CAP Oral History

Pam Stevenson (Q):

Today is Thursday, October 12, 2006 and we are in the Denver area doing some oral history interviews. This one is for the Central Arizona Project. I'm Pam Stevenson doing the interview and Bill Stevenson is the videographer. I'd like to let you introduce yourself

Ed Barbour (A):

Edmond Barbour and everybody calls me Ed.

Q: When and where were you born?

A: I was born in Port Arthur, Texas, March 13, 1924.

Q: What was your family doing in Texas at that time?

A: My dad was in the real estate business at that time and of course my mother was just a homemaker. I was one of eight children; four boys and four girls and I was the third eldest. There are four of us left, and I am the eldest.

Q: So did you grow up then in Texas?

A: Yes, I grew up in Texas. I never really got out of the county until I went in the Army, which was when I was 19. I tried to get into the Air Corps. After Pearl Harbor, all the young fellows wanted to get in the Air Corps, be a cadet and get wings. But my folks didn't agree with that. If you were 18, of course, you had to have your parents' permission, and they wouldn't agree to it. So I said okay, I'll just let them draft me and I'll end up in the Infantry and I won't last long. You think it's dangerous in an airplane; you ought to see what it's like in the Infantry. But anyway, I did get drafted when I was 19. I had my basic training and I ended up at a radio operator school in Scott Field, Illinois and I learned to be a radio operator-navigator and B-17. We're all

looking forward to going to gunnery school and I was a hunter as a kid. Used to hunt ducks and geese on the rice farms. That was one of my favorite sports. So I was anxious to go over there and see if I could shoot down a few Messerschmitts and FolkWolfs and whatever. But, hadn't my name started with a B, and they took all the As and Bs from the class and put them in a replacement depot because they needed replacement people overseas, so we didn't get to go to gunnery school. So we got assigned to a different unit which was what we call a hot unit, ready to go overseas. It turned out that they assigned me as a radio operator, communications, and I didn't get to fly on a plane. I was very disappointed, but we didn't have much time to get disappointed, because they shipped us out of there and we were on a convoy going to England in March of 1943. We spent time in England. We didn't stay too long, because D-Day was in June and they sent our group, we were in a fighter-bomber group, and I was on the ground radio station because there wasn't room in a one-seat plane for a radio operator and in those days, we were using Thunderbolts. They sent us over to Omaha Beach on about D+24 to set up the first airstrip there. By the time we got to the end of the runway, we were over in enemy territory, so it was kind of exciting in those days. I was fortunate that I didn't get into the B-17 because we had a lot of B-17s that crashed on our little airstrip. I spent two or three years there in the European Theatre and came back home and, just like all the other GIs, took advantage of the GI Bill.

I got out in November and decided I needed to get out of there and get some education. I tried to get into the University of Texas, but they're on a semester system. But someone told me that Colorado is a nice place to be, and I found that the University of Denver was on a quarter system and that they would take me in January. I applied and they accepted me. I think they would have accepted anybody in those days. Right now, it's hard to get in to. The University of Denver is a beautiful place. So I went to the University of Denver and decided that I didn't know what I was going to do, so I thought I might do accounting and CPA. My dad was in business and wanted me to join him in the real estate business but I didn't want to do that. But I decided I would go that way until I met an economics professor, a Dr.

Louis O'Quinn. He impressed me so much that I ended up with a double major in Economics and Accounting. I went on to get my Master's degree there.

I will always remember one thing that Professor O'Quinn told me. I was a sophomore and taking my second Principles of Economics course. He said that really there are only two things worth talking about, and that's economics and women. But now we're going to have to refrain and only talk about the first subject. He was an institutional economist; they look at economics in terms of how we organize ourselves to get the means of life experience. And you have what they call the instrumental part and the ceremonial part of our institutions. The instrumental part is getting things done. And the ceremonial part is how we organize ourselves in a power structure.

So this is the angle he took and we studied economics from that viewpoint, meaning there were two aspects, getting things done and then facilitating it through how we organize ourselves in a power structure. For example, our final test in that class was to sit down and appraise the economic theory underlying fascism, socialism and capitalism. That was one question. It was two hours. We did it and I got an A in the subject. In fact, I was lucky, because when I graduated in '49, I went on to get my Master's and I was able to get a student assistantship to kind of help out, so I ended up teaching a principles course. It's too bad to have a student teach a principles course, but there were so many students in those days, GIs, so I got a start there and I used the notes from Dr. O'Quinn very liberally in those days. I had four job offers when I graduated. One was from Prudential in their investment department. One was from Merrill Lynch in Colorado Springs. Bank of America in the executive training program.

Then I had met this economist who was the head of the finance department. I had done some work for him. He was writing a book on finance and I helped him write some of the chapters. He suggested I meet a Dr. Hughes, who was an economist for the Bureau. Now they usually only have engineers, but he's one of the rare economists they have in the Bureau of Reclamation. He happened to be the chief

economist for MacArthur in Japan and he had some wonderful stories to tell. So I went to visit with him and he said I ought to go to work in water resources, that I would like it. It turns out they offered me about $300 a month because I had my Master's, as opposed to Prudential and all the rest, who offered me about $200 a month. Then I liked the idea of water resources because I liked the outdoors so I took that job.

I ended up in Indianola, Nebraska at the German prisoner of war camp where we had our offices. We had about 400 people working there building all those projects in Nebraska, mostly irrigation and flood control projects. So that's how I got my start. At that time they had about 4,000 engineers at the Bureau of Reclamation and very few economists. They decided maybe they had engineers doing economic studies, and maybe they ought to have a trained economist do some of those studies. So that's what I started to do. I started to look into the background, thinking about my institutional economics, on how these things fit together, and I found out nobody really cared too much about the engineering aspects, not when you went for authorization. They wanted to know something about the economics. They wanted to know whether it was worthwhile. They call them benefit-cost ratios. They wanted an analysis of the benefits and costs and then they wanted to know how it got paid for with a financial analysis. There was nobody in the office to do that, so I was the youngest guy and they didn't too much care. They used to call me an accountant instead of an economist, because I used to catch them with a lot of funny numbers, so I had to put the thing together in an authorization report.

