably faster; they are generally completed within 15 years of initial study. For a detailed discussion of this issue, see Galloway, Impediments in the Process.

Since all the water agencies are similar in this respect, only the Corps of Engineers' procedure will be highlighted as an example. 21/

Once a water resources problem is recognized and the Congress approves a feasibility study, it takes, on average, 4.4 years for the Corps to receive an appropriation to pay for the study. The study itself takes about 4 years to complete, during which time an Environmental Impact Study is prepared. Review by the Corps, Office of Management and Budget (OMB), and the Congress of the feasibility report takes another 1.5 years on average. If approved by all reviewers, authorizing legislation must be passed by the full Congress and signed by the President. Once authorized, it takes an average of 11 years to obtain construction funding and design the final water project. Actual construction takes an average of 5.7 years, each of which requires another Corps' request for appropriations, approval by OMB, and appropriations by Congress.

Although this multistep process was designed to promote projects in the public interest and eliminate undesirable ones, more and more projects are simply being delayed, thus causing massive backlogs. For example, the Corps of Engineers has a backlog of over 400 authorized and active projects at various points in the process, which in aggregate would require about $36 billion to complete. Similarly, the Bureau has an authorized project backlog that would require $14 billion to complete. 22/

---

21. Bureau and Corps projects are budgeted on a line-item basis while the SCS plans and builds projects from a general appropriation. Under a separate process, the Corps can build small water projects (up to $2 million depending on project type) without individual Congressional or Executive approval.

22. In a recent study, the General Accounting Office (GAO) estimated that the Corps and the Bureau had 934 authorized water projects needing about $60 billion to complete construction. Of these, 289 were funded in 1982; 257 were considered active, but did not receive funding in fiscal year 1982; and 388 were considered deferred or inactive. In order to complete the 289 projects actually funded in 1982, appropriations of $35 billion would be necessary in future years. The remaining 645 projects would require about $25 billion in future funding, although the GAO considered such funding to be uncertain. For additional information, see U.S. General Accounting Office, Water Project Construction Backlog--A Serious Problem With No Easy Solution (January 26, 1983).