

**INTERVIEW WITH
PROFESSOR ARTHUR MAASS**

Q: Professor Maass, by way of going back and just recapitulating some of the things that you have been involved with in your life--with water resources development--maybe we can start things off by talking about how you got involved in water resources, how you came to write Muddy Waters, and a little bit about your earlier career.

A: All right. I graduated from the college at Johns Hopkins University in 1939. I had been a student of V.O. Key and at his suggestion went to Washington for a year as a National Institute of Public Affairs intern. I was assigned to the Division of Administrative Management of the Bureau of the Budget, which only that year had been transferred from the Treasury Department to the newly created Executive Office of the President.

The Reorganization Act of 1939 gave President Roosevelt authority to propose reorganization plans to Congress, and the President asked his Cabinet officers to propose such plans to him. These would be reviewed by the Bureau of the Budget. I was put to work on the proposals of Secretary of Interior Ickes that the U.S. Forest Service be transferred to the Interior Department from the Department of Agriculture and that the civil functions of the Corps of Engineers be transferred to his department from the Department of the Army. That was my introduction to the activities and operations of the Army Corps of Engineers.

After the one-year internship in the Bureau of the Budget, I accepted a Harvard fellowship at the Graduate School of Public Administration, where I continued my interest in water resources while earning an M.P.A. degree. After one year at Harvard I returned to Washington to work for the National Resources Planning Board, which had been transferred to the Executive Office of the President at the same time as the Budget Bureau, and there I was able to further my interest in water resources programs. But that didn't last long, for soon after war was declared I joined the Navy, in which I served for a little over four years. Concluding naval service in 1946, I resumed studies at Harvard as a graduate student and took up again my interest in water resources, but more largely from an academic perspective.

My first book was called Muddy Waters: The Army Engineers and the Nation's Rivers. It was an administrative study of the civil functions of the Army Corps of Engineers. Although it was published by Harvard University Press in 1951, it was completed essentially as a Ph.D. thesis two years earlier. And some of its findings were published earlier, in an article in Harper's magazine of August 1949, "The Lobby That Can't Be Licked: Congress and the Army Engineers." This was written jointly with Robert De Roos, who was then a Neiman Fellow at Harvard, and its style is considerably more "popular" than I have used subsequently.

Also, before the book was published, but based on its analysis and findings, I was appointed to the research staff of the Natural Resources

Task Force of the first Hoover Commission, which was chaired by ex-Governor Miller of Wyoming. There I helped to write the sections of the task force report which deal with water resources, including a lengthy case study of conflict between the Corps, the Bureau of Reclamation, President Roosevelt, and the Congress over the Central Valley of California. The task force report was published in January of 1949, almost two years before the book.

The principal criticisms of the Corps of Engineers contained in Muddy Waters, to a certain extent in the task force report of the first Hoover Commission, and in a brassier form in the Harper's article, were really two. First, that the Army Corps of Engineers was not a responsible administrative agency because its leaders did not consider themselves to be directly under the supervision of the President of the United States. They called themselves "engineer consultants to the Congress of the United States," and their principal accountability, as they saw it, was to the congressional committees that had responsibility for authorizing studies and the construction of water resources projects. I criticized this unusual pattern of executive-legislative relations, involving, as it did, relations between an executive agency and a congressional committee that were so intimate that the President and the Executive Office of the President were virtually excluded from decision making and had little authority over the Corps.

My second principal criticism of the Corps was that it was overly conservative in the professional standards that were used to plan and design water resource systems. The Corps was oriented very much toward single-purpose projects, either for flood control or for navigation, and had failed to endorse enthusiastically the concept of multipurpose development exemplified in the exciting work of the TVA [Tennessee Valley Authority].

Based on this analysis and other considerations, the Hoover Commission task force recommended that the civil functions of the Army Corps of Engineers be transferred to the Department of the Interior and consolidated with those of the Bureau of Reclamation. There is a lengthy justification in the report for this recommendation, which I need not repeat here.

The Chief of Engineers at that time was General Pick. He took strong, very strong, exception to what I had said, as well as to other criticisms of the Corps that had begun to surface at the same time. His objections were stated most emphatically in testimony before a Special Subcommittee to Study Civil Works of the House Committee on Public Works, chaired by Congressman Robert Jones of Alabama. This subcommittee was established in response to the Hoover report and recent criticism of the Corps, and it provided the Corps an opportunity to respond. For this purpose the Corps prepared for the committee a lengthy report (subsequently published as Volume 3 of Part 1 of the 1951 Annual Report of the Chief of Engineers) which, most notably in Appendix B, responded to the criticisms of my book.