I knew the most important thing was getting through Congress obviously so those projects were part of the Missouri Basin Project. Pick-Sloan Plan was the second major large basin development. The first one was TVA, but it was done on a separate authority. This was done within government but the Corps of Engineers and the Bureau of Reclamation authorized this huge project on the Missouri River and the Corps built all the mainstem projects and developed a lot of power. The Bureau of Reclamation was building all the other projects, a lot of irrigation projects, and there was a lot of competition between the Corps and the Bureau in those days. I

found that some of the irrigation projects that I was trying to justify were overloaded with what they call a power allocation. A requirement in the Bureau is you have to show the repayment, analyze the repayment aspects. Irrigators need subsidies, so a lot of the costs of the irrigation projects are subsidized by power. When we did the economic analysis, you had to assign some of those power costs to the irrigation projects. I found that the Corps of Engineers assigned a lot of costs to our individual projects and we were having a heck of a time justifying them. So I suggested to the Washington office that we tell the court to go jump in the lake and we would build our own coal-fired plants and generate electricity and with the cost they were assigning us, and we would actually save money from an economic standpoint. It didn't make any sense, but I had to do that just for fun. Then I had to learn about coal-fired plants, so I got into the field of energy that way. Also I got into the field of how all these projects fit together and how they would pay off. The pay-out study on that particular project took 125 years. But you had to show a project paid off in 40-50 years after it was constructed so we used power revenues. Irrigators pay only what their ability is to pay, and we had to determine that. The municipal water supplies had to pay all their costs, and power had to pay all of its costs, but flood control was non-reimbursable. So I got this background, this reputation of knowing how to do Basin allowances, because I ended up putting all of the pay-out studies together and I ended up in the Denver office in charge of the technical side of economics. Also I had the environmental group, the social welfare group, soils and resources group, but my favorite subject obviously was economics. When the Central Arizona Project came up, I had experience there, I had done work on the Central Valley Project, and the Colorado River Basin Project. They're all major basin projects and had to establish repayment. Then they sent me out to Phoenix in July 1961 to see if I could straighten out their economics for the Central Arizona Project, which had been studied for years and years. Cliff Pugh was the project manager and I worked with Cliff and his staff. Tom Clark was there and he was kind of a young fellow. He seemed to be very bright so I asked him to be assigned to me to help me with my studies. That made some of the old-timers a little bit upset about it, but anyway, that's how Tom got his start working with me on economic studies on the CAP.

Q: Do you know when they started planning?

A: I'm not sure when they started planning, but it seems like there's always been a Central Arizona Project. It was just a matter of time until Hayden got his project. If Senator Hayden hadn't lived as long as he did, and the Secretary hadn't been there, Udall, I don't think they'd have gotten their project. Hayden was the chairman of the appropriation committee. It was the most powerful committee. There was no question he was going to be denied, as long as he was chairman. And he lived long enough to see that project get authorized. The first hearings in the House were in Aspinall's committee and they were crowded. He had a small meeting room and there were no seats to be had. Tom did all the extra work and facilitated things for us, so he went in advance and set up nine chairs in the hearing room. The first three chairs were the Secretary, the Commissioner and the Solicitor. The second level were the Regional Director and heads of planning and so forth and then the third level were the technician people, Cliff Pugh and I and a guy by the name of Dan Dreyfuss. It was sort of like a football team. They would ask questions of the Commissioner and, if he didn't know the answer, he would hold his hand back like this. We had witness books and for those Congressmen who were friendly to the project, they would give us the questions the night before. They'd call the commissioner, and we would work all night to be sure we got answers that the Commissioner was willing to read. Dominy was a tough guy, very smart and articulate guy but he was tough. For example, once I handed him the wrong answer, and he looked at it, and he was answering the question, he turned around and he said "well, if my incompetent staff would give me the right information" in front of the whole hearing. That hearing was interesting and we were all nervous about it. Aspinall, he was tough and he could hardly see over the podium. I'll have to tell you a little story. In that hearing, Aspinall was passing photographs around and they were looking at them and not paying attention to what was going on. These are photographs that Dominy had given him when he made his famous trip floating down the Colorado River with David Brower. In fact, I understand from the seven stories I get that when they got to Lava Falls, Brower took a look at that and decided he wasn't going down there. But Dominy, he lit a cigar and floated right

down the river. He said that the talus slopes actually aren't that pretty. In those days, they were pushing for Bridge Canyon as a source of power. When you go back to these Basin studies, you had to have a cash register. And the cash register was always power. Because hydropower could be constructed cheaply and it produces energy with very low operating costs. It lasts for a hundred years, forever, so we felt that was one of the major alternatives.

Q: Let's go back and talk about 1961. That's when you went to Phoenix. Did you actually move to Phoenix or you just went down there?

A: No, I insisted on staying in Denver. My daughter had allergies and she was okay here and they tried to get me to transfer to Washington but they let me stay in Denver. I worked in the Chief Engineer's Office and that's where all the technical studies are done so we called ourselves experts in the technical part of it. And in the policy stuff, the political stuff was done in Washington.

Q: What was done in Phoenix?

A: There was a project office and they did all the planning. They had an economics staff there and I worked with them allocating costs. This is one of the very touchy, but arbitrary, subjects we had to deal with. When you build a multiple purpose project, since Congress established repayment requirements, some had to be repaid at 40 years, 50 years, with or without interest. The whole project had to be repaid and some aspects were non-reimbursable, so you could assign some costs to flood control. Obviously, you can see if you're going to allocate a cost, there are a lot of political pressures because the allocation determined how much they had to pay. So I decided that since that was a very controversial subject and right down my line, one reason I went into economics is because the answers are really a matter of opinion. That's the way cost allocations were, although we had procedures that were developed by TVA way back then. I had studied that and they had different procedures that we used. I guess I was one of the experts in cost allocation in those days. One of the big problems was allocating the costs and

showing that the project could pay out. If we didn't have that requirement, we would have probably done something else. We used to have a lot of foreigners come into my office, and they wanted to learn about our economics. They wanted to learn how we allocated costs among all these different purposes and determined repayment. I used to tell them what our procedures were and I would end up saying "actually you don't need to do that." Let's face it, it's arbitrary in the end. What you need to do is make a good analysis of what you can afford to pay, how much the user can pay, and the rest that they can't pay, you ask for a subsidy. You get it one way or the other. And you're talking about 50 to 100 years in time, but we had our own rules, our own institutions, economic institutions that we had to pursue, so we had to do that because it was a requirement. I think, if I had my druthers, I would have done it differently but it's still the same rules. They haven't changed. When they put in the Water Resources Council, they asked me to put together the procedures and I worked with a committee and we put out what they called the new principles and standards on how to evaluate projects. I had a group of about 40 people from all the agencies meeting over in the Denver office and we put together what we called the yellow book which was instructions on how to deal with it. Actually, the whole world was interested in it. They asked me to make a presentation before the United Nations in the Philippines, in Manila, and I presented a paper on how to do multiple objective planning and look at all aspects, environmental, economic, social impacts. We set up accounts but when the Reagan administration came in, they decided a lot of that was a bunch of nonsense, and said we're going to use economics as a major analysis of national economic development measurements, so all the work that we had done, and of course, they did away with the Water Resources Council.

Q: Let's go back to July of 1961. You got assigned to the Central Arizona Project. You went down to Phoenix. What was Phoenix like then? What was your impression?

A: My impression was hot. It was 113 degrees, that I remember. The downtown was nice, and I've visited since then. I couldn't believe what's happened. And it was growing. Where they sited the canal, there was no development out there. Now

there's development on both sides of the canal, I understand. I thought it was kind of a nice place to visit. We did mostly work when I was there.