In the committee% hearings in April 1952, General Pick made some rather strong accusations against me for publishing this book. I won't repeat

them here, for they are available in the published hearings of the subcommittee. But I thought when I heard them (I was in the hearing room at the time), and have continued to believe, that the charges were entirely unjustified. In a letter to Congressman Jones, I subsequently made two points concerning General Pick's testimony.

First, the general said that he was positive that influential people who were interested in changing federal policy or attempting to usurp power themselves had been instrumental in getting books like mine written. I found the charge that I had been influenced to write a book for the purpose of supporting the objectives of an outside power-seeking group, rather than for the purpose, as I saw it, of discovering truth through impartial analysis of available data, to be a most serious charge. Furthermore, I believed that my profession had high professional standards and ethics, not unlike the general's view of his own profession.

It is true, of course, that my conclusions were approved and even publicized by outside groups, some of whom had objectives with which I agreed. But this would have been equally true, if, after a careful examination of the evidence, I had come to the opposite conclusion, that the Corps had over the years and in all cases developed the nation's water resources in accord with the most desirable standards.

Q° Did anybody ever accuse you of being a Communist as a result of your book, or of having "pinko" tendencies? Do you recall anything about that?

A: The general stated in his testimony that I was a member of a small and effective group who had been able to gain access to the archives of this great government of ours, to select and use to their advantage the information which can be found in the writings and sayings of governmental leaders that is not generally available to all of the people of the United States. Of course, this was absurd; my access was to public documents available to anyone. So there was an element of conspiracy theory in that comment, but I don't recall that General Pick ever accused me of being a Communist.

To repeat, the reason that the Jones subcommittee held these hearings was that the conclusions I had published in Muddy Waters and similar conclusions in other reports and articles had come to be repeated many times, and both the Corps and the committee felt that it was important to give the agency an opportunity to defend itself against these criticisms.

Soon thereafter, President Truman undertook to draft reforms in the resources area, based on the Hoover Commission reports. While teaching at Harvard, I was called in as a consultant to the Office of the Secretary of Interior to work on proposals for reorganization in the water resources field. I worked then with Joel Wolfson, Al Wolf, Maynard Hufschmidt, and ultimately Oscar Chapman, who was then Secretary of the Interior.

We developed a plan that would transfer the civil functions of the Army

Corps of Engineers to the Interior Department, to be merged with those in the Bureau of Reclamation. This plan was sent to the White House, and, to my secondhand knowledge (I have no firsthand knowledge of this), they had been approved tentatively by President Truman, when there occurred a great flood on the Mississippi and Missouri rivers.

In response to that natural disaster, President Truman flew over the flooded area with General Pick. As a result of this flight and subsequent meetings and activities, the President backed away from the proposed reorganization plan. It was never presented in Congress. It was aborted.

After General Pick retired, the Corps of Engineers rapidly changed its attitude concerning its responsibilities to the President and to Congress. The Corps decided that it was in fact a part of the executive branch of government. It began to cooperate with the Executive Office of the President and to report to the President directly and to the Congress only through the President rather than, as previously, reporting directly to the Congress.

When the Corps of Engineers changed its attitude, so did the congressional committees. They no longer expected the Corps to be the engineer consultants to and contractors for the Congress of the United States, which had been the justification for direct relations, but to report to Congress through the President. With these important developments, the case for reorganization became much, much less pressing in my view than it had been before. I lost interest in reorganization--although I did come to be marginally involved in two subsequent efforts, in 1966 and 1970--and began to believe that there were alternative and more effective ways to solve the problems that remained, as I saw it, in the government's programs for water resources.

My interest then changed from these organizational questions to the question of how to design multipurpose, multiobjective water resource systems. That change was signaled by the formation of what came to be known as the Harvard Water Program. This was a multidisciplinary research and training program, with faculty representing hydrology and engineering, principally Professor Gordon Fair, the elder statesman of the group; Professor Harold A. Thomas, Jr.; and their student, Professor Myron B. Fiering. Representing economics there were Professor Robert Dorfman and Professor Stephen A. Marglin, then a young student. Dr. Maynard Hufschmidt, who was then working in the program staff of the Interior Department and had previously worked in the National Resources Planning Board and the Budget Bureau on water resource problems, came to Harvard to be research director of this program. I was the faculty chairman.

In planning this multidisciplinary study of water resources, we explicitly eschewed any concern for government organization and reorganization which had consumed so much intellectual effort in previous years. We were going to study how to design complex water resource systems in the light of new techniques of analysis that were only coming to be applied to economic production functions and that involved simulation with high-speed computers, linear programming, and optimizing mathematical models.