Q: What state was the project at? You said they had already sited the canal?

A: They generally had the canal sited and they were still discussing how they would provide energy for pumping. Bridge Canyon was always a consideration. But the Sierra Club and a lot of the environmentalists didn't like the idea so we were even looking at alternatives in those days. We began to look at various options then, but the major problem was the major canal and the surface and the sources of energy. Sources of energy for pumping water because you had to lift it from the Colorado River and run it all those miles to Phoenix and Tucson.

Q: What about storage of the water at that time? Towards Phoenix, did they already have the Orme Dam planned? Was it part of the plan in 1961?

A: Yes, I think it was. They also were looking at some side storage too. Regulatory storage. But Orme Dam was the major storage facility in those days.

Q: And Marble Canyon was still on the table as being the cash register?

A: And Bridge Canyon. They were two alternatives. The week before we met with Udall and they made the decision on what the plan would be, I was called in. I was there in Washington. I had previously stopped by and picked up all the studies. This was now in 1966. In all those years, every year we added alternatives and modified the plan and refined it, and got ready for hearings every year, but it looked like things were going to go in 1966, because of the political climate at that time.

Q: That was five years after you started working on it.

A: But I had worked on lots of projects during that time. We had controversies on the Central Valley Project and we were working on the Columbia Basin Project, a third

power plant. We were having lots of fun doing lots of things in those days. I had responsibility for looking at all the projects but these were most important so they would send me out on the projects that were critical.

But going back, just to finish that story. The evening before we presented all these alternatives to the Secretary's office, we had a meeting with Dominy, just two technicians, Dan Dreyfuss and I, because we had all the technical data he wanted. So we discussed Bridge Canyon and Marble Canyon. He asked me about Marble Canyon. I told him I had all the cost data and the power potential and the size of the cash register it would provide. I compared it with Bridge Canyon and told him there was no question that Bridge Canyon was obviously superior, and then we had a High Bridge Canyon and a Low Bridge Canyon and we changed the name of Bridge Canyon to Hualapai. Because we thought it was politically more acceptable and we thought the Indians would like that and support us in the project. But all the work that we did, it was High Bridge and Low Bridge. I told the Commissioner that Low Bridge was probably more acceptable to environmentalists because there was some trail and they walked out of the canyon. And then High Bridge Canyon backed more water into the national park, so we talked about those things and then he got a telephone call. And he said, "Yes, Wayne, yes, yes, I agree." He hung up, and he says, "boys, it's going to be High Bridge Canyon and we're going to build it."

I said we had these other alternatives, and he said we could do the alternatives and the Secretary wants all those other alternatives, but it's going to be High Bridge Canyon. He didn't even want to discuss the alternatives. We had done nuclear power alternatives, one side at Pendleton, one side at Topac, which now turned out to be Navajo Power Plant and we did a Four Corners coal-fired plant. We did pump storage plants. Those were the major things. We had the superior plant based on all the data that we could get from G.E., Westinghouse, and the Atomic Energy Commission, is that a nuclear plant with its very low cost fuel at Pendleton was probably the best cash register we could put together, and provide all the power we needed to exchange

Q: Pendleton is a long way away, but I guess it didn't matter.

A: It didn't matter where it was. So anyway, we put all these 30 some plans together. The most important thing was how it would be paid for. For example, ad valorem tax was considered as a direct source of payment to the federal government to pay for the project. That was ruled out by the Secretary. And it turns out that was the redeeming factor for the district because they assessed ad valorem taxes. The district is supposed to come up with all the operating costs, but they were able to assess an ad valorem tax and that saved them because that's how they financed their operating costs. That kept the district really going. It did turn out to be a wise decision, not from a taxpayer's standpoint because we'd have been assured more money with an ad valorem tax that was earmarked to pay for the project, and that was an alternative to a cash register. If we did get some sort of a cash register, some sort of power source, but we had all these plans. About a night or two before, the Secretary's people called me and said we had to have a special meeting. We're not going to present that many alternatives to the Secretary. We needed to get it down to a manageable number. So they had this meeting and they threw out the coal-fired plant. I said I didn't think they should do that. We were talking about using Indian coal at that time. It was a major alternative. They said they didn't think the Secretary wanted to look at that. So we did about eight plans and worked like the dickens, put them all together to present to the Secretary. Udall was the Secretary, Luce was the Under Secretary, and Ken Holum was the Assistant Secretary. Luce had worked for the utilities in New York, so he had a great deal of knowledge about the electric industry. Holum had an interest in it as well. Later he did a lot of work in that field. We put the plans on a big chart, how it would pay, what the operating costs would be, what the water charges would be, what the power charges would be. The Commissioner then joined us in the elevator going to the Secretary's office. All he brought to the meeting was a screen and a slide projector, no other papers. We brought in this big chart, and he had to move to get the chart in the elevator. We went into the Secretary's office and then we waited in the Assistant Secretary Ken Holum's office until Udall would see us. Ken wanted to go over the plans. So I went through the plans and he asked me what happened to

the coal-fired plans. I said his people in his office deleted it. He said, "what?!" Little did I realize that they had been negotiating with the Sierra Club and the Indians and everyone else and, in my estimation, they had decided that was the alternative and there were no numbers on the chart. So he asked if I had the numbers, and I said I had the numbers. So he took his ball-point pen and he put in all the numbers in that plan. Guess what got built?

In the meeting, we went over all these plans and we could see more emphasis being put on the coal-fired plant. Fortunately, Dan and I had done a pretty good job. Luce knew a lot about it and he quizzed us about all the supporting data. At the end of the meeting, the Commissioner said now it was his turn. He said he wanted to show us some pictures, and he showed them slides of his trip down the Colorado Canyon. These are the same photos that were being passed, Aspinall would look at them and pass them on. I had my witness book and I was very nervous. I had all the economics that I was responsible for and the answers to the questions that might be asked at the hearing. Dan had all the technical stuff in his notebook. Then we had Cliff Pugh who could tell them anything they needed to know about the physical plan. I had my book and I'm ready for the first question. Dan Dreyfuss told me to close my book. I asked him why and he said David Brower, head of the Sierra Club, was looking over my shoulder. It turned out that David Brower had pulled up a chair next to me. He was also at the Senate hearing but they smartened up in the Senate hearing. They separated us from the Commissioner.

Q: What was so interesting about these pictures?

A: He's showing the talus slopes and saying this isn't so pretty. Look what you're talking about. The dam would be here. There would be a beautiful lake here. There's lots of river left over. And, of course, there was a lot of river left over.

Q: How did your meeting with Udall go?

A: It went real well. The fact that Ken Holum had asked for that, I could see where it was going, so I sort of emphasized, but they still had to make a lot of decisions on whether there should be an ad valorem tax, what the water charges should be. They selected a $10 rate. What the energy charges should be. Since you had a cash register, you didn't have to calculate what that would be to repay the project. You just had to say it was a reasonable, fair price, and when you think of your constituents, whether or not they might think it was a fair price. The Assistant Chief of our Division was a little concerned that I was probably the lowest grade guy in the room. He was one of the bosses and wanted to go with me to the meetings. I wrote a memo reporting on the meeting with his name on it and my name, and attached a list of all the attendees, Udall, Luce, Holum, Solicitor Berry, Deputy Assistant Weinberg, McConnell, Lineweaver Jr., Carl Lee, our chief economist, Chase, a commissioner, Regional Director West, Pugh, Keating who was head of power, McCarthy who was head of planning, Dan Dreyfuss. But my supervisor said not to include the list and I wondered why he didn't want me to include the list with my memo. It turned out that his name wasn't on there and he went to Washington with me. As soon as we got back, there was an extremely important meeting. He went to the chief engineer and reported about the meeting. He had my memo. The Chief Engineer asked him, were you there, Charlie? No, I wasn't. Ed was at the meeting. So he said call him in and let him report on the meeting. We didn't get along too well there for a while but that's why the list of attendees was left out of my memo.

Q: That was just a meeting to present it and no decisions were made?

A: We just presented it, and I got implications of where it was going but apparently that had been some high level negotiations prior to the meeting. This was December 9, 1966.

Q: Why did you get the feeling that it was going toward the coal-fired plants?

A: Because Holum was appalled at the fact that the alternative wasn't there. I personally had been indoctrinated by the Atomic Energy Commission. They had sent me to Oak Ridge to get the latest data and I worked with some of the G.E. people at Westinghouse doing different type of reactors. All the numbers showed that nuclear power was really, using the cost data that we had at that time, and looking from an environmental standpoint, in fact, I still think that it's a good solution to some of our power problems. But that's beside the point. But the coal-fired plant, they had negotiated with the Indians. The Sierra Club was willing to accept as a substitute to the dam and the canyon. Later, I heard that they changed their mind and they were sorry they agreed to it but, by then, the decision was made.

They had a big problem with whether the federal government could own a thermal plant. So they had to make arrangements of someone else owning the plant. Then the project would get the benefit of it, and they ended up with the Salt River Project. In those days, we used a 30-year life and I think the 30-year life is just about up on it, but you could spend money and extend the life of those power plants. In my analysis, I put what we call a replacement cost in there, so that it would accumulate enough money theoretically in the Treasury so they could rebuild the plant in 30 years.

Q: They just spent a lot of money refitting it for the pollution, so I wouldn't think they'd scrap it.

A: Oh no, they're not. If it has to be rebuilt, they'll do it. The only mistake we made with that plant, I think, is we sited it too close to the canyon. I didn't do the economic studies, but someone did some studies of coal haul vs. water haul, so that consequently they moved it closer to the canyon than I think it should have been and they should have had it over there on the reservation, then the smoke wouldn't drift into the canyon. You can see that plant from the satellites, and Dominy said, "that little dam, you can hardly see it, it's only about this big." I also got involved in the Hell's Canyon controversy in Idaho. In fact, I testified for the Secretary on high mountain sheep in Hell's Canyon and, as an economist testifying for the Secretary,

they wanted me to go with all the engineers and geologists to see the site. It was a huge controversy. That one turned out to be a national recreation river. I also got involved in the controversy when Eisenhower decided that we had a single dam plan in Hell's Canyon, and he decided that the private sector ought to build it, and Idaho Power & Light ended up with three small dams in the canyon which underdeveloped the site. This proposal was to use the total capabilities of the site by building another dam in Hell's Canyon so that would have been four dams in Hell's Canyon. We initially looked at one dam. That's unfortunate too, but those political decisions have tremendous impact on what our country looks like today.

Q: It does seem like a lot of the decisions are made more on politics than on economics or engineering.

A: Right, but they use economics to say if a project is worthwhile or not. And I got into a lot of trouble on some of my economic studies and nearly got fired once. I said some of Aspinall's projects weren't worth building that we authorized when we had big agreement and got certain dams built. Aspinall got his dams and Arizona got their project. One or two of those projects were extremely costly. So I had done an analysis showing that it was too great a subsidy and that they weren't worthwhile doing

Q: Which ones did you think weren't worth doing?

A: Fruitland Mesa was one of them, but there were a number of those projects. Some of them are built, some of them aren't. Some of them they only built reservoirs, which are working out really well, because Colorado needs the storage, but the irrigation parts of them were extremely costly and it took a tremendous subsidy. But we had these basin accounts and we could show that they could be repaid no matter how costly they were.

Q: Let's go back to the CAP. You were talking about some of the Congressional hearings you sat in on.

A: These would be in 1967. These were prior to authorization. They were the major hearings. The one was held in Aspinall's office, the one in the House, then one was held in Senator Hayden's hearing room, because it was the Appropriation Committee's, plush, large, could hold a lot of people. They separated the team. They isolated the Commissioner and Secretary and put them in chairs up front. Then we had to sit with everybody else. So we couldn't get up and pass information to the Secretary and the Commissioner like we could do in the House. There were a lot of enemies to the Project too in those days. We would never hear from them the night before, but all those who were friendly, we could get their questions.

Q: Who were the enemies?

A: Saylor was one, in the House. As far as the Senate, I don't think there was that much opposition. You support my project, and I'll support yours. Hayden waited all this time and he had a lot of chips coming back, and he was going to cash in on those chips. He let a lot of projects go forward that he could have stopped. This was his time. This was his birthday present, I guess. It was a great thing for Arizona.

Q: Do you remember the hearing when Governor Goddard went back and testified? Tell me about that.

A: Oh yes, that's kind of an interesting story there. Of course, they asked for his statement and he had a wonderful statement. He made one mistake. He called Congressman Aspinall, Aspinwall. Aspinall kind of took him to task for that. Of course the Governor was very embarrassed and Aspinall didn't treat him too well during his testimony.

Q: Do you think the Governor had enough preparation for that hearing?

A: Of course, he had everything pretty well written out. He had some pretty good statements as I recall.

Q: I heard that Aspinall started asking him about the Columbia River and he wasn't prepared to answer those questions, that that wasn't what we was there for.

A: I don't know how the Columbia River got involved except maybe there had been some questions planted that they talked about maybe getting water from the Columbia River, and we had done this study on the QT and presented it to Udall on a Saturday of moving Columbia River down to augment the Colorado River. This is how we got Appropriations to do the West-wide Study of the water problems in the 11 western states. We set up a separate office in Denver. We had all the agencies participate and we had the 11 western states represented. Each state put together a team and we took all their water problems and tried to consider them.

At that time, we assumed that Central Arizona Project would be built so we worked with all the top people in the 11 western states and they provided input. At the same time, we were doing new water resource procedures, the Water Resources Council, and we got those people to participate too and help us develop procedures that all agencies would follow. A uniform set of procedures for water resources.