The first results of this study were published in 1962 in a large book called Design of Water Resource Systems: New Techniques for Relating Economic Objectives, Engineering Analysis and Governmental Planning. This book, I think I can say (since I was only one of several authors), had a tremendous impact in the fields of public investment economics, engineering design, and hydrology. As I see it, there were three principal contributions from this first stage of the Harvard Water Program.

First was the use of simulation by computer to design water resource systems. We were, so far as I know, the first group to use simulation on high-speed digital computers to examine the economic as well as the physical consequences of alternative designs of such systems. Prior to this time there had been one or two simulation studies conducted entirely in physical terms, where the purpose was to find, for example, the best alternative design in terms of the number of kilowatt-hours that could be produced from a series of dams in a river basin.

Ours was much more complex than this, for our simulations included benefit, cost, and economic loss functions for multiple purposes of development (for example, electric power, irrigation, flood control) and multiple objectives of development (for example, national income, income redistribution). This contribution was reported initially in Design of Water Resource Systems and was further elaborated in a subsequent volume authored by Maynard Hufschmidt and Mike Fiering, Simulation Techniques for Design of Water Resource Systems.

A second major contribution was the development of synthetic or operational hydrology as a means for designing water resource systems. The point was this: Having developed methods to design systems with the aid of high-speed digital computers, we could use more hydrologic data than frequently were to be found in the historical record. The method then used by hydrologists in the Corps and elsewhere to construct a record longer than the historical record was simply to repeat the historical record or otherwise to manipulate it marginally.

Our hydrologists were convinced that the likelihood that an historical record will repeat itself is very low. One can take the basic data which constitute the historical record, mix them up in ways known to those who, like Thomas and Fiering, are familiar with the most sophisticated statistical techniques, and produce a synthetic record of streamflow that is more likely to represent the future than any repetition of the historical record. Having done this, you have a self-generator of hydrologic data that will produce as many years or hundreds of years of data as may be needed to compare alternative designs. This contribution, too, was reported in Design of Water Resource Systems, and it was developed further in a subsequent book by Fiering, Streamflow Syntheses.

The third contribution—which may be the most important—was the development of multiobjective economic analysis and planning, which, it should be noted, is not the same as multipurpose planning. Multiobjective planning focuses on such objectives as economic growth, regional income distribution, and environmental quality, whereas multipurpose planning

relates to such purposes as flood control, navigation, and irrigation. Until then the design of water resource systems had been in terms of a single objective, namely maximizing economic growth. Other objectives, if they were taken into account at all, were never included in the basic analysis. They were discussed, usually nonquantitatively, in additional paragraphs in committee reports, that is, paragraphs added to those containing the principal analysis which was in terms of the single objective of economic growth.

We were convinced that this was wrong and that we now had available the techniques that would enable us to construct multiobjective planning functions and to design complex systems in terms of such functions. We did not pretend to prescribe the relative value that should be placed on each objective in a multiobjective function. But we believed that such values could be elicited in a political decision process involving the executive and Congress. What we did demonstrate was that you could design a complex water resource system in terms of a complex objective function.

This contribution was also presented initially in Design of Water Resource Systems. It was subsequently elaborated in a book by Professor Marglin, Public Investment Criteria; in two articles that I wrote, one in the Quarterly Journal of Economics and one in Public Policy; and in a monograph by Dr. David Major entitled Multiple-Objective Water Resource Planning.

It is interesting to note that the Corps of Engineers cooperated with the Harvard Water Program from the beginning and, indeed, became the leader among federal agencies in trying to develop and apply the new techniques.

Thus, the criticism of my first book, Muddy Waters, that the Corps had been backward in professional standards, that it was not as interested in multipurpose planning, which was then the new technique, as were other agencies--this criticism had by now come to be outdated. The Corps' enthusiastic cooperation in the development of new methods of planning proved this to me.

And there is other evidence of this. At about that time, I believe, the Corps organized its own research institute to carry on some of these studies, the Institute for Water Resources. One of the institute's senior officers was Colonel Charles Eshelman, who had been associated with the Harvard Water Program.

Also, I should have mentioned that in the years 1956-1958 the Corps assigned several of its senior civilian employees to the Harvard Water Program, as did certain other agencies, to help us in working out these techniques. Ed Landenberger was one, and there were a number of others.

With respect to the specific design techniques developed by the Harvard Water Program, the chief hydrologist of the Corps, Leo Beard, was not initially prepared to accept synthetic hydrology. He said we couldn't prove that a streamflow record like the synthetic one had occurred or

ever would occur. Indeed, it hadn't, for we mixed up the historical record and produced from it a synthetic one. Most of the hydrological community initially shared Beard's concerns about this new technique.