Q: So the idea of Columbia River water supplementing Colorado River water was kind of a secret idea? Why?

A: Absolutely. They knew, Senator Jackson obviously, or the people in the northwest wouldn't tolerate it or wouldn't like it. But whether it was a strategic move, or on Udall's part or not, to say you've got lots of water. I think the Columbia is about 180 million acre-feet, and we can hardly get along with 12 million acre-feet or, in a good year, 15 or 16 million acre-feet. You've got all that water, you can spare 10 million acre-feet. And that's what we designed, a project that would move 10 million acre-feet all the way, ultimately. We did leave some water in the state of Nevada. I think we were going to stabilize Pyramid Lake. That's something that was done in several months and out of that came this requirement that we could not spend any money investigating the Colorado River, but they gave us money to

study all other plans for augmentation of the Colorado River. That was part of the West-wide Plan. All these states were helping us devise plans. We looked at rain-making, weather modification, desalination, one was desalination of ocean water, with an artificial island off the coast of southern California with two big nuclear plants there, and moving the water into Lake Mead. That didn't get built. Then we looked at another source, building it in Mexico, a joint plan with Mexico and the U.S., a large nuclear desalting plant and they would get some of the water. They needed water and we would desalt some of the Pacific Ocean that way in the Baja California area. We were going to build a canal that went all the way to Yuma, Arizona. Then we were going to site the plan where half of it would be in the United States and half of it would be in Mexico. They would get additional water supplies, because they thought they weren't getting their fair share of the Colorado River water. What they were getting was pretty salty. We even looked at alternatives there on cleaning up the Colorado River. In fact, they built some desalting plants, reverse osmosis plants, and I did the economic studies on those, away back when. In those days, they had all this water in the northwest, and there was always some little talk about hauling some of that water. I don't think at that time we had done any specific studies, but later I know that we did, because I did all the economic studies on that particular thing. It was hush-hush and we were sworn to secrecy on it. We were limited to five reports. That study moved roughly 10 million acre-feet, pumped it out below the lowest dam, Grand Coulee, and all the way in to Lake Mead and provided water on the way through canals all the way down. It took pumps and energy. I used nuclear plants because it seemed to be the most economic in those days.

Q: So it was a pretty serious idea then, if you were doing these studies.

A: I don't know if it was done for political reasons. Actually, we looked at a lot of different studies. We looked at moving icebergs. We did one study when we would take an iceberg and move it into southern California. As it melted, we would take that water and then through exchange, give it to the Californians for water out of Lake Mead. Then we looked at a plan where we would move northern California

water through a sunken fiberglass pipe about 10-12 feet in diameter and it would carry fresh water from northern California to southern California. That would be anchored on the bottom along the coast. We also looked at bringing water up from Canada, called the Rocky Mountain Trench Project, in which we would bring water from Canada into the United States. I used to have what they called the science fiction desk, because they got all these ideas. The technical part, the engineering was kind of dull, anybody could understand that. But then everybody had an idea about the economics of it. So they had to know roughly what it cost. We had engineers that do the cost, but then roughly what would it do? How would we pay for it? Who would have to pay and those kinds of things? Those are the things the Congressmen were interested in. Is it worth doing? There was a lot of difference of opinion on whether it was worth doing or not. So we devised the benefit cost ratio. If you didn't have a benefit cost ratio of better than 1:1, you'd better have some good justification. But if there was enough political support, it didn't matter if it was .6 or 2:1. Then there's what we call the indirect effects. All the businesses created a secondary effect, and there are a lot of secondary effects. In fact, when we developed the new procedures for evaluating projects, we had what we called an economic efficiency account in which we'd look at the direct effects on income, for example. Then we had a regional development account, meaning that, and that's why we built the Columbia Basin Project, it was the regional benefits, providing the new towns, the facilities, and irrigating lands, especially in the rural areas where they're all declining, and to provide jobs. Those were secondary and very important economic impacts. So those were an indirect effect. When we couldn't make a benefit cost ratio, then we would try to justify it on the basis of this area of declining population or this was an Indian project. You didn't have to have a benefit cost ratio if it was a Navajo project. Because we had all these social benefits involved. We also had a social well-being account. We had a four account system, which is very good, well defined. Economics efficiency, regional development, social well-being and an environmental quality. I also had the environmental group there in the office. I had an economics group, a social impacts group; I had the only agency that had a social psychologist on our staff, because it involved people, their viewpoints and opinions and how they felt about

projects. So we had a social psychologist, a Dr. Adams, who was very good. We did a lot of new work in the field of social impacts and the effects on people. Then there was a social well-being account. Those four accounts you would use to appraise a project and then we'd have to do alternatives that emphasize these different major objectives. So if you had a project that emphasized environmental quality, you would spend more money to protect the environment. If you had a project in which social well-being was the most important thing, like the Navajo Project, you could evaluate that, and that would be the most important thing. If you had something that was efficiency, energy, irrigation, municipal and industrial water supply, flood control, then that would be the major.

So we said when you formulate plans, use these different objectives and come out with alternatives and then let Congress decide in our democratic process on what the best project was. And it was a good system. But in those days, when Reagan came in, we pretty well developed most of the major water projects, because there weren't a lot to develop. I think there were only one or two sites left in the country that you could develop and I'm sure he would never do that.

Q: That's what I was going to ask you about. Some people say we've seen the end of the big water projects.

A: I thoroughly believe that. There's one site left on the Columbia. You'd never build that. In fact, they want to tear the dams down on the Columbia. And they're certainly not going to build a new thing on the Colorado River. We could build a pump storage facility that would make it a lot more efficient and take out just a little bit of the river below Glen Canyon or below Hoover Dam and use the Upper Reservoir and a small Lower Reservoir and firm up that energy there. But I don't think that will ever be done. We did studies on that years and years ago.

Q: So you don't think any of those science fiction ideas that you worked on will ever come about?

A: I don't think we will do any major desalting. They're doing it in Israel and certain desert countries. They're getting their water supply, but it's extremely expensive and it uses a lot of energy. Unless you go to the dual purpose of nuclear power and you get the spent energy. The theory there is that you would use the energy. They measure energy effectiveness with entropy of energy is its ability to do work. You take most of that out to develop electricity through your generators and then you'd use the heat to boil the water to convert it to fresh water. That was the concept we were using at Bolsa Island, the plant I told you we thought about building out from the southern coast of California.

Q: Now let's get back to the actual passage of the Central Arizona authorization. Were you back there in Washington when that finally came to pass in 1968? Tell me about that. How did that come about?

A: Oh yes. Actually, we participated in all the hearings. I didn't get involved, I was just told about it being authorized, but the real important thing was the hearings and the results of the hearings, of course. But as far as the celebrations that went on afterwards, I didn't participate in that. I wish I would have had a chance too.

Q: It seems like the compromises that came about to make it happen happened kind of suddenly at the end.

A: It did. And I think the breakthrough was the Navajo Power Plant. We got the Indians behind it. We got the Sierra Club to accept it as a substitute because they were pushing very hard for Bridge Canyon. They'd agree that anything was better than another dam in the Canyon. The night before the meeting is when they got that agreement and, once they got that agreement, they were able to go on with the project.

Q: Was it a surprise to a lot of people when they dropped the canyon dams and went with the power plant?

A: Those who supported the dams, it was a surprise to them. It was a surprise to Dominy. In fact, I think he may have been out of the loop at that point in time, because he didn't even pay attention to the thermal alternatives. At that meeting we had, when we went through all the alternatives, he didn't ask many questions. Just sat back and waited his turn to show his slides. Because he felt he already had an agreement with Aspinall, that it was going to be High Bridge Canyon and he thought politically they could get it done. So he wasn't prepared for this compromise and he would never agree to it either. After the meeting, Udall was very nice. He said he wanted to congratulate us on doing a very fine job, all these alternatives which took a lot of work. Luce turned around and pointed to Dan Dreyfuss and I who were the lowest in the group there. All the other guys were pretty important but we were the technical people. He asked us if we were electrical engineers. Dan told him he was a civil engineer and I was an economist. He said to Floyd that he wanted to do something for these guys. He said he just got Dan a promotion to a Grade 14 and that was the end of it.

This was around Christmas time, December 9. I had a friend; his name was Jim Casey who was politically oriented and a very smart man. We had worked together and he knew the work I'd done on the project. I told him about this, so he went in the Commissioner's office, and asked him if he knew who the lowest paid guy in the office is? He asked who, and Jim said Ed Barbour, he's only a grade 13. I was back in the office about Christmas time and I got the call that I'd been promoted to a grade 14. It was a Christmas present and my local bosses didn't particularly like that. In fact, I didn't even get a very decent place to sit in the office. My desk was way in the corner, but I had the same grade as my boss at that time. As it went down the road, my boss was moved to a research job and I ended up heading up the group over in the chief's office, so it tuned out okay. It really wasn't the grade. It was the excitement of the studies we did in those days. We did a lot of exciting things in the Bureau

Q: It was exciting too to go back to Washington and be part of those hearings too.

A: It really was. I felt very privileged to have done that. When you think back, now the project's built, and they have water in southern California and to feel that you're a part of that. I went to visit Tom once and I crossed the ditch and I sat there and looked at the ditch and there it was.

Q: You said Dominy wasn't really aware of the seriousness of the compromises? What was the reaction when the project was approved with the Navajo Generating Station?

A: I don't know what his personal reaction was. We had the largest project to date, as far as cost-wise. He got the Central Arizona Project which was the largest project the Bureau had ever built.

Q: Talking about the water projects that you've been involved in, people have talked about the good ole days of water politics. Looking back, how would you describe the good ole days?

A: The good ole days were when we had a large program of development. When I went to work, we had lots of money. It was after the war. They felt they needed to make public investments. We had the Missouri Basin Project. We had all those major dams being built on the Missouri River. We had authorizations to build a lot of irrigation projects in Kansas and Nebraska. We had a lot of political support in those days. We had floods, the Kansas River flood. I was in the office then, so that generated a lot of authorizations. We had a lot of projects that we built out of that little office at the prisoner of war camp in Nebraska with 400 federal employees out there. Like a commune. It was unbelievable. We had vegetable gardens and we were all assigned a little vegetable garden. We had our little water supply and we'd go out there and visit. You knew the spring gardeners from the real gardeners. In the spring, everybody was out there planting potatoes. When fall came, or when July 25 came, you'd see a few patches that didn't have weeds, and the rest was overgrown. They'd given up the thing. But we built all those reservoirs in that area in Kansas and Nebraska. In fact, I nearly drowned in one of the reservoirs.

Q: How did that happen?

A: We were hunting ducks on Swanson Lake, which was Trenton Dam that we had built, and we had a successful hunt. We had a small boat and the wind came up, as it does on the Great Plains, and we got swamped. We didn't have life jackets, but we did have four sacks of decoys. Now I was born and reared on the Gulf Coast. I was used to the Gulf of Mexico. I used to go deep sea fishing. I didn't think a little lake could do you in. We had a small boat that three of us had built together. It was a Montgomery Ward boat, a kit boat. It wasn't very large. We had gone across the lake. We started to head back and the wind and the waves came up and swamped the boat. Before we started out, I was concerned that we didn't have life jackets, but we had our decoys in gunny sacks, so we tied the necks of them together so we could use them as water wings. When we got out there and started to swamp, my buddy only had a little pork and bean can available. I told him to use his hat, so he was bailing feverishly with his hat and of course, the next wave put us under. I was running the little motor in the back, and it gurgled and stopped and we started to sink. We had tied most of the stuff to the boat, to be sure we wouldn't lose it, camera, guns, and shells. As we went down, my buddy, Hank Wilson, who was a program officer in Washington, got on his two sacks of decoys and started to float in. But I stayed with the boat. I didn't want to leave it. I thought maybe we could take the boat with us. Well, I felt it hit ground and I said "hey, it's shallow right here. We're on some sort of a bank." Hank came back. We had a long ways to go to shore. We just happened to be on some little bank out there in the middle. The banks of the river were built up and there happened to be trees there. I said if we can get this motor off, we can flip the boat, get the water out of it, and float to shore. He held the boat up, I took the motor off and I had this motor out here in the middle of the lake. And I see where this tree they had cut down had grown back up and I could see where the branches were extending out of the water. So I stuck the motor in there. Then we flipped the boat over, got the water out as best we could, and we sat in the boat and kept our water wings on, which were the decoys. And we floated off the bank into the deep water. The next wave flipped the boat out from under us. So all we had to support us was the decoys and

Hank didn't think we were going to make it. When we were on top of a wave, we could see shore, but when we were in the trough, Hank would say we're not going to shore. I said we would hook our arms together in case we got so cold that cramps set in and we could help support each other. Anyway, we finally made it to shore and we didn't know that hypothermia was setting in. Our teeth started chattering and we were crawling then, we could hardly move. We found an old duck blind and jumped into it. The wind was blowing and blew the sand and the dirt. We were wet and we were covered with sand and dirt but anyway, we got out of that. The dam tender came over and helped us. A guy in a big boat came over and I told him our motor was out there, and he took me out. Hank held me by the waist and I reached underwater and I'll be darned if I didn't find that motor and pulled it onboard. Three of us owned it, and we were poor in those days, just starting out with the Bureau and we didn't own anything. The dam tender got us warm clothes and we decided we wouldn't tell our wives. They didn't notice that we had changed clothes. So we went along the whole week. I belonged to a Methodist church there. We had a preacher there that had a little sport show on Saturday, The Puny Pastor's Sport Show. He announced that Ed Barbour and Hank Wilson nearly met their Maker there on Swanson Lake last Saturday, so the whole world knew about it. We got into big trouble about that. That's my real live experience about reservoir recreation.

Q: How have you seen the whole western water issues change during your career?

A: Obviously, the big dams are over. Now the emphasis would be on water conservation and the conversion of water, irrigation, to municipal and industrial water supply and for other uses. That's what's going to happen. Because we have no sources of water and it looks like even this with this global warming and more droughts than we had in the past. That was a big issue on the Colorado River and how to figure the water supply in the future. I don't think there's going to be any more projects of any size. The emphasis has got to be on water management, water quality, and the conversion. There's a problem with the conversion because you have all these economies built around irrigation and, although the value of

water has increased enormously, depending on what the water right situation is, that water can be bought from the farmers. The farmers are well off, the individual farmers, but the area, the secondary effects are very severe. We see these small towns gradually going away. So water is going to be an issue in the future, obviously. But there's water there for conversion, from irrigation. I don't know what the numbers are now, but we figured about 80% plus used for irrigation and the balance we use for other uses, so I suspect that will change over time.

Q: When did you actually retire from your job at the Bureau?

A: 1981. With my Army time, I had 34 years. I retired to go into private consulting so I went to work for Tudor Engineering Company, half-time as their chief economist, then I went out on my own and worked for various companies. Stone and Webster was one, and we did power projects. I made my reputation more in the energy side of it, so they hired Stone and Webster to do some studies for Western Area Power Administration. I did some studies for them on replacement of large facilities so I got to see those big power units at Grand Coulee. The Russians had large plants there. I got involved in that big controversy on the third power plant, whether the unit should be 300 mega-watts or as large as what the Russians were building, which were 600-700 mega-watts. So they asked me to do a study comparing those. It was kind of interesting. They decided that to be more conservative, the smaller units. They hadn't built a lot of large units; the Russians had. I had written this memo saying that if all the data I received from the technical people was correct, the larger units were more economical. But that was relying on what they said about the efficiency of the generators. They decided they would go ahead and design the smaller units, but it turned out the memo I had written to the Chief Engineer somehow got into the Washington office and they used it as a basis to overturn that judgment and decided to go with the large units. They had invested two or three months in the design of those small units and we end up with the large units. Now they're even larger units. I suspect they wish they had the smaller units because of the flexibility but that's in the third power plant. When I was doing this study of replacement

costs, they had one opened up, so I got to look inside of one of these units. It's amazing the size of the inside of the turbines.

Q: Regarding the 1922 Water Compact that divided up the Colorado River water, how accurate do you think their forecasts were?

A: That was such a subject of controversy. Our chief hydrologist, Rider, he's the one that did all the water analysis. That was a constant argument on the drought period, whether it would reoccur, what the average supply was. I was on the periphery of that. That was well discussed. I had no opinion about it. I heard both sides of the story, that drought was going to continue forever, that no, we're going to have wet years.

Q: Do you think those estimates are as good as anything to work with? Or should we revisit that?

A: I'm not up to date on what they're using these days. I know that in our office we computerized the River and did all kinds of analysis of it, but I wouldn't have the slightest idea of what's going to happen with the Colorado River.

Q: Should they reopen that Compact and renegotiate it?

A: I didn't get involved in that aspect of it. Fortunately, I had somebody else make those decisions. My feeling was that we'd probably have to plan for less water than more water and we did studies to show the effects of less water as opposed to more water. Fortunately, in those days we got Honeywell computers and I was able to put all these analyses on the computer, which helped me considerably. I had someone back in Denver, and every time someone asked for a different option or alternative, I would call in and have them run and that's how we got 37. I felt pretty darn important when I went into these meetings with the Under Secretary, the Commissioners, and all these people waiting for the results and I could walk in with these huge printouts that they had in those days. I'd throw them on the table and

say, "what is it you want to know?" I was just sort of the flunky there in providing all the data they needed and tried to explain what they meant. One of my first assignments when I transferred out of McCook, Nebraska, into the Chief Engineer's office into the economics group, and I began to review projects, I was assigned to work on the payout studies of the Missouri Basin Project. That was like 40+ projects extending with all the major dams in it, and with a lot of future projects in it, so I had a feel of how everything fit together and I knew how to handle the cost allocation controversies that always came up and allocating costs among the various purposes. I decided if I became an expert on cost allocations, which was an arbitrary subject to begin with which fit right in to my profession of economics, I could do that as well as anybody and I'd studied the subject. That's one way I was able to proceed from just doing routine to getting into these major project problems which were always involved, economics and how they could be paid for. Which was the most fun, obviously.

Q: What was your final job title when you retired?

A: I was Chief of the Resource Analysis Branch, and I had the environmental studies, land resource studies, social impact studies and the economic studies in my branch. I had the only what they call a multi-disciplinary group. We looked at those kinds of aspects, which it turns out to be the most controversial aspects of all the projects.

Q: Looking back over your career, what accomplishment are you proudest of in relation to the Colorado River water?

A: We needed to get the Central Arizona Project built, so that was a major accomplishment there. We built a lot of irrigation projects that helped the farmers and kind of stabilized some of these farm communities to some extent in Kansas and Nebraska. We built a lot of flood control projects that have worked over time.

Q: Tell me about the Central Arizona Project. Were there any surprises in that project, anything that you hadn't expected that came up?

A: I was dealing mostly with the economics part of it. There were some physical problems, engineering problems that came up, siphons and that kind of thing. And there were a lot of arguments on the repayment part of it. That bred a lot of other projects. That meant that we had to do this augmentation study, so I was pulled off the other studies and was taken out of my job at that point in time and moved over to the West-wide Studies. We had a separate entity there, a multi-agency entity there. I lost track there of all the changes in the economics part. They had arguments about the cost allocation and the repayment and all that sort of thing. I was involved in all these other studies and trying to develop the augmentation studies for the Colorado River. It really was a by-product of the Central Arizona Project. We're going to be taking water out of there for Arizona, how can we replace water in the Colorado River. That's how the Columbia Basin site study came about. And how nuclear desalting was involved. That's how running the icebergs down the coast became involved and developing water in Canada and bringing it over.

Q: Do you think as we look at possible drought now, more people here and needing more water, that they should revisit some of those?

A: I don't think they were that practical. I suspect the way we'll solve our water problems is conversion from irrigation. I don't think desalting is really economically feasible to any large degree

Q: Even if water gets more valuable?

A: I don't think so. It's so costly and so energy dependent. Weather modification, seeding clouds, has never produced a lot of water what we thought would add up to 300-400,000 acre-feet. We did a lot of studies in Denver on that subject. It's hard to prove is one of the big things. We did studies on the use of wind farms and we built some large units there and discarded those. But now wind energy is more competitive.

Q: What about solar energy?

A: We did some studies on solar, but that was pretty expensive, and when you're an agency, they emphasize hydropower. There's no more hydropower left. It's such a clean source but it changes the river.

Q: There is a desalinization plant they built down by Yuma. I've heard recently they're going to restart part of it and do some more testing on it.

A: That's a reverse osmosis plant. That's mostly to clean up the water than it is to produce a new water supply. That's really to clean up the water from Mexico, isn't it, so they can meet our requirements of decent water. I did the economic studies on reverse osmosis, as well as using heat evaporation systems and it's very expensive and uses a lot of energy. That's why you don't see a lot of those new plants. Actually, that was more of a research project than anything.

Q: Looking back on all the projects you've been involved in, anything that you think should have been done differently?

A: Some of our projects ended up with an inadequate water supply. Whether or not we could have gone back and anticipated that I don't know. We had that one big dam failure at Teton. That was unfortunate and set the Bureau of Reclamation back for years. I think we did a fair job. Some of them were expensive from a national standpoint. There's a difference between what's good for the general taxpayer and what's good locally. We had a big controversy on the Narrows Dam in Colorado, whether it should be built. It was authorized way back when as part of the Missouri Basin Project in 1935. I testified for the state and for Sparks. He had some professors at Colorado State saying it was not a feasible project for the state. They asked me to testify, and I said from the state's standpoint, it's a wonderful project, because a large part of it is going to be paid by the federal government and it's going to generate a lot of income in the local economy. But from the federal standpoint, I didn't think it was too good of an investment, all the numbers that I

had seen. The amazing thing is that some of the state people were opposing it and now it's not built. They still own the site. So there's a difference between how the state perceives it and how the national government, since the national government normally has to pay for it, but now more and more states are having to participate in the repayment of the projects. I think that's a good thing, but there are no more projects to build, except the fixed dams and lining the All American Canal, or whatever they're doing these days.

Q: Are you ever sorry that they didn't build the Marble or Bridge Canyon Dam?

A: I've never thought of it. I felt in those days that Bridge Canyon, possibly Low Bridge Canyon might work. The High Bridge Canyon either did more environmental damage and, in those days, we were kind of brainwashed by hydropower. But there were not many hydropower sites left, and hydropower was so important to our program since we couldn't build thermal plants. TVA owns a lot of thermal plants but I don't think there's a federally owned thermal plant. That was a new area that we were operating in and, fortunately, I was right on the edge of that and was able to get the data we needed. So I happened to be the only one in the Bureau that they would rely on to do the economic studies of the thermal plants, and it was kind of fun.

Q: Looking toward the future, how do you see the future for water in the west, particularly Arizona and Colorado?

A: Scarce. Water quality has become a problem. We're going to have to spend more time and manage the resources a lot better than we are. There are a lot of water losses, but I think they're working on those things. But I don't see any new sources of water. Back in those days, we were out on the fringe of knowledge. I was a member of a team and we were always looking at new technology. We went to Oak Ridge to see what they were doing in nuclear desalting. We had a program going, and now there is no program and maybe there's no need for it, but there is certainly a need for better management of what we have now, whether we create more

water supplies. We might do some small projects and reregulation and some pump storage projects, but that's just recycling water.

Q: Do you think if water becomes scarce, it'll become more expensive, and people would use less?

A: Yes, that's the strategy of most of those who are selling or distributing water. Except they find in a wet year, they start using less, they run out of money, and that's what has happened to Denver Water. Oh my goodness, we're going to have to raise rates because they're not using enough water, and then everyone cuts back on use of water. The price mechanism is one way to regulate the use of water and the use of energy. In our society, the marketplace plays a very important part in getting that done.

Q: Do you have any advice for people that are running the water systems today controlling water resources?

A: I'd say we have to look at conservation. There are a few sites still available like I supported the dam here in the Platte Canyon, Two Forks, so that we wouldn't have to really change the character of our environment by drying up the irrigation lands. Although I used to fish the stream, I thought maybe we might have to give that up and there would be lake recreation and usually more people would participate in it. So I was a supporter but the Environmental Protection Agency killed that one. I doubt if there are going to be any more dams built, so it's going to either be development of underground water resources, or conservation. We're going to have to do with what we have.

Q: Looking back on your career, what advice do you have for young people trying to decide what they want to do with their life?

A: Since I spent my career in public service, and then I went into the private sector, and when I retired, I was 57. I went into consulting work, worked halftime, and then

quarter-time, and then took odd jobs, and then when I hit 70, I just quit working. And I miss it, incidentally. You have to find something that you're interested in and that's the hardest thing to find. When you go to college, you've got to remember that you have to have a meal ticket. It's nice if you enjoy what you do in order to earn that meal ticket. And you need to think about the public sector. Don't just always take, but you also have to give too. I enjoyed my work in the public sector, although there's a lot of criticism of federal employees, that they're lazy, and so forth. I've been in both the private and public sector, and there are those kinds of people everywhere. The important thing is to manage those people so that they are happy in what they're doing. That's probably the most important thing; find something you like to do. I was lucky, it was exciting. It had an impact. I would say often, now I know the state wants this project, but you have to look at the public too, the taxpayer. They said no way, you're working for the Bureau of Reclamation and you have all of our supporters, our constituency. But I have another constituency, and that's the public, the general taxpayer. As an economist, I was probably more sensitive to that than some of my engineering and political friends were. I thought it had to be fair, so very often I would turn down an economic analysis because I thought it was unfair to the taxpayer. I got into a lot of trouble, because when you did a cost allocation, in my estimation, it was arbitrary. You could, by increasing the benefits of some of these purposes that don't have to be paid back, and assign large portions of cost, so then you could reduce the cost to those who had to pay for it and they loved it. This was especially so when you built projects for municipalities and they got a water supply, and they were supposed to pay for it with interest, and it came out of a multi-purpose reservoir, and it provided flood control and fish and wildlife and recreation.

The way our rules were, you could allocate 80% to these things, and had the community had to build the reservoir, they would have had to pay 100%. I said that wasn't fair to the taxpayer. So let's use a reasonable price and use that end of the formula for allocating these costs, so that's where I emphasized my career, in the economics, the institutional part and that way I felt I had an impact on projects and how they were repaid. The taxpayer got, I hope, a fair deal on the project that I

had anything to do with. But there was a political aspect so there was always some compromise involved.

Q: I think I've covered most of the questions. Is there anything else you wanted to bring up that I didn't ask?

A: We could talk for hours and hours. I'd say it was very exciting working for the Bureau of Reclamation and I enjoyed my career in water resources. Young people going into water resources, I'm trying to think where they would go. Certainly not the Bureau or the Corps of Engineers. They're not building a lot of dams or structures anymore. So it would mostly be in the management part of it and that could be a challenging job I'm sure.

Q: Sounds like you've been a part of history in your career, too.

A: I'd say I had a lot of fun.

Q: Thank you so much for spending this time with us today.

A: I enjoyed it and appreciate your coming out. I'm afraid I was probably a little disjointed.

Q: When you're talking about your whole life, it's kind of hard.

- - - End of Interview - - -