But soon, with some proselytizing by Thomas and Fiering, the technique came to be accepted. The Corps adopted it as quickly as any agency, I believe.

Next, with regard to multiobjective planning, the Corps climbed on board very quickly in the sense of making a major effort to see if this technique could be used in project planning. At that time the Corps was developing a special report on water resources in Appalachia, and for it they used multiobjective planning.

Furthermore, the Corps was the lead agency in a large interagency framework study of water resource development in the entire North Atlantic region from Richmond to Maine. It was called the North Atlantic Framework Study. In that study there was a herculean effort--largely successful, in my view--to apply multiobjective planning. As a member of the advisory committee for the framework study, I helped to push the concept, and one of the best of the next generation of young scholars to come out of the Harvard Water Program, Dr. David Major, went to work on the study, directing the staff effort to apply multiobjective analysis. Major subsequently worked for the Corps in the Institute for Water Resources.

Furthermore, Steven Dola, who had been at Harvard during the years when we first developed these techniques, took a job in the Office of the Chief of Engineers, and subsequently in the Office of the Assistant Secretary of the Army for Civil Works, principally to apply these methods to Corps planning.

Finally, in the late 1960s and early 1970s the Water Resources Council developed a set of proposed standards and criteria that were to be used by all agencies in the design of water resource systems. These were fashioned around the technique of multiobjective planning, and the Corps of Engineers was, I would say, the lead agency in helping to define the new standards and criteria.

By this point, to repeat, my principal criticisms of the Corps in Muddy Waters had been well responded to. The Corps had become a leader in developing professional standards, and the Corps had also become as cooperative as any federal agency with the Executive Office of the President in clearing its projects and helping to develop a presidential program for water resources.

At this point, as I saw it, the main obstruction to the adoption of forward-looking, state-of-the-art techniques for the development of water resources was not the Corps of Engineers but the Office of Management and Budget. They strongly resisted multiobjective planning and frustrated the efforts of the special task force established by the Water Resources Council to rewrite the standards and criteria. OMB feared that if multiobjective planning were used it might result in greater demands for federal funds for water resource development, and that this was to be

avoided at all costs, even if multiobjective planning was more responsible than planning for the single objective of increasing gross national product. I supported this conclusion in an article on public investment planning which appeared in the journal Public Policy in 1970.

I realize now that I have failed to mention an important consideration relating to cooperation between the Corps and the Harvard Water Program. After the program concluded its first phase in 1962, the **Corps** of Engineers entered into a contract with the Harvard Water Program to study application of the new planning techniques that were presented in Design of Water Resource Systems--the application of these to the water resource planning process of the Corps of Engineers. Maynard Hufschmidt led the study, and I like to think that, to a certain extent, the resulting report influenced the Corps' planning process.

Now let me change the focus a bit to say a few words about my consulting for the Corps subsequent to my participation in the Harvard Water Program. First, the Office of the Chief of Engineers established in 1965 or thereabouts a civil works study board under the direction, as I recall, of Alfred B. Fitt, who was a special assistant to the Secretary of the Army for civil functions. I consulted that study board on its recommendations, and my contribution can be found in the board's report.

In 1968 I consulted with the Office of the Chief of Engineers on a study of alternative institutional arrangements for managing river basin operations. I worked fairly closely with Colonel Robert Werner, who was in the Office of the Chief of Engineers. The recommendations that I made, which can be found in the reports of this study, concerned principally organization for river basin development.

In this same line of consultations with the Office of the Chief of Engineers, I was appointed a consultant to a task force on civil works planning, established in 1970 or 1971 and chaired by Brigadier General Robert Mathe. Here again, I think that anyone who is interested can see what contribution I made to this study by reading the task force report.

In April of 1970, Atlantic Monthly featured an article by Elizabeth Drew, entitled "Dam Outrage: The Story of the Army Engineers? I was outraged by this piece and undertook, after consultation with the editor of the Atlantic, to write a response. For this purpose, and in response to my request, the Office of the Chief of Engineers sent me considerable data. With those data in hand, I wrote the reply. The Atlantic, for their own reasons, refused to print it, whereupon Representative Ed Edmundson of Oklahoma entered it in the Congressional Record for December 22, 1970. I felt that Mrs. Drew was going back to criticisms of the Corps that might have been applicable in 1945 but were scarcely relevant in 1970. My reasons are spelled out in detail in that issue of the Congressional Record.

Let me conclude this imperfect summary of my relation to the **Corps** of Engineers in recent years by referring to the book published in 1971 by Arthur Morgan entitled Dams and Other Disasters. In that book Morgan accuses me of changing my views about the Corps of Engineers because the Corps had employed me as a consultant and contributed to the

Harvard Water Program. Obviously, I believed that this was entirely unfair. Morgan also attacked Dr. Gilbert White in this book in ways that seemed to me to be equally unjustified.

Morgan had previously written me, as early as 1965, for my views about the Corps, and I had responded to him at great length, telling him why my views had changed since publication of Muddy Waters and precisely on which points they had changed and on which they had not. Several years later Morgan sent a research assistant to interview me on the same subject. I tried to talk to this young man rationally but apparently without success. My impression is that Morgan's mind was fairly well closed; he was not prepared to entertain data or views in conflict with those he had learned many years before.

At that time, I received a letter from Lieutenant General Clarke, Chief of Engineers, expressing his concern about Morgan's unkind comments about White and me. I recall responding to General Clarke something to this effect: that Morgan had always had two sides, one creative, the other destructive. As Francis Biddle, who was chief counsel of the congressional committee that investigated FDR's firing of Morgan from the TVA, had said of him, "Morgan has the strength and the smaller weaknesses of the American zealot."

Like Gilbert White, I had tried in correspondence and by talking to one of his research assistants to encourage Morgan to look afresh at the Corps today, but he appeared only to have resented these efforts and searched instead for conspiratorial explanations for them, such as the suggestion that I had been bought off by the Corps consulting fees. The Congressional Joint Investigating Committee of 1939, to which I have referred, was "forced to conclude that there were differences of opinion on the TVA board which became exaggerated out of all proportions because of the Chairman's [Morgan's] propensity for attributing moral delinquencies to anyone who opposes him." The old boy hadn't changed.

As for reasons for changing my view of the Corps, I have indicated these earlier in this interview. I also summarized them in a lengthy footnote (number 7) to the 1970 article on public investment planning in Public Policy. Anyone who would like further explanation of why my views changed can see that article.

Q Professor Maass, I've got some specific questions about your particular work, and then some more general questions about water resource development, and I'd like to have your comments on them.

First of all, turning to your own work, in particular Muddy Waters, I'd like to go back for a moment and capture the mind set in which you wrote that book. A few things occur to me. You asked, evidently, Harold Ickes to write the foreword to the book. The foreword is, to say the least, rather strident in condemning the Corps of Engineers. Your book, of course, is scholarly. Did you ever regret having Ickes write that foreword?

A I guess the answer is no, but I probably would not do it today. Because of Ickes' foreword the book got public attention, but this

probably is not a good justification. Ickes's foreword was typical of his mind set and style. He was a very colorful man, and he frequently overstated his case. I thought everyone would take it as such and would not expect a foreword by Ickes to be as dull and as balanced as a scholarly study might be.

Q: Did you ever figure out whether you were quoted more or Ickes was being quoted more from the foreword in various reviews?

A: Yes, that depended on the medium. The daily press gave greater notice to Ickes, but the scholarly journals paid little attention to his views.

It is interesting, though, that when Ickes first wrote his introduction he included several long paragraphs on his objections to the Chicago Drainage Canal, which I had not mentioned in my book and which had little relation to the book. This had been a concern of Ickes when he lived in Chicago. The problem for me was how to get those paragraphs out of the foreword. It wasn't easy for me--indeed, for anyone--to make such a suggestion to Harold Ickes. So I had to work through people whom I knew a little better; namely Mike Strauss, the Commissioner of Reclamation, and Joel Wolfson, the Assistant Secretary of Interior. They agreed to suggest to Ickes that he cut the material on the Chicago Drainage Canal. He raised a terrible fuss but agreed finally to strike the paragraphs and allow me to **"publish** his dog with its amputated tail. He was a colorful character.

Q: You made in your book several major criticisms of the Corps: lack of responsiveness to the executive branch, conservatism in professional standards, and also the refusal to endorse multipurpose river development. Now I would like to talk about the last two, mainly. This conservative approach in professional standards--when you wrote the book, did you ask whether there was a good reason for the Corps to be conservative in its professional standards, considering its flood control responsibilities and the consequences if a dam collapsed?

A: One could argue that I wasn't sufficiently sympathetic to the conservative orientation of engineers, which results in part from the fact that they can be held to account for their errors. A social scientist will commit errors of interpretation in an article and then simply admit to them in a subsequent article. If, on the other hand, an engineer makes a mistake and his structure collapses, it's much more difficult for him to explain it away. And I probably was not as sympathetic to that source of conservatism as I should have **been**.

But I don't believe that in fact I criticized the Corps very much for its conservatism in design of structures, such as would be observed in overbuilding. There was a little criticism of this, but not much. My criticism that the Corps was overly conservative related to the fact that they failed to take into account planning purposes other than protection against floods and improvement of channels for navigation. They were unsympathetic to multipurpose planning as it had been developed by the TVA and was being used by the Bureau of Reclamation.

Q: This conservative engineering approach, of course, is part and parcel of this perhaps lack of sympathy with the multipurpose approach. You can look into transactions of the American Society for Civil Engineering in the 1930s and 1940s and come across engineering articles by people throughout the Corps who claim that you cannot, for instance, run a viable flood control program and also have a multipurpose project because the flood control reservoir has to be empty, your reservoir for navigation has to be full, and so forth.

A: Yes.

Q: Again, in light of those kinds of engineering concerns, do you feel that perhaps there was some justification for the Corps being conservative in refusing to accept with open hands the multipurpose concept?

A: Certainly they were justified in demanding that the advocates of multipurpose development come up with proof that storage space could in fact be used for more than one purpose. But I also think that the Corps was insufficiently receptive to suggestions about how that could be done.

You will recall that the Water Resources Committee of the National Resources Planning Board (the secretary of that committee was Gilbert White, and the chairman was Abel Wolman, a very fine civil engineer) concluded in several reports that much more could be done on joint use of reservoir space and conjunctive use of physical facilities than the Corps was willing to admit.

I must say that, at the time, I was much impressed by those reports in this regard, and I think that if the Engineers in the Corps today were to read again those reports of the late 1930s and 1940s, they might be surprised that their predecessors had opposed them so vigorously.

Q: Do you think some of the Corps' reluctance to embrace multipurpose river development had something to do with this upstream-downstream controversy that was taking place at the time, in other words, the tug of war between the Soil Conservation Service and the Corps?

A: Certainly that was part of the story. Those who proposed that we could solve the flood problem by upstream measures principally or exclusively exaggerated tremendously the possibilities of their program, and the Corps was right in pointing out the deficiencies of their analysis and claims. But then, as a reaction, the Corps became a little too vociferous in their opposition to upstream watershed programs.

In 1954 I wrote a lengthy article entitled "Protecting Nature? Reservoir" (published in Public Policy), in which I analyzed the upstream-downstream question.

The controversy between dams and watersheds originated, you will recall, with the Flood Control Act of 1936, which provided that investigations and improvements of rivers for flood control were to be under the Corps, while those for retarding water flow on upstream watersheds should be

under the Department of Agriculture. Between 1936 and 1954 the Corps and USDA [U.S. Department of Agriculture] were unable to agree on how to allocate the benefits of these two programs, that is, on the relative contribution to the prevention of flood damages that should properly be attributed to dams and to watershed programs. Some who called themselves conservationists at the time exacerbated the disagreements, making it more difficult for the agencies. For example, there was Elmer Peterson's book, Big Dam Foolishness, with a fiery introduction by Paul Sears.

The SCS's [Soil Conservation Service] involvement in the planning and installation of upstream structure and farm conservation practices for flood control was greatly accelerated nonetheless in 1954 with passage of the Small Watershed Act.

Q: In making a recommendation that the Corps' civil works function be transferred to the Department of the Interior, was the recommendation made mainly because you thought it to be just good government policy to put water resources development in one agency, or was it made because you felt that the Department of the Interior simply was more competent in dealing with water resources?

A: I think it was a little bit of both. One should keep in mind that reorganization transferring bureaus around from one department to another, was a trendy idea at that time. The broad justification for such reorganization had been developed by the Brownlow committee in 1937, and the Reorganization Act, which authorized the President to propose plans to transfer and consolidate bureaus, was passed in 1939.

Certain agencies were exempted from the President's authority, among them the Corps of Engineers. But that didn't mean that the President could not submit a legislative proposal to transfer the Corps of Engineers to the Interior Department and combine it with the Bureau of Reclamation. Secretary Ickes recommended such a reorganization to the President, and it was studied by the Budget Bureau. But before Roosevelt took any action, World War II intervened. It was not until after the war that attention was again focused on possible reorganization of the government for water resources development. This, then, was the environment for deliberations of the first Hoover Commission.

At the time, my convictions were based on two factors: one, that the Corps of Engineers was operating independently of the President and of the executive branch.

A: second and closely related factor was the backwardness of the Corps, at least as some of us saw it, in some of its professional standards, most importantly its failure to endorse the TVA concept of basin-wide planning and multiple-purpose planning. As I document in Muddy Waters, the Corps had fought pretty strenuously right down the line the National Resources Planning Board's recommendations for a new approach to river basin planning.

If one agreed--as I did--with the Planning Board in promoting integrated, multiple-purpose development of water resources, involving more than

simply flood control and navigation, which were the principal purposes of the Corps' planning at that time, then one way to force such broader water resource planning was to place the Corps under the President's authority.

Q: Of course, the Corps did get involved in basin-wide planning with the Pick-Sloan plan in the Missouri River, and by the late 1940s you have basin-wide studies of the Columbia being done.

A: The Corps was directed from outside to cooperate in those studies. I don't know that they necessarily wanted to do them. I think President Roosevelt ordered the Corps under General Pick and the bureau under Sloan to get together and come up with a single Pick-Sloan plan. There had previously been a Pick plan and a Sloan plan if I recall correctly.

Q: True.

A: The same was true in the Columbia basin. The Corps didn't go into cooperative planning very willingly. A lot of effort was lost in the frictions that were present among federal agencies.

Q: You mentioned before that in the mid-1950s the Corps started to change from an agency that thought of itself as mainly responsible to Congress to an agency that thought of itself as a responsible executive agency.

The question is, do you feel that this was done consciously by the Corps, or was this done basically to the Corps by other agencies, in particular by the Bureau of the Budget, which at that time in the Eisenhower administration was looking for cost cuts wherever it could. The Corps was basically in a very defensive posture, versus the Bureau of the Budget.

A: The latter certainly was one point, but I honestly think that there was a conscious effort by the Corps. I don't know about this for sure, but I have always had the feeling that some members of the Corps were just a little embarrassed by General Pick's last years in office, when he took so strong a position against proposals for change, and it was my impression that the next Chief of Engineers after Pick-1 can't remember his name.

Q: After Pick, it was Sturgis.

A: Sturgis, yes. I had the impression from talking to General Sturgis that he consciously wanted to get the Corps on a different track.

At the same time, the noteworthy changes between 1948 and 1968 in the attitude and policy of the Corps of Engineers was due to several factors apart from the personalities of the Corps' leaders. The Corps decided in the middle 1950s to cooperate with, rather than to oppose, constructive critics in the academic community. That was when they became a principal cooperator in the Harvard Water Program here.

Also, there was increasingly effective control by the Bureau of the

Budget over the legislative programs of all executive agencies, which is the factor that you mentioned. And the Corps began to feel a need for broader support in the executive, due, in addition to the factors above, to the relative decrease in significance of water resource development in the sum of federal programs and to the degrading of the Corps' representation at the Cabinet level.

With the merger of the Department of the Army into the Department of Defense, the Corps' nominal civilian and political representative, the Secretary of the Army, lost Cabinet status, and the Secretary of Defense had little time for, or interest in, the Army's civil functions. At the same time, the Secretary of the Interior had become more than ever the President's spokesman on water resources.

These, then, were the factors that accounted for the changes between 1948 and 1968 in the Corps view. I have discussed them in that 1970 article in Public Policy, especially in a lengthy footnote.

Since then, of course, we have had the rise of the environmental movement and all things related to it.

Q: In the late 1950s and early 1960s you do have the articulation of something called floodplain management. I use that phrase because you can argue that floodplain management goes back before that time, but certainly the term becomes commonplace in the 1950s and early 1960s with Gilbert White.

The question is to what extent do you believe the Corps embraced floodplain management at the beginning? I mean, do you have any feeling about how receptive the Corps was to Gilbert White's ideas, the ideas that came out of the University of Chicago?

A: Certainly they weren't receptive initially. If I recall correctly, Gilbert White's first book, Human Adjustment to Floods, which was his Ph.D. thesis in geography at the University of Chicago, was published in the early 1940s. Is that correct?

Q: As a thesis, it was the early 1940s. I think it came out as a paperback in the mid-1950s.

A: Perhaps so, but Chicago in those days published its Ph.D. theses, and White's came out in the 1940s. At that time, certainly, the Corps was not very receptive to his ideas concerning floodplain management. But Gilbert White is, as you know, a persistent man. He kept at it, and finally the Corps adopted the concept. I don't remember what year that was; it was when they supported a provision in the civil works bill authorizing floodplain studies.

Q: In 1960, there was a floodplain management services thing--

A: Yes. And once they accepted the concept, I had the impression that the Corps rather quickly began to make analyses of projects in the light of alternative adjustments to flood hazards. To be sure, they continued in many cases to favor flood control structures more so than

some of their critics. One of the first of the surveys in which the Corps actually rejected structures, recommending instead zoning and other flood management devices, was the Charles River study, which came along a bit later. But, on the whole, I have little criticism of the Corps once they became involved in floodplain studies.

Q° You were talking about the synthetic hydrology and the simulation that is now being used in place of modeling and so forth. A few questions. I don't pretend to be an engineer, and I don't know if I understand completely how simulations work; I'm sure I don't, actually. But the bottom line, the kinds of data you're looking for--isn't that still basically a very subjective type of operation, to decide which categories of data are the important categories?

A° Yes, indeed, it is. The principal advantage of simulation is that once you've written the simulation program, you can very quickly--well, let me start over. Simulating river systems for the purpose of design (I'm not talking about operations) is not new. Corps planners have always simulated, but with desk calculators.

They would select two or three possible designs and then simulate with desk calculators the consequences of each of these in terms of river flows and of benefits and costs, by assuming that the design structures are in place and then running through them the monthly or daily streamflows that are taken from the historical record. Now with computer simulation one can, with the same amount of effort, test more than 100 alternative designs and find the best one of these. If you are able, with the same effort, to examine 100 alternatives rather than 2 or 3, and to recommend the best one, the chances are very high that the net benefits of the former will be much, much greater than those of the latter.

In either case one needs the intelligence of the engineer and the designer as to what data are relevant and what data are mostly irrelevant. And you don't want to design a computer program with a capacity that exceeds the firm and relevant basic data that you have in hand.

Q° Would it be fair to say that these kinds of simulations allow you to do more social engineering? What I mean by that, more or less, is using public works projects to redistribute the income.

A° Yes, you can vary your objective function much more easily; I believe that's what you are suggesting. Furthermore, with computer simulation you can test several alternative objective functions. You could have as a single objective to optimize national income, that is, to optimize the difference between benefits and costs, all measured in terms of national accounts. Or you could optimize national income subject to the constraint that you redistribute so much of this income to particular groups or to particular regions.

The point is that it's easy to specify a complex objective function in computer simulations, whereas this is much more difficult if the simulations are being done with desk calculators. And it is also easier to

compare the results of using alternative objective functions. But conceptually, there's no difference.

Q But then, of course, if you do get involved in these kinds of variables, you immediately get involved with political questions.

A There's no question about that. My point would be that we don't design and build dams for engineering reasons. We design them to meet national needs, and the national needs are the objective function.

Until our work in the Harvard Water Program, the objective function of water resource development projects was almost always to maximize the increase in gross national product. Yet, as I have pointed out in several articles, this most frequently is not the reason why government becomes involved in such activities. The government is likely to have different objectives: for example, to redistribute income among individuals or groups, to redistribute income from one region of the country to another, or to promote environmental quality.

Thus, to design programs that maximize the single objective of increasing gross national product is not at all responsive to national needs. This procedure may have been more acceptable when we didn't know how to do otherwise; but now that we have the capacity, with the use of simulation and other techniques, to construct complex objective functions and then to test which among many alternative designs will maximize such functions, there is little justification for continuing to design for national income only.

Q Are you familiar with how the Corps develops BC [benefit-cost] ratios now?

A I am not familiar with developments in the last four or five years. I do know, however, that the Corps' efforts to respond to requirements of multiple-objective design have been thwarted time and again by the OMB, which has discouraged and tried to prevent the Corps from using these techniques. But maybe you could be more specific about your question.

Q I was just going to lead into the obvious question: Do you believe that the Corps in the way that it develops its BC ratios today reflects this kind of multiobjective?

A Yes. I think it does better on this than any other federal agency, and the Corps would do much better than it does if it were not under the what seems to me to be unreasonable pressure from the OMB not to include in their planning any objectives other than increasing gross national product. OMB has said that in reviewing the Corps' projects and deciding whether or not to approve them in the name of the President, they will not allow the calculation of benefits and costs from multiple objectives, only those from increasing national income. At least they said that some years ago, and I don't think the situation has changed.

So the response of OMB to the Corps' efforts on multiple-objective

planning has been a great discouragement for the agency. What the Corps did, at least in the 1970s, was to prepare their multiple-objective analyses none the less, but to prepare also a single-purpose national income analysis, knowing that the OMB would use the latter one when it decided whether to approve the project or not. And this created great difficulties.

Q: That's true. There has been no water resources act since 1976. This kind of multiobjective simulation--does it have anything in common with risk analysis?

A: It certainly does. And we examined in the Harvard Water Program the problems of multiple-objective planning under different assumptions of risks and uncertainty. This turns out to be quite complicated and difficult, but It's important that uncertainty be considered in this context.

The problems of uncertainty and risk analysis relate also to the question of the discount or interest rate that is used for planning government projects. Some attention was given to this question, also, in the reports of the Harvard Water Program, especially the work of Stephen Marglin. In addition to what he has to say in Design of Water Resource Systems, Marglin subsequently wrote two articles in the Quarterly Journal of Economics on how to derive and use a social rate of time discount. as he called it, in designing water resources and other public projects. rather than the market discount rate, which he showed to be less relevant.

Q: Thank you very much for your time, Professor Maass